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Vanishing Flocks and Shifting Livelihoods: Understanding the Decline and Future Prospects of Sheep Farming in Highland Community of Bhutan

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Abstract

Sheep farming continues to thrive across most of the nation despite the enormous challenges. However, in the past decade, the practice of sheep farming has completely disappeared in two highland blocks of Gasa district in Bhutan. Therefore, to identify the causes of sheep farming cessation and to analyse future acceptability to revive the sheep farming, a cross-sectional, community-based study was conducted in the Laya and Lunana blocks of northern Bhutan from August 2019 to February 2020. The study employed set of semi-structured questionnaires including household surveys, free-listing challenges faced in sheep farming to capture quantitative information. A total of 132 households (67 hh from Laya and 65hh from Lunana blocks were obtained using Cochran's formula and respondents were face to face interviewed. The survey revealed that the majority of household in Lunana (91%) relied more on cordyceps compared to those in Laya (70%). However, Laya found to have more diversified income sources. Furthermore, the study identified low economic return (Lunana) and the presence of poisonous plants (Laya) as two major issues that has attributed to cessation of sheep farming. Overall, the majority (Laya=75%; Lunana=95%) of the respondents were not willing to revive sheep farming. Therefore, this study suggests that the sheep farming and its revival in study areas is not viable. Furthermore, it is recommended to conduct research to identify the intervention to transform sheep farming into economic viable enterprise for its revivable and sustainability.

Keywords: Community acceptability, Cordyceps economy, Economic viability, Highland community, Sheep farming

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Introduction

Sheep farming remains a thriving industry in most countries, despite some of the various challenges (Zygoyiannis, 2006; Pulina et al., 2018). Over the past decades, the global sheep population has declined but production has increased (Lasseur, 2005; Morris, 2009; Jones, 2004). Sheep farming practices prevail across diverse topographical conditions and environment temperature worldwide due to their essential socio-economic contributions (Hadjigeorgiou et al., 2002; Fakoya & Oloruntoba, 2009; Snoussi, 2003; McManus et al., 2011). Most importantly, small ruminants such as sheep and goats are playing a significant role in livelihood of pastoralists (Caballero, 1999; Næss et al., 2004; Frachetti & Benecke, 2009; Toro-Mujicab et al., 2011).

Likewise, Bhutan has a native sheep population and sheep farming practices, ranging from altitudes above 100 masl in the south to over 3000masl in the north (Dorji et al., 2003). Presently, Bhutan is a homeland to approximately 10858 sheep (DoL, 2019). However, the number of sheep and sheep farming, particularly within pastoral communities in Bhutan has drastically declined (Dorji et al., 2017). In the similar way, the trend of yak population and yak herders also declined unprecedentedly since 2006. The reason for this decline trend could be partially due to the legalization of cordyceps collection in the highland areas (Wangdi, 2016).

Rapid decline in sheep population in the country resulted end of sheep farming in Gasa district long time ago. Historically, Laya and Lunana, the two highland communities had dependent on livestock mainly yak and sheep for their livelihood enhancement. These trends are attributed to the change in income sources and rapid socio economic development in these areas. The lack of organized market system to sell the highland products and value chain facilities also negatively impacted the sheep farming. Additionally, the lack of farm household labors and the increase in trade scope with other lower communities has brought dramatic shift in the income generation and living paradigm among Laya and Lunana communities.

According to verbal reports from highland communities, sheep farming was ended due to a lack of severe pasture shortage, the presence of highly toxic plants, and a high frequency Gid disease infestation also known as coenurosis caused by taenia multiceps. The high prevalence rate of this disease has been reported in Laya due to pasture contamination by Wangdi et al., (2021). Similarly, toxicity of the highland pasture has been reported in other regions causing mortality of sheep and other highland livestock (Negi et al., 2022; Oliveira et al., 2021; Kara & Kara, 2019). However, there is little research-based information explaining why sheep farming has declined. Therefore, the objective of this study is to determine the possible reasons for the cessation of sheep farming among the highlanders of Laya and Lunana, as well as to analyse the feasibility in reviving of sheep farming in the future through appropriate government interventions.

Materials and methods

Study sites

The study was conducted in Laya and Lunana, the highland blocks of Gasa District located in the northern part of Bhutan at the elevation of 3500 to 4000 masl (Figure 1). By territorial expanse, Gasa district positions as the second largest among 20 districts in Bhutan. However, it has the lowest human population, with scattered human settlements across its terrain. The entire study areas are lie within the Jigme Dorji National Park where, district serves as the homeland for many endangered species such as the Snow Leopard (*Panthera uncial*), Red Panda (*Ailurus fulgens*), Tibetan Snowcock (*Tetraogallus tibetanus*) and, Takin (*Burdux taxicolor*). The people in both this study area primarily rely on cordyceps collection, agriculture and livestock farming.

