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Research article

The dependence of tribal community on forest resources for household fodder security in Gurez Himalaya of Kashmir

M.A. Islam*, Ummar Atta, A.A. Wani, A.A. Gatoo, Murtaza Shah, K.A. Sofi, G.M. Bhat and A.A. Parrey

Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Ganderbal-191201, India
*Corresponding author email: ajaztata@gmail.com

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Abstract

The study investigated dependence on forests for fodder security, the economic valuation and socio-economic determinants of fodder extraction in the Gurez Himalaya. Multi-stage random sampling technique was employed to select the sub-divisions (03), villages (18) and households (337). Data were collected using structured interviews, non-participant observation, focus group discussions (FGDs) and rapid market assessments (RMA). Results revealed that the total collection of green forest fodder was 1577.75 tonnes/year @ 4.68 tonnes/household/year, of which 1290.59 tonnes/year were consumed for subsistence and 287.15 tonnes/year were sold for cash income. The economic value of the fodder extracted from forests was Rs 12622000/-year @ Rs 37454/-household/year. It included Rs 10324796/-year as subsistence and Rs 2297204/-year as cash income. The forest dependence index (FDI) was intermediate (mean=0.348, SD=0.155) while the relative forest income (RFI) was low (mean=0.074, SD=0.070). Socio-economic variables such as education, family size, family labour, herd size, on-farm income, off-farm income, land holding, wealth status and annual income had significant effect on the forest fodder dependence.

Keywords: Fodder security, Forest dependence, Gurez valley, Kashmir, *Shina* tribe

Introduction

Livestock production is the backbone of tribal agriculture, the economy, food security, cottage industries, socio-economic wellbeing, and livelihood security in the Indian Himalayas (Nautiyal *et al*., 2018; Islam *et al*., 2023). In the fragile ecosystem of the Indian Himalayas, livestock husbandry predominately plays a crucial role in farming systems (Ahmad *et al*., 2016; Negi and Maikhuri, 2017). The Himalayan people rear livestock for milk, ghee, meat, dung, manure, draught power, religious sacrifices, pack animal services, entertainment, propitiation of Gods, and celebrations (Baba and Islam, 2017; Islam *et al*., 2021). The Himalayan people have traditionally relied on cattle wealth to support their subsistence lifestyles, provide monetary income, create employment opportunities, and serve as a safety net against calamities such as crop failures (Farooq, 2022; Yadav *et al*., 2022). The quality and quantity of livestock production largely depend on the quality and availability of fodder (Nautiyal *et al*., 2018; Kereto *et al*., 2022). In the Indian Himalayas, fodder scarcity is a major constraint to better productivity (Ahmad *et al*., 2017; Negi and Maikhuri, 2017). The exploitation of forests and pastures is a common practice among Himalayan dwellers to ensure fodder security for livestock production (Akhter and Malaviya, 2014; Mir *et al*., 2016). Forests and grasslands provide between 30-50% of all animal feed (Ahmad *et al*., 2016; Himshikha *et al*., 2022). Green biomass from grasses, shrubs, tree leaves, and other herbaceous plants in the pastures and forests are the animal feed which the people exploit by grazing or cut-and-carry (Rawat *et al*., 2018; Islam *et al*., 2023). The alarming anthropogenic pressure on forests for fodder security has an adverse impact on the growing stock, regeneration, biodiversity, stand quality and composition (Qureshi *et al*., 2019; Farooq, 2022).

Gurez Valley in India's north-western Himalayan region is largely mountainous, with rugged terrain and an inclement climate characterized by inaccessibility, fragility, marginality, and isolation from the Indian mainstream (Shaheen *et al*., 2017). Livestock production is the second-most important source of livelihood and contributes about 24.96% of the household economy (Atta *et al*., 2018). The *Shina* people rear small ruminants (sheep and goat), bovines (cattle, yak, and Zho or Zombo), and

