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FODDER DIVERSITY, AVAILABILITY AND UTILIZATION PATTERN IN GARHWAL HIMALAYA, UTTARAKHAND.

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Abstract

In Garhwal Himalaya, livestock are the important source of income in rural areas. Livestock mostly rely on fodder from forest. The diversity, utilization pattern and season of availability is important to prioritization of fodder species in the area. The present study attempts to enumerate 165 fodder species representing trees (68 spp.), shrubs (28 spp.), herbs (65 spp.) and climbers (4 spp.). Poaceae (27 spp.) and Moraceae (12 spp.) amongst families and Ficus (9 spp.) amongst genera are rich in species. 30 species are used in summer, 32 in winter, 47 in rainy and 28 in all over the year. Herbs are used as fodder mainly in rainy season. Amongst the recorded species 148 species are used as green fodder while 5 spp. as dry species while remaining species are used both as green and dry.

Key words: Fodder, diversity, used pattern, availability status, Garhwal Himalaya.

Introduction

Fodder and fuel wood are the two most important livelihood resources for mountainous regions, of the Himalayas (Ramakrishnan *et al.* 2000). Fodder plays a critical role in the crop, livestock, manure and soil nutrient cycle in traditional farms in the mountains of the Himalaya. Collection of fodder is the first step that turns the wheel of the agricultural economy of the village community (Makino, 2009). This complex interrelationship between forests, grasslands, livestock and crops in mountain farming systems has contributed to the sustainability of mountain agriculture for generations (Singh, 1994).

Indian Himalayan Region (IHR) supports diverse habitats, species, populations, communities and ecosystems. Vegetation is ranges from tropical to alpine types. It supports about 18,440 species of plants, of which about 8,000 species are angiosperm (Singh and Hajra, 1997). The goods and services such as fodder, fuelwood, wild edibles, medicine, house building, agricultural implements, religious and various other purposes are being used by local communities (Samant and Dhar, 1997). In hills, fodder trees, shrubs and grazing in the forests are the main sources for the livestock feed including use of agricultural residue (Singh and Sundriyal, 2009). In the mid-hill of Himalayas, about 30-50% of total animal feed mainly grass and tree fodder is from forests and grasslands (Singh and Naik, 1987; Bajracharya, 1999). As per another study, approximately, two-thirds to three-fourth of the fodder requirement are met from the forest in mid hills and 26-43% in the lower hill (Singh, 1999). Interestingly, it has also been reported that dairy cattle are also dependent on forest resources particularly in the Himalayas (Tulachan *et al.*, 2002).

Livestock rearing is an integral component of mountain farming systems. In the Uttarakhand Himalaya, there is a dynamic relationship among common property resources (CPRs), livestock, and crops in the mixed crop-livestock farming systems. Livestock depend, to a great extent, on fodder grown on the community land, forestland, and as well as on crop residue. Meanwhile, the animals provide milk, manure, and much needed draught power. Livestock are therefore, an important to the sustainability of hills and mountain farming. About 80% of the population's livelihood is based on livestock rearing under subsistence cereal farming systems.

Uttarakhand, inspite of being a small state, has certain key features that make it distinct from other states of the country and highlights its potential for development, tourism, poultry and wool-based livelihoods, agriculture

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diversification, ambient natural resources beside this, the state faces the challenge of promoting livelihoods to minimize migration through local employment and income generation, and to enhance the quality of life of people living in villages. Uttarakhand is well endowed with forests, which constitute about 63.87% of the total geographic area; about 4.04% is estimated to be under permanent pastures and other grazing lands. Out of the total population of uttarakhand nearly 74.33% of the state lives in rural area, more than three-fourths of Uttarakhand's total population depends on agriculture for their livelihood (Mittal *et al.* 2008). Forests of the State are the repositories of great biological diversity and are extremely important as they provide ecological stability, timber, fodder and a variety of other produce to the local inhabitants. Livestock and animal husbandry have made these people more dependent on their immediate environment, to meet their daily requirements of fuelwood and fodder supply.