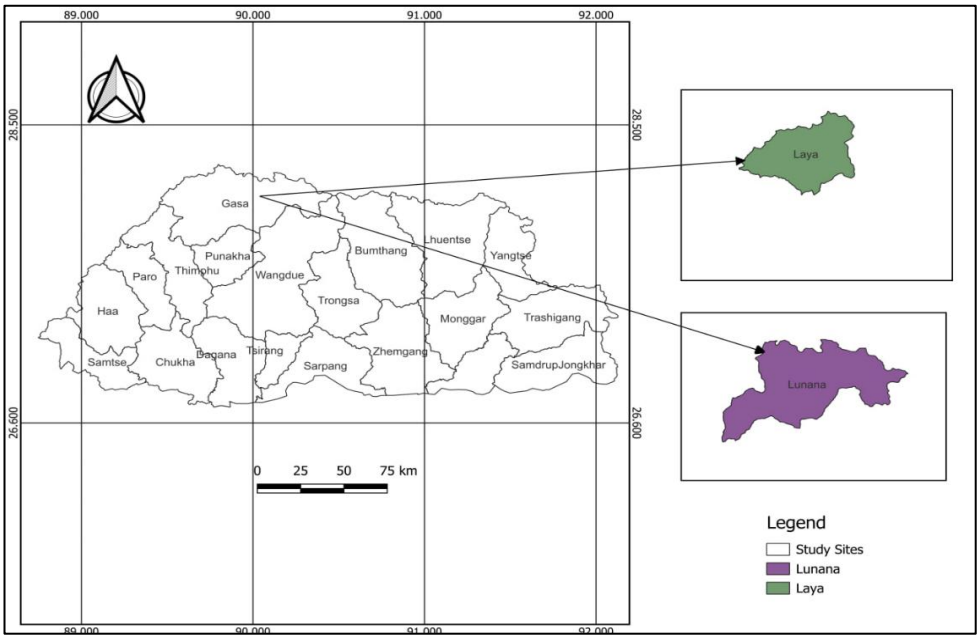

Fig. 1. Showing the two study areas under Gasa district

Study design and data collection

There were 410 legally registered households (hh) in the two study block: 216 in Laya and 198 in Lunana (PHCB Gasa Dzongkhag, 2017). The sample size was determined using the Cochran's formula for estimating proportions as below:

$$n = (Z^2 \times p(1 - p)) / e^2$$

where n is the initial sample size, Z is the Z-value at 95% confidence level (1.96), p is the assumed response distribution (0.5), and e is the margin of error (0.10).

Substituting these values, we obtained minimum of 78 households as minimum required sample size. However, to improve representation and enable accurate comparison between the two blocks, a total of 132 households (67 from Laya and 65 from Lunana) were included in the study.

We have employed simple random sampling for the field survey. The survey was conducted from August, 2019 to December 2019 covering survey households in every village within the blocks and also herds-to-herds visits. It was face-to-face interviews using set of semi-structured questionnaires with adult person (>18 years of age) each from selected households and herds. We have collected data on respondent's gender, age and was categorized into three groups: 18-30, 31-60 and >60 years; education level, occupation, and income sources.

Before the interview, informal consent was accorded before each interview, and respondents were explained on the aims and objectives of the study. The interview questionnaires were translated in the local language - Dzongkha - and recorded in English

The questionnaire comprised a combination of both closed and open-ended questions, divided into six sections: respondent's characteristics, highland animal population, history of sheep farming and reason of waning, future acceptance, and support needed from the government. Additionally, the questionnaire also included a free-listing section on the challenges and future opportunities of sheep farming in the community (Borgatti, 1999). To ensure clarity, the questionnaire underwent a pre-test in the Gasa district involving 5 farmers and subsequent modifications were made accordingly.

The survey was conducted only after receiving the formal approval letter from the District Administration Gasa vide DAG/DLS/04/2018-2019/017 dated August 14, 2019.

Data analysis

Initially, data were entered and cleaned using a Microsoft Excel (Microsoft Excel Version 16) and subsequently exported and analyzed using R statistical software version 3.6.0 using the packages "dplyr"," descry", "focasts", "lmtest", and "LogisticDx" (R core Team, 2017).

Descriptive statistics were performed. Variables like socio-demographic characteristics (gender, age group, educational level, occupation, household roles, income sources), sheep farming experiences and future acceptability of sheep farming were expressed in percentages. The mean was used to present age of respondents and also range were expressed to present range of age and family members in the household. Additionally, the frequencies of categorical variables between two blocks were compared using Chi-square test. A significance level of $p< 0.05$ was set for all statistical tests to determine the significance difference.