equines (mules, ponies, and horses) for wool, meat, milk, draught purposes, and pack services (Beigh *et al*., 2020). Household dependence on forests for fodder security is high in the impoverished Shina community, whether for consumption, sale, or as a safety net (Islam *et al*., 2022). Forest-dependent households expend considerable time and effort to harvest forest fodder as they lack alternatives (Beigh *et al*., 2020). High fodder extraction may cause deforestation and forest degradation (Haq *et al*., 2020). The previous study suggests that there is a complex and dynamic relationship between forests and livelihoods, necessitating an appropriate assessment of household forest dependence (Islam *et al*., 2022). Quantifying the extent of forest dependence is crucial for informing forest-based poverty alleviation strategies, enhancing household wellbeing, and conserving forest resources (Mir *et al*., 2016). The present study was carried out- 1) to estimate the quantity of fodder collected from forests for both consumption and marketing, 2) to assess the economic value of forest fodder and estimate its absolute and relative income contributions, and 3) to determine the socio-economic factors that influence forest dependence for fodder security in the Gurez Himalayas.

Materials and Methods

Study area: This research was conducted in the Gurez Valley of the Bandipora district in Jammu and Kashmir UT. Gurez valley is located 2370 metres above mean sea level, between 34°23′ and 34°41′ N and 74°37′ to 74°46′ E across the famous Razdan peak. The valley shares its borders with Pakistan-Occupied Kashmir (PoK) in the north, Bandipora district in the south, Drass, Ladakh, in the east, and Kupwara district in the west. The valley extends over an area of 362.88 km^2 and is composed of forests, meadows, and pastures. It has abundant, dense coniferous and broad-leaved forests with ample richness in floral and faunal diversity (Champion and Seth, 1968). The region experiences a temperate environment with four distinct seasons and substantial winter snowfall. The valley is home to 37,992 people, according to the Census of India (2011), including the *Dardic* ethnic group's *Shina* tribe, who maintain a unique socio-cultural, traditional, and linguistic identity. The *Shina* is the largest community, with 31,094 (81.84%) of the total population in the valley. Agriculture, livestock husbandry, and gathering non-timber forest products (NTFPs) are the main subsistence activities of the inhabitants of the valley (Anonymous, 2011).

Sampling design: A reconnaissance survey of the entire research region was carried out to identify the sampling units. A multi-stage random sampling technique (Ray and Mondol, 2011) was employed to select the sub-divisions, villages, and households that were already forest-dependent, securing their considerable fodder demand from forests. In the first stage, three subdivisions, including Gulshanpora, Dawar, and Tilail, were selected. In the second stage, 18 villages were sampled, comprising 12 villages from the Tilail sub-division, 4 villages from the Dawar sub-division, and 2 villages from the Glushanpora sub-division. In the third stage, a total of 337 households were selected from these villages, with a 10% sampling intensity. To produce a legitimate sampling method and ensure the validity of the study's findings, a combination of proportionate and purposive random sampling was employed (Islam *et al*., 2015).

Data collection: Data were collected using both primary and secondary sources. Primary data were collected using structured interviews, non-participant observation, focus group discussions (FGDs) (Mukherjee, 1993) and rapid market assessments (RMA). Secondary sources included departmental records, village records, institutional, and technical reports, previous research, and the internet. The interview schedule was developed to record both qualitative and quantitative information pertaining to socio-economic characteristics (Table 1), forest dependence for fodder security and usage for subsistence, cash income, and safety nets. The collection and consumption estimate of fodder were made at each homestead and extrapolated in tonnes/year basis at the household level. The interview schedule was tested with multiple households in non-sample village before it was applied in sample villages. The non-participant observations were carried out to establish personal on-the-scene contact with the respondents in natural situations. The focus group discussions (FGDs) were conducted with 8-12 knowledgeable participants. The FGDs were conducted to cross-check and validate the data generated. A rapid market assessment (RMA) of forest resources was conducted to understand the market dynamics and trade mechanisms. The structured interviews and FGDs were conducted at the respondents' residences or workplaces by the investigators. The household heads or the eldest family members were generally considered the primary respondents. The fieldwork was facilitated by village-level workers (VLWs), village heads, local officials, and NGO staff.

