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AGRONOMY

Fodder Diversity, Availability and Utilization Pattern in Western Himalayas

Chander Shekhar[1*], Sarthak Verma[1], Akhilesh Kumar Mishra[2], Vishwajeet Singh[3], Sunil Prakash[4] and Pankaj Lal[5]

[1]Department of Agro-Sciences, (Forestry) Uttaranchal (PG) College of Bio-Medical Sciences & Hospital, Dehradun, India
[2]Division of Forest entomology, Forest Research Institute, Dehradun, Uttarakhand, India
[3]Division of Silviculture, Forest Research Institute, Dehradun, Uttarakhand, India
[4]School of Agriculture, Uttaranchal University, Dehradun, Uttarakhand, India
[5]College of Forestry Ranichauri, University of Horticulture and Forestry, Bharsar, Uttarakhand, India

*Corresponding author: chandershekhargenetics@gmail.com (**ORCID ID:** 0000-0001-6935-7217)

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ABSTRACT

Trees have been used for centuries for fodder globally. Tree foliage is substantial source of feed for livestock. As in many other regions of the world, farmers in the Himalaya region depend largely on this for sustaining their livestock during winter and summer season for almost half of the year. Himalayas are remote and inaccessible; people's dependency relies mainly on forests resources to fulfill livelihood services. Fodder availability in hill villages of Uttarakhand Himalayan region is insufficient and a part of it is supplemented through lopping of tree foliage. The dependency is very high (>70%) during the period, beginning from October to February. Owing to changing climatic conditions, a farmer's preference for a particular tree species is also variable, according to the low, mid and high hill regions depending on where he lives. For the present study, a Questionnaire survey was conducted in different districts of Kumaon and Garhwal region of Uttarakhand.

HIGHLIGHTS

- To quantify various fodder species in Uttarakhand Himalayas.
- To conduct survey to understand utilization pattern in Uttarakhand Himalayas.
- To assess preference of people according to elevation and season.

Keywords: Trees, Fodder, Questionnaire survey, inaccessibility, Season, Elevation

Himalayas are the youngest fold mountain range globally and represents 18% of India's total geographical area. Himalayas are home to diversified tribes and people, living in the remote and inaccessible valleys and mountain. Due to inaccessibility, they are relying on the forest resources since inception of civilization (Rawat *et al.* 2020; Parveen *et al.* 2018). Fodder and fuel woods are two essential livelihood resources for people of the Himalayas (Ramakrishnan *et al.* 2000). Further, it is observed that livestock's mainly relies on forest wealth especially in the Himalayas (Tulachan *et al.* 2002). Fodder collection plays a critical role in the turning the wheel of hill agriculture in the mountains of the Himalaya (Makino 2009). Forests fulfill 87% of fodder demand in the Himalayan region for feeding their cattle's for approximately five to six months in a year (Pandey and Singh 1984). Several species of fodder yielding trees are distributed in different elevation zones in the mountains of Uttarakhand Himalaya. Due to variation in climate and elevation, a farmer's preference changes according to elevation

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and season (Verma *et al.* 1989; Rawat *et al.* 2018). The in depth understanding and detailed data on community's choice in the selection of key species is of vital importance for formulation of environmental conservation (Kala 2007). Case studies are limited in the Uttarakhand Himalaya which is conducted on fodder resources according to season, elevation and lacks comprehensiveness (Anonymous 1982; Jackson 1985; Bhatt and Rawat 1993; Singh 1985; 1989, 2002, 2005; Jodha and Shrestha 1990; Singh and Bohra 2005; Singh and Gaur 2005; Bohra 2006 and Singh and Sundriyal, 2009; Nautiyal *et al.* 2018). In order to address availability and utilization pattern of fodder tree species in Uttarakhand Himalayas Following objectives were framed in our case study.

1. To enlist various fodder tree species available in Uttarakhand Himalayas.
2. To conduct survey to understand fodder utilization and preference pattern according to elevation and season in Uttarakhand Himalayas.

MATERIALS AND METHODS

(a) Study area

The state of Uttarakhand was chosen as study area, which is known for its highly varied physiographic and biodiversity. Uttarakhand located between coordinates E 77°34′–81°03′; N 28°43′–31°28′ is among 12 Himalayan states of India.

(b) Methodology

To assess the fodder preference, elevation and seasons were chosen as criterion. To understand the effect of elevation the study area was classified into five elevation zone (Table 2). Communities were interviewed through questionnaire for collection and recording of Data. Surveys were confined to two political regions Kumaon and Garhwal in duration of 2018 – 2022, during different seasons of the years. Information regarding details of fodder species part used, season of lopping locality, local names were documentized by interviewing the communities and shepherds residing in study villages. To identify the fodder species, Fodder collection sites were visited in company with shepherds and women's during gathering of fodder. To understand utilization pattern, seasonal, and species preference, surveys were carried out for of each species separately in different seasons. The specimens were collected and identified from Botanical survey of India and Systematic discipline of FRI, Dehradun.

RESULTS

Diversity and availability according to elevation

Total 41 species of fodder plants representing 24 genera taxonomically belongs to 18 families were enlisted and documentized (table 1). Maximum fodder species belongs to family leguminaceae (27 spp.) trailed by Moraceae (12 spp) (Table 1). Maximum richness of Species was shown by the genus *Ficus* (8 spp.), then trailed by *Quercus* (5 spp. Each).