Results and Discussion

Socio-demographic characteristics of respondents

A total of 132 respondents were interviewed, with 67 from Laya and 65 from Lunana. Among the respondents, 60.7% were female, slightly outnumbering males (39.3%). The predominance of women in this study indicates typical gender roles in highland household, where women manage household while males were involved in external activities such as pack-pony services (Gitungwa et al., 2021). Their ages ranged from 18 to 84 years, with a mean of 37.7 years. Regarding household roles, 55% identified as mothers, 28% as fathers, 15% as sons or daughters, and 2% as in-laws. In terms of educational level, formal education and monastic education were significantly higher in Laya (30%) compared to Lunana block (9%).

On average, households consisted of 4–5 family members. In terms of income sources, majority of household in Lunana (91%) relied more on cordyceps compared to those in Laya (70%). However, Laya found to have more diversified income sources such as sales of yak products, non-wood forest products, medicinal herbs, and pack pony services from tourism sector. Interestingly, labour charge and agriculture contributes limited income in both the blocks (4% = Laya; 1% = Lunana) (Table 1).

Table 1. Socio-demographic characteristics of respondents in the two study sites Laya and Luana

Variables	Laya = n (%)	Lunana= n (%)
Gender		
Male	35 (52)	45 (70)
Female	32 (48)	20 (30)
Age(years)		
18-30	34 (51)	4 (6)
31-60	27(41)	61 (60)
>61	6 (8)	0 (41)
Qualification/education level		
No schooling	29 (42)	36 (51)
Non-Formal Education	12 (17)	1 (1.5)
Primary school (<=6)	11 (15)	3 (4)
Lower secondary school (<=8)	1 (1.5)	4 (6)
Higher secondary school (<=12)	4 (6)	15 (22)
Degree level or higher	1 (1.5)	10 (14)
Monastic education	12 (17)	1 (1.5)

Variables	Laya = n (%)	Lunana= n (%)
Occupation		
Farmer	47(70)	59 (91)
Civil servant/Corporate worker	2 (3)	0 (0)
Military	5 (7)	4 (6)
Student	6 (9)	0 (0)
Monk/Gomchen/Nun	4 (6)	0 (0)
Business/Contractor	0 (0)	0 (0)
Others	3 (5)	2 (3)
Income Sources		
Cordyceps	41(61)	59(91)
Yak and yak products	9(13)	1(2)
Horses and transportation	4(6)	0(0)
Tourism	0(0)	5(7)
Agriculture	2(3)	0(0)
Business	2(3)	0(0)
Others	94)	0(0)

Sheep farming history and experience

According to the memory-based recollections of respondents, sheep farming in Laya had completely declined as early as the late 1950s to early 1960s, while in Lunana it continued until 2006. The early cessation of sheep farming in Laya block may be associated to its proximity to urban town, where rapid urbanization likely enabled earlier access to alterative economic opportunities. In contrast Lunana being one of the remotest block in the country has retained sheep farming till 2006. However, it was observed that the proportion of respondents with prior sheep farming experience was significantly higher in Laya than in Lunana as indicated by chi- square test (χ^2=3.614, df=1, p=0.05). This differences may be attributed as Laya's proximity to urban areas likely facilitated better access to animal husbandry practices and support services. Further, respondents from both the study areas were unable to identify which kind sheep breed was present. This is inability of respondents, suggest that there was a substantial loss of sheep breed knowledge and weak intergenerational knowledge transfer. This finding aligns with broader historical context of sheep farming in Bhutan, where information on sheep history like its origin and breed were limited and largely relied on oral history (Dorji et al., 2003).

Factors associated with the cessation of sheep farming

The research has explored the causes of sheep farming disappearance in two highland blocks (Laya and Lunana) under Gasa district. The result showed that sheep farming

was disappeared due to various factors like plant poisoning, low economic return, other income sources, Lack of proper market system and labour shortage which has played differently in both the study areas (Figure 2). Among all, plant poisoning was observed as major causes of sheep cessation only in Laya, whereas low economic return in both the study areas. Further other factors also contributed in cessation of sheep farming, however lack of market isn't a factor for cessation of sheep farming in Laya. The findings support the previous studies that reflects that the younger generation access to the modern education and alternative income sources has led to the disappearance of livestock farming (Singh & Kerven, 2023).