Data analysis: Descriptive statistics, including frequency, average, percentage, standard deviation, and range (Snedecor and Cochran, 1967), were used to summarize the socio-economic characteristics, estimate the economic value of fodder collection, consumption, and marketing, and calculate the total value of forest dependence for household fodder security. An analysis of covariance (ANCOVA) was used to determine the effect of different socio-economic variables on forest dependence for fodder security. Forest dependence index (FDI) measures the proportion of products collected from forests compared to all sources of forest products used

by a household, including those that are purchased or collected from non-forest locations (Newton *et al*., 2016). FDIs were calculated by the following formula:

$$Forest\ dependence\ index\ (FDI_f) = \frac{f_f^q}{\sum_{i=1}^{n} f_i}$$

Where f_f^q was annual collection of fodder from forests and *fi* was annual household fodder collection from source *i*. Relative forest income (RFI) estimates the financial contribution of forest products to the annual household income generated by all livelihood sources (Wunder *et al*., 2014). RFIs were calculated using following equation:

$$Relative\ forest\ income\ (RFI_f) = \frac{f_f^x}{\sum_{i=1}^{n} x_i}$$

Where f_f^x was annual income derived from forest fodder and x_i was annual household income from source *i*.

Results and Discussion

Socio-economic profile: The descriptive statistics for the socio-economic characteristics of the surveyed households (Table 1) indicate that there is a prevalence of middle-aged (44.11) household heads with literacy up to the primary level (2.50), large-sized families (1.66), and a labour force of three workers (3.36). The size of land holdings owned by the households was marginal or small (1.54), and the herd size ranged from 5 to 10 cattle (1.78). The household members were primarily engaged in traditional caste occupations or non-timber forest product (NTFP) collection (2.95) and were employed as either self-employed individuals or casual employees (1.57). The wealth status of the households was medium (1.21), and the average annual income earned was Rs 92,811.24, varying between Rs 30,000 and Rs 42,000. The low socio-economic characteristics of the people indicate that the residents of the Gurez valley are in an underprivileged position, despite inhabiting a resource-rich landscape. The main reasons for such conditions are the dominance of the tribal population, the land-locked landscape, the lack of infrastructural facilities and the remoteness of the valley, which compelled them to seclude themselves from the mainstream of the nation. The socio-economic conditions of the tribal people are far from the expected level, with considerable scope for improvement through livelihood diversification strategies based on entrepreneurship development and the commercialization of forest resources.

Table 1. Summary of descriptive information of household socio-economic variables (N = 337)

Variable (unit)	Description	Measurement	Mean ± SD	95% CI for mean (Lower-Upper)
Age (year)	Age of household head in years	Chronological age in year	44.11± 16.73	42.32-45.90
Education (score)	Education level of the household head	0=illiterate, 1<primary, 2=primary, 3=middle, 4=high school, 5=intermediate, 6≥graduate	2.50± 1.68	2.32-2.68
Family size (score)	No. of family members in a household	1=small (≤5 members), 2=large (>5 members)	1.66± 0.47	1.61-1.71
Family labour (score)	No. of workers in a household	1=1 worker, 2=2 workers, 3=3 workers, 4=>3 workers	3.36± 0.85	3.27-3.45
Land holding (score)	Land area under household management	0=landless, 1=marginal (≤1.0 ha), 2=small (1.1 to 2.0 ha), 3=medium (2.1 to 4.0 ha), 4= large (>4.0 ha)	1.54± 0.73	1.47-1.62
Herd size (score)	No. of livestock owned by the household	0=no livestock, 1≤5 livestock, 2=6 to 10 livestock, 3>10 livestock	1.78± 0.87	1.69-1.87
On-farm occupation (score)	Occupation in which an individual is engaged for six months or more in a year	0=no-farming job, 1=cultivation, 2=livestock production, 3=NTFP 4=horticulture, 5=agroforestry	2.95± 1.39	2.80-3.10
Off-farm occupation (score)	The state of having a paid job	0=unemployed, 1=casual labour, 2=caste occupation, 3=petty business, 4=regular service, 5=remittance	1.57± 0.85	1.38-1.56
Wealth status (score)	Relative position of households in the community in respect of wealth/ physical assets	0=poor, 1=medium, 2=rich	1.21± 0.04	1.12-1.28
Annual income (Rs)	Household gross income earned by all the on-farm and off-farm sources	Rs/year (very low≤Rs 30000), (low=Rs 30001 to Rs 60000), (medium=Rs 60001 to Rs 90000), (high>Rs 90000)	92811.24± 70467.79	30000-420000

The observations made by earlier studies (Mir *et al*., 2016; Atta *et al*., 2018; Islam *et al*., 2022) were in line with the present findings, which revealed the low socio-economic conditions of the *Shina* people.