In the Uttarakhand Himalaya, farmers maintain naturally regenerating tree species, particularly on edges of terraced agriculture fields without any significant input of manpower. This reduces the pressure from forest resources in terms of fodder and fuelwood along with site improvement . Several tree species are used for fodder purposes in Garhewal Himalaya. *Grewia oppositifolia*, *Morus serrata*, *Bauhinia variegata*, *Quercus leucotrichophora*, Quercus *floribunda, Ilex dipyrena, Oogeinia oojeinensis, Boehmeria rugulosa, Morus alba* ,*Celtis australis* are common species which are used as fodder in Garhwal Himalaya.

Several species of fodder yielding plants including herbaceous plants, trees and shrubs are present in the submontane and montane zones in the mountains of Uttarakhand Himalaya. A few studies have been conducted on fodder resources in the Uttarakhand Himalaya by 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 *et al.* 2008. In the present paper attempts has, therefore, been made to enlist plant species which are commonly used for cattle growing in the area. Thus the present study deals with diversity and utilization pattern of fodder species in Garhwal Himalaya, Uttarakhand.

Study Area

The study covers some areas of Garhwal Himalaya of Uttarakhand, which lies in between 29031.9' N to 31026.5'N lat and 77033.5'E to 80060' E long. Physiographically, the whole terrain is mountainous and can be divided in to three zones-lower Himalayan zone (300-500masl); middle Himalaya (600-1000masl); and upper Himalaya (1100 -2500masl). The mainland of Uttarakhand constitutes about 92.6% of the total geographical land of the state. It is characterized by dominance of subsistence cereal crops. It is also a main source of livelihood. Besides, livestock rearing for milk and manure and forest-based non-timber products constitute major parts for livelihood. The availability of natural resources as forest, water, and soil and manpower is enormous as the forest (mostly temperate) covers about 60% land and the rivers are fed by the glaciers, which are perennial.

The vegetation is predominantly of forest communities with frequent interruption of scrub jungles, savannas, grassy localities and crop fields. The vegetation is categoriesed into:- (i) Submontane vegetation adjacent to Gangetic Plains, (ii) Submontane and montane intermixed vegetation and (iii) Montane (temperate-like) vegetation. Several environmental factors control the distribution of vegetation, however, usually in the hilly tracts vegetation is demarcated on the basis of altitudinal gradient. In general, the climate of Garhwal Himalaya is with less severe summer, higher precipitation and more prolonged winter (Gaur, 1999).

Methodology

Research was conducted by means of community based questionnaire survey. Surveys were conducted during the years 2014 - 2015. For collection of fodder specimens frequent field trips were made during different seasons of the years. For this some areas of Garhwal Himalaya like Joshimath, Shivpuri and Adhwani were visited. Information regarding locality, feeding period, mode of use, part used, and vernacular names were recorded by interviewing the villagers, old ladies, and shephereds of the studied villages. Traditional knowledge system plays a key role in the use of any plant species as fodder with species preference, the inhabitants of the area, especially old aged peasants and shepherds were consulted for determination of any plant species as fodder. Fodder collection sites were visited along with the villagers during collection of fodder to mark the fodder species. Surveys were carried out for seasonal lopping and utilization pattern of each species. Seasonal mode of use (green and dry) were studied through direct observation. The collected plant specimens were identified with the help of regional flora and herbaria (BSD, DD & GUH).