Table 1: Some major fodder enlisted during surveys from study area

Sl. No.	Botanical Name	Family	Local name
1	*Acacia catechu*	Mimosaceae	Khair
2	*Acer caesium*	Sapindaceae	Kainjal
3	*Acer acuminatum*	Sapindaceae	Kainjli
4	*Albizia chinensis*	Mimosaceae	Siris
5	*Albizia leebeck*	Mimosaceae	Siris
6	*Albizia procera*	Mimosaceae	Siris
7	*Anogesis latifolia*	Combretaceae	Daur
8	*Bauhinia purpurea*	Caesalpiniaceae	Guiral
9	*Bauhinia variegata* L	Caesalpiniaceae	Kachnar
10	*Bauhinia semla*	Caesalpiniaceae	Semla
11	*Butea monosperma*	Caesalpiniaceae	Dhak
12	*Celtis australis*	Ulmaceae	Kharik
13	*Cinnamomum tamala*	Lauraceae	Dalchini
14	*Ficus auriculata*	Moraceae	Timla
15	*Ficus hederacea*	Moraceae	—
16	*Ficus hispida*	Moraceae	Ghogsu
17	*Ficus neriifolia*	Moraceae	Khilku
18	*Ficus palmata*	Moraceae	Bedu
19	*Ficus racemosa*	Moraceae	Gullar
20	*Ficus semicordata*	Moraceae	Khainu
21	*Ficus subincisa*	Moraceae	Chanchari
22	*Fraxinus xanthoxyloides*	oleaceae	Ash tree
23	*Grewia optiwa*	Tiliaceae	Bhimal

24	*Leucena leucophala*	Mimosaceae	Subabul
25	*Machilus duthei*	Lauraceae	Kowala, Bhojo
26	*Mallotus phillipiensis*	Euphorbiaceae	Rohini
27	*Morus alba*	Moraceae	Shahoot
28	*Morus serrata*	Moraceae	Tut
29	*Neolitsea cuipala*	Lauraceae	Kostermans
30	*Oogeinia oojeinensis*	Fabaceae	Sandan
31	*Quercus semecarpifolia*	Fagaceae	Kharsu
32	*Quercus floribunda*	Fagaceae	Moru
33	*Quercus Lanata*	Fagaceae	Rianj
34	*Quercus leuchotrichophora*	Fagaceae	Banj oak
35	*Quercus glauca*	Fagaceae	Phanat, Bani
36	*Robinia pseduocaceae*	Fagaceae	—
37	*Schleichera oleosa Oken*	Sapindaceae	Kusum
38	*Swida macrophylla*	Cornaceae	Khagsu
39	*Symplocos paniculata Miq.*	Symplocaceae	—
40	*Symplocos crategoides Miq.*	Symplocaceae	Lodh
41	*Terminalia tomentosa*	Combretaceae	Sain

Table 2: Fodder species according to elevation zone

Sl. No.	Elevation zone (amsl)	Major fodder Species preferred
1	500–1000 m	*Albizia leebeck, Albizia chinensis, Albizia procera, T. Tomentosa , Celtis australis, Leucena leucophala, Robinia pseduocaceae, Quercus glauca*
2	1000–1500 m	*Grewia optiwa, Quercus leuchotrichophora, Quercus glauca, Q. floribunda, Celtis australis,*
3	1500–2000 m	*Quercus leuchotrichophora,*
4	2000–2500 m	*Quercus leuchotrichophora, Q. floribunda, Celtis australis, Q. Semecarpifolia*
5	2500–3000 m	*Fraxinus xanthoxyloides, Q. Semecarpifolia*

Utilization pattern

Fodder utilization pattern and preference of species is governed by season and according to elevation zone. Variation in utilization pattern is induced due to elevation and different climatic zones present in study area. Oaks were considered as the lifeline of people in (between 1500-3000m) higher Himalayas, whereas in lower elevation (500-1000) *Grewia Optiwa* was species to support the livelihood of inhabitants (Table 2). Winter season scarcity of fodder was fulfilled by *Quercus* species and in lower elevation by *Grewia optiwa*. In summer's season Subabaul and *Albizia* spp. were fodder trees available to farmers. *Quercus leucotrichophora, Q. floribunda, Q. semicarpifolia, Machilus duthei, Grewia optiva, Bauhinia spp.* and *Ficus spp*. are the species preferred for lopping during winter season. *C. australis, M. serrata, O. oojeinensis, Acer spp., Ficus spp., M. duthei* were preferred for lopping during summer season (Table3).

Table 3: Seasonal availability of primary fodder species in Uttarakhand Himalaya

Summer	Rainy	Winter
Celtis australis		*Grewia optiva*
Machilus duthei		*Quercus leucotrichophora*
Morus alba		*Q. floribunda*
Acer caesium		*Q. semecarpifolia,*
Acer acuminatum		*Oogeinia oojeinensis*

CONCLUSION AND DISCUSSION

According to the respondents, there are seasonal variations in fodder availability. It was observed that trees foliage is preferred for feeding in summer and winter season's only. Further during rainy season, abundant herbs, shrubs, trees fodder species are available to feed livestock's. Results of our case studies reveals that some species are similar with that of (Samant *et al.* 2007; Singh *et al.* 2008; Singh and Sundriyal 2009; Nautiyal *et al.* 2018) in the Indian Himalayan Region. Results of recent case studies indicate species are becoming scarce because the forests and pasturelands are converted to crop agriculture and to settlement. Results of the study suggest that there is a diversity of fodder plants in Uttarakhand Himalaya but due to reductions in grazing areas it was hard to find fodder in enough quantity to fulfill the daily nutritional requirement of livestock. The present case study revealed that altitude as well as season significantly influences the preference of fodder by inhabitants. Moreover sites which were in higher elevation Himalayas and inaccessible were more relied on conventional forests than communities near to cities. Singh *et al.* (2012) concluded in their case study on Q. semecarpifolia that season and altitude influences nutrient composition. In nutshell our case study treid to fill some gaps but some more comprehensive case studies are required by

the researchers and scientist revealing nutrient composition, preference of fodder due to altitude and season in western Himalyas.

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