Forests dependence for fodder security: The total annual collection of fodder from forests either in terms of cut and carry or grazing was 1577.75 tonnes in the surveyed population, of which 1290.59 tonnes were consumed for subsistence and the remainder (287.15 tonnes) were sold for cash income. The average annual per household collection, consumption and marketing of fodder were 4.68 tonnes, 3.82 tonnes and 0.85 tonnes, respectively (Table 2).

Livestock production is a prominent source of livelihoods for local people, and livestock owners secure their major fodder requirements from forests, including forest herbage, tree foliage, green grasses, aquatic vegetation, weeds, and other forest residues, in the form of grazing or cut-and-carry. People collect the fodder from forests and store it on their roofs to meet the fodder shortage in the severe winter months. Tree leaves are excellent fodder for animals; people collect browses by lopping trees, and sometimes animals are used for onsite browsing of trees. The important plant species that are exploited by the people as fodder are *Populus* spp., *Robinia pseudoacacia*, *Acer caesium*, *Allium carolinianum*, *Bromus japonicas*, *Chrysopogon gryllu*, *Draba aubrietoides*, *Lonicera quinquelocularis*, *Melilotus officinalis*, *Oxytropis mollis*, *Prangos pabularia*, *Salix denticulate*, *Salix flabellaris*, *Trifolium alexandrinum*, *Trifolium pratense*, *Ulmus wallichiana* etc. Low socio-economic conditions, unmanaged pasture, the unavailability of fodder production units, and ignorance towards green fodder production are the major causes of higher dependence on forests for fodder security (Ahmad *et al*., 2016; Baba and Islam, 2017; Islam *et al*., 2021; Singh *et al*., 2023).

Economic valuation of forest dependence for fodder security: The total economic value of the fodder collected annually from forests was Rs 12622000, including both subsistence (Rs 10324796/year) and cash income (Rs 2297204/year). Average annual household consumption of fodder for subsistence, sale and total was worth Rs 30637.38, Rs 6816.63, and Rs 37454.01, respectively (Table 3).

This study revealed that the value of fodder for subsistence consumption was significantly higher than market sales for many poor families and marginalized sections of rural society in the valley. The economic valuation of fodder suggested that they hold greater significance as a source of subsistence than cash income. Households with lower socio-economic backgrounds were actively engaged in collecting fodder from forests, consuming them at the household level, and trading a small fraction in local markets to address livelihood security needs. The collection of fodder from forests was frequent and ample due to their sufficient availability, easy accessibility, and higher utilization on a regular basis. During the harsh winter months, when fodder is scarce and households risk shortages, processed and stored resources from forest landscapes serve as significant safety nets. Nonetheless, the findings suggested that forests play a significant role in meeting the day-to-day household's livelihood needs and economic well-being (Ahmad *et al*., 2016; Islam *et al*., 2021) and serve as a crucial safety net or essential coping strategy for the rural poor to address livelihood stress (Arora and Kataria, 2023; Gupta *et al*., 2023).

Forest dependence index (FDI) and Relative forest income (RFI) for fodder: The FDI (mean= 0.348, SD= 0.155) indicated that the majority of households had intermediate levels of forest dependence for fodder security (Table 4). The extent to which fodder is collected from forests is a crucial strategy for meeting household needs in subsistence livelihoods. According to the FDI, forests provided a considerable quantity (34.80%) of the total household fodder intake, either through grazing or the cut-and-carry method. The remaining fodder was obtained from agroforestry, woodlots, agricultural fields, fruit orchards, common property resources, and social forestry plantations. The livestock owners secured their dry fodder requirements as maize, dried oats, tree fodder, weeds, agricultural residues, and paddy straw. Fortifications of fodders, silage making, feeding mineral mixtures, or concentrate feeding were very limited. The *Shina* tribe primarily rears cows, bullocks, horses, sheep, goats, zho, and zombo for animal products such as milk, ghee, meat, dung, manure etc.; ploughing; religious sacrifices; entertainment; propitiation of gods; and festivities (Mir *et al*., 2016; Beigh *et al*., 2020); hence, procurement of forest fodder is imperative.