Results

Diversity

In the present study 165 plant species of fodder under

Table 2: Some important fodder plants of the study area

Species name	Local name	Family	Life form	Feeding time	Mode of use
(1)	(2)	(3)	(4)	(5)	(6)
Abies pindrow Brandis	Raga	Pinaceae	Tree	w	G
Acer acuminatum Wallich ex D.Don	Til- kanjul	Aceraceae	Tree	R	G
Acer caesium Wallich ex Brandis	Kanjul	Aceraceae	Tree	R	G
Achyranthus aspera L.	Sajji	Amranthaceae	Herb	O	G
Aesculus indica Hook.	Pangar	Hippocastanaceae	Tree	R	G
Agrostis pilosula Trinius		Poaceae	Herb	R	G
Alnus nepalensis D.Don	Utees	Betulaceae	Tree	R	G
Amaranthus viridis L.	Chaulai	Amranthaceae	Herb	A	G
Anemone vitifolia Buch.-Ham. ex DC.		Ranunculaceae	Herb	R	G
Apluda Mutica L.	Tachlu	Poaceae	Grass	R	G
Aplula aristata L.		Poaceae	Herb	R	G
Artemisia nilagirica	Kunjaa	Asteraceae	Shrub	S	G
Arthraxon lancifolius Hochst.	Kanglya	Poaceae	Herb	O	G
Arundinella pumila Steudel		Poaceae	Herb	R	G
Astilbe rivularis Buch.-Ham. ex D.Don		Saxifragaceae	Shrub	R	G
Bauhinia purpurea L.	Guiral	Caesalpiniaceae	Tree	S/W	G
Bauhinia semla Wunderlin	Semla	Caesalpiniaceae	Tree	A	G
Bauhinia vahlii Wight & Am.	Malu	Caesalpiniaceae	Climber	W	G
Bauhinia variegata L	Guriyal	Caesalpiniaceae	Tree	W	G
Betula alnoides Buch.-Ham. ex D.Don	Bhojpatra	Betulaceae	Tree	S	G
Bidens pilosa L.	Kumraya	Asteraceae	Herb	O	G
Boehmeria macrophylla D.Don		Urticaceae	Shrub	S/W	G/D
Boehmeria platyphylla D.Don	Khagsa	Urticaceae	Shrub	S	G
Boehmeria rugulosa Wedd.	Genthi	Urticaceae	Tree	S/W	G
Bothriochloa pertusa A. Camus		Poaceae	Herb	R	G
Brachiaria villosa A. Camus	Malchu	Poaceae	Grass	R	G
Bridelia retusa Sprengel	Ghayya	Euphorbiaceae	Tree	W	G
Broussonetia papyrifera Ventenat	Ghagynyu	Moraceae	Tree	A	G
Carpinus viminea Lindley		Corylaceae	Tree	S/W	G
Celtis australis Hook. f.	Kharik	Ulmaceae	Tree	S	G
Cenchrus ciliaris L.	Godla	Poaceae	Herb	R	G
Chenopodium album L	Bathua	Chenopodiaceae	Herb	S	G
Chenopodium botrys L		Chenopodiaceae	Herb	S/R	G
Chrysopogon fulvus Chiovenda		Poaceae	Grass	S/W	G/D
Chrysopogon gryllus Trinius		Poaceae	Grass	R	G
Commelina benghalensis L.		commelinaceae	Herb	R	G
Corylus jacquemontii Decne.	Kabasi/ Bhotia-badam	Betulaceae	Tree	S	G
Cotoneaster bacillaris Wallich	Ruins	Rosaceae	Shrub	S	G
Cymbopogon martinii W. Watson		Poaceae	Herb	R	G
Cynodon dactylon Persoon	Dubla	Poaceae	Grass	S	G
Cynoglossum glochidiatum Wallich ex Benth.	Lachkuru	Boraginaceae	Herb	R	G
Debregeasia longifolia Wedd.	Ghinghara	Urticaceae	Tree	S/W	G
Debregeasia salicifolia Rendle.	Tusharu	Urticaceae	Shrub	W	G
Dendrocalamus strictus Nees	Bans	Poaceae	Grass	W	G
Desmodium elegans DC	Chamla	Fabaceae	Shrub	R	G

Continued on.....

Continue.....