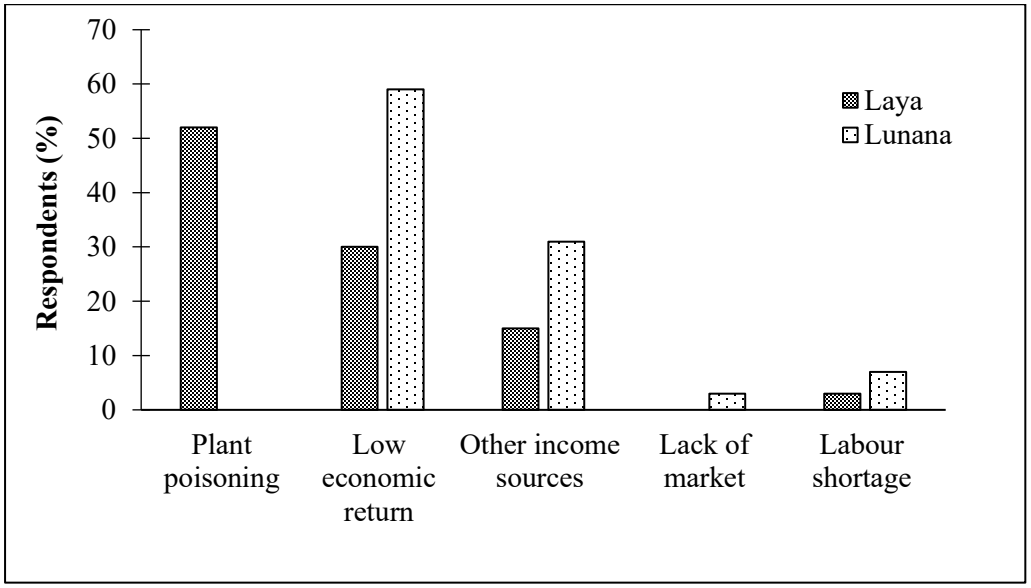

Fig. 2. Showing various factors for sheep farming cessation in both the study sites

The disappearance of sheep farming in these two study areas also reflects the broader Himalayan trends where pastoralism is under pressure of modernization, changes in policy and migration pattern (Wangdi, 2016). Further, the income from alternative sources such as cordyceps weighs far better than sheep farming. This can be seen has economic choice that reflects the much greater potential to earn economic return from other diverse alternative income sources like collection of cordyceps, tourism, sales of yak products, non-wood forest products, and collection medicinal herbs in both the study areas. Existing literature from nearby highland countries like Tibet and Nepal shows that households collecting cordyceps can earn approximately USD 1,500–3,500 per year (Winkler, 2008; Shrestha et al., 2019), while small ruminants generate USD 300–800 annually in similar mountainous areas (Devendra, 1986). This huge economic disparity and labor flexibility accounts for farmers' preference of cordyceps collection over livestock farming (Thapa, 2017). Moreover, there is no

organized market system for highland sheep products. Furthermore, long walking distances to lowland markets also impose a significant transportation cost, making highland sheep production economically unviable. Interestingly, despite of high prevalence of GID disease reported in this study area, respondents indicated that they experienced minimal challenges related to GID diseases in sheep farming in the past. Other factors to disappearance of sheep farming was labour shortage as sheep farming demands extra management as to prevent from wild carnivores and free-roaming dogs.

Acceptability to revive sheep farming

In the context of sheep farming cessation in Bhutanese highland communities, assessing the acceptability of reviving sheep farming is important. Livelihood changes, socio-economic development, labor shortages, and market uncertainty strongly influence respondents' willingness to revive the sheep farming (Dorji et al., 2003). Understanding acceptability therefore, help us to know beyond technical feasibility and shows whether revival strategies match the current aspirations of the respondents. To examine this, a chi square test was conducted, which revealed a significant difference in the degree of acceptability and willingness to revive sheep farming between two blocks ($\chi^2 = 9.5022$, df = 1, p = 0.002) indicating a very low acceptability in Lunana. It signifies that the income from cordyceps likely to be main factors affecting the future acceptability of sheep farming in Lunana. Whereas, Laya being closer to urban town has advantages for sheep product market accessibilities may explain higher acceptability. However, the majority of respondents from both study areas (Laya = 75%; Lunana = 95%) were not willing to revive sheep farming despite the support of free-input supply from the government. This clearly shows, people's choice for the high profitable activities over the livestock farming (Dorji, 2023). This trend further tells us that the younger generation has a greater access to alternative income opportunities indicating, people's choice for the high profitable activities over the livestock farming (Dorji, 2023).

Conclusions and Recommendations

The study findings show low levels of community acceptability for reviving sheep-raising in the study blocks. This low acceptability is a result of economic feasibility issues and the presence of poisonous plants. Thus, to provide accurate and comprehensive evidence, we recommend future researchers to conduct a detailed spatial analysis of poisonous plant types to understand their distribution, toxicology, and seasonal occurrence to inform highland communities about risk management methods. Further, we recommend to conduct research to identify the intervention to transform sheep farming into economic viable enterprise in order to revive sheep farming and its sustainability.

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