Table 2. Collection, consumption and marketing of forest fodder (N = 337)

Variable (Unit)	Collection	Consumption	Marketing
Total (tonnes/year)	1577.75	1290.59	287.15
Average (tonnes/ household/year)	4.68	3.82	0.85
Per capita (tonnes/year)	0.87	0.71	0.15

Table 3. Economic valuation (gross) of fodder collected from forests (N = 337)

Variable (Unit)	Subsistence	Cash	Total
Total (Rs/year)	10324796.00	2297204.00	12622000.00
Average (Rs/ household/year)	30637.38	6816.63	37454.01
Per capita (Rs/year)	5694.68	1267.03	6961.71

Table 4. Forest dependence index (FDI) and Relative forest income (RFI) for fodder (N = 337)

Variable	Mean	SD	Minimum	Maximum	95% CI for mean	
					Lower	Upper
FDI	0.348	0.155	0.140	0.870	0.3314	0.364
RFI	0.074	0.070	0.000	0.390	0.0665	0.081

Table 5. Influence of socio-economic variables on household forest fodder exploitation (N=337) (ANCOVA)

Source	Coefficients of correlation (r)	Type III sum of squares	df	Mean square	F-ratio	p-value
Corrected Model	-	150.863[a]	10	15.086	47.624	0.000*
Intercept	-	1.789	1	1.789	5.649	0.018*
Age	0.104[NS]	0.004	1	0.004	0.014	0.906 [NS]
Education	0.501*	13.327	1	13.327	42.072	0.000*
Family size	0.504*	0.613	1	0.613	1.935	0.016*
Family labour	0.599*	27.405	1	27.405	86.512	0.000*
Farm size	-0.468*	0.337	1	0.337	1.064	0.033*
Herd size	0.593*	8.245	1	8.245	26.028	0.000*
On-farm occupation	0.347*	0.366	1	0.366	1.154	0.028*
Off-farm occupation	-0.291*	4.669	1	4.669	14.741	0.000*
Wealth status	-0.372*	2.174	1	2.174	6.864	0.009*
Annual income	0.304*	3.307	1	3.307	10.438	0.001*
Error	-	103.269	326	0.317		
Total	-	7640.764	337			
Corrected total		254.131	336			

[a]R Squared= 0.594; Adjusted R Squared= 0.581; NS= Non-significant at 5% level of probability; *= Significant at 5% level of probability

As regards RFI (mean= 0.074, SD= 0.070), the majority of households had low dependence on forest fodder for cash income diversification (Table 4). The low RFI suggested that the least thought-out source of boosting household economies was the sale of forest fodder. Essentially, agriculture, livestock husbandry, non-timber forest products (NTFPs), wage labor, and petty businesses are the primary sources of livelihoods and risk coping strategies among the *Shina* people. Since the *Shina* people have a variety of on-farm and off-farm livelihood strategies, they do not diversify their livelihoods to enhance income sources by selling forest fodder. Meanwhile, the *Shina* households have more subsistence pressure for fodder than income earnings; consequently, only a very small quantity of fodder is sold either at exigency or as surplus, to animal feed dealers, local vendors, or livestock farmers. Further, the lack of alternative sources for fodder procurement and the availability of a sufficient number of NTFP income sources also restricted the sale of forest fodder for income earnings. Another obstacle to the adoption of collecting and selling fodder for income generation was that it is time-consuming, cumbersome and less remunerative for the efforts made. The results of prior studies (Islam *et al*., 2015; Baba and Islam, 2017) corroborated the current study, which reported low RFI from forest fodder.