(1)	(2)	(3)	(4)	(5)	(6)
Desmodium laxiflorum DC.		Fabaceae	Shrub	A	G
Dicliptera bupleuroides Nees	Kodi	Acanthaceae	Herb	W	G
Dodecadenia grandiflora Nees		Lauraceae	Tree	S	G
Echinochloa crus-galli P. Beauv.	Jhavara ghas	Poaceae	Grass	R/W	G/D
Eleusine coracana Gaertner	Mandua	Poaceae	Grass	W	D
Engelhardtia spicata Leschenault ex Blume		Juglandaceae	Tree	S	G
Eragrostis sp.	Ginni ghas	Poaceae	Herb	A	G
Eranthemum palchellum Andrews	Thunarya	Acanthaceae	Tree	S	G
Euonymus pendulus Wallich		Celastraceae	Tree	S/W	G
Euonymus tingen Wallich		Celastraceae	Tree	S	G
Eurya acuminata DC.		Theaceae	Tree	W	G
Fagopyrum dibotrys Hara	Kanaya	Polygonaceae	Herb	R	G
Fagopyrum esculentum Moench	Ougal	Polygonaceae	Herb	S/R	G
Ficus auriculata Lour.	Timla	Moraceae	Tree	W	G
Ficus hederacea Roxb		Moraceae	Shrub	A	G
Ficus hispida L. f.	Ghogsu	Moraceae	Tree	W	G
Ficus neriifolia Smith	Khilku	Moraceae	Tree	A	G
Ficus palmata Forsk.	Bedu	Moraceae	Tree	S	G
Ficus racemosa L.	Gullar	Moraceae	Tree	S	G
Ficus sarmentosa Buch-Ham. ex J.E.Smith	Moraceae	Shrub	A	G	
Ficus semicordata Buch.-Ham. ex J.E. Smith.	Khainu	Moraceae	Tree	S	G
Ficus subincisa Buch.-Ham. ex J.E. Smith;	Chanchari	Moraceae	Tree	W	G
Galinsoga parviflora Cav.	Banglya/ Angeraji ghas	Asteraceae	Herb	R/W	G/D
Galium elegans Hara & Gould		Rubiaceae	Herb	S/R	G
Geranium wallichianum D.Don ex Sweet		Geraniaceae	Herb	R	G
Girardinia diversifolia Friis		Urticaceae	Herb	W	D
Grevia optiva Drummond ex Burret	Bhimal	Tiliaceae	Tree	W	G
Hedera nepalensis K. Koch		Araliaceae	Climber	S/R	G
Heteropogon contortus P. Beauv. ex Roemer & Schultes		Poaceae	Grass	A	G/D
Holarrhena pubescens Wallich ex G.Don	Bakara	Apocynaceae	tree	S	G
Hordeum vulgare L.	Jau	Poaceae	Grass	S/W	D
Hypericum choisianum Wallich ex N.Robson		Hypericaceae	Shrub	S	G
Hypericum elodeoides Choisy		Hypericaceae	Herb	R	G
Ilex dipyrena Wailich		Aquifoliaceae	Tree	A	G
Ilex excelsa Hook, f		Aquifoliaceae	Tree	A	G
Impatiens balsamina L.	Jannu	Balsamiaceae	Herb	R	G
Impatiens scabrida DC.		Balsamiaceae	Herb	R	G
Indigofera heterantha Wallich ex Brandis	Sakina	Papilionaceae	Shrub	R	G
Justicia simplex D.Don		Acanthaceae	Herb	A	G
Leucaena leucocephala De Wit	Kurmurya	Mimosaceae	Tree	S/W	G
Leucas aspera		Lamiaceae	Herb	O	G
Lonicera quinquelocularis Hardwicke		Caprifoliaceae	Shrub	S/W	G
Lyonia ovalifolia Drude.	Anyar	Ericaceae	Tree	O	G
Machilus duthei King ex Hook, f.	Kaulu	Lauraceae	Tree	S/W	G
Mallotus phillipiensis Muell.-Arg.	