Socio-economic determinants of forest dependence for fodder security: The ANCOVA showed that among the socio-economic variables, education (F = 42.072, p = 0.000), family size (F = 1.935, p = 0.016), family labour (F = 86.512, p = 0.016), farm size (F = 1.064, p = 0.033), herd size (F = 26.028, p = 0.000), on-farm occupation (F = 1.154, p = 0.028), off-farm occupation (F = 14.741, p = 0.000), wealth status (F = 6.864, p = 0.009), and annual income (F = 10.438, p = 0.001) had a significant influence on forest dependence for fodder security (Table 5). However, there was a non-significant effect of age on forest dependence for fodder security (F = 0.014, p = 0.906). The R^2 (0.594) of this particular model indicated that 59.40% of the variation in the household forest dependence for fodder security can be explained by the socio-economic variables. The model's unexplained variability was attributed to random error or other excluded factors, which may include biophysical variables such as proximity to forests, frequency of forest visits, market accessibility, alternative forestry sources, and family forestry.

The significant effect of education on the forests for

fodder security confirmed that formally educated people depended more on the forests for fodder security as compared to illiterate people. The *Shina* community has low literacy rates, ranging from illiterate to primary level. Hence, compared to their less educated counterparts, higher-educated individuals had greater access to forests, better connections with government officials, and more experience in extracting goods and services from forests for household subsistence, income, and safety nets. Additionally, education is crucial for increasing awareness, technical proficiency, and decision-making. The significant effect of family size on forest dependence for fodder security implied that larger families require and collect more fodder resources than their counterparts with smaller families. Households with more family labour are more likely to collect fodder from forests because of the available family labour that is utilized for the collection, transport, processing and storage of fodder resources. Households with larger farms are more likely to arrange for a large quantity of fodder resources from their own lands, indicating that the larger the size of the agricultural land, the less the household will depend on forests for fodder security. The herd size had a significant impact on forest dependence for fodder security, implying that as the number of livestock increases, household dependency on forest fodder also increases, as these resources are indispensable for livestock rearing. On-farm occupations, including agriculture, animal husbandry, non-timber forest products (NTFP) collection, horticulture, and agroforestry, have direct linkages with livestock holdings to support household economic activities. As a result, if a household has more on-farm occupations, there is a higher probability of forest dependence for both reliable access to fodder and sources of income. People with better off-farm occupations had higher income sources and purchasing power for alternative arrangements, which reduced their reliance on forests for fodder security. The significant effects of wealth status on forest dependence for fodder security indicate that wealthy households are less dependent on forest fodder than poor households, as they are able to secure capital, cash, and inputs to arrange alternative sources of fodder for family consumption. Annual income was a key financial capital that plays a major role in determining how much forest fodder will be purchased for household usage from their neighbours collectors, forest depots, and local markets. Higher annual-income households acquired more forest fodder through purchases and personal collection, which made them more reliant on forests for their fodder needs. The non-significant effect of age on forest dependence for fodder security implied that people from all age groups, whether young, middle-aged, or old, equally indulge in the fodder collection from forests. There are a multitude of studies (Islam *et al*., 2015; Baba and Islam, 2017; Qureshi *et al*., 2019; Himshikha *et al*., 2022; Kereto *et al*., 2022; Yadav *et al*., 2022) that emphasized that socio-economic characteristics are vital predictors of forest dependence for household fodder security.

Conclusion

In the impoverished *Shina* community, household dependence on forest resources for fodder security in terms of subsistence, cash income, and safety nets is very crucial. The people's low socio-economic status compelled them to harvest huge quantities of forest fodder, as they lack access to alternative sources. The total annual collection of forest fodder was 1577.75 tonnes, including 1290.59 tonnes for subsistence and 287.15 tonnes for cash income. The forest fodder had an annual economic value of Rs 12622000, which included Rs 10324796 for subsistence and Rs 2297204 for cash income. According to the FDI (mean=0.348, SD=0.155) and RFI (mean=0.074, SD=0.070), the forests contributed to household fodder security as intermediate for subsistence and low for cash income. ANCOVA (R^2=0.594) indicated that the socio-economic variables were potent predictors of household forest dependence for fodder security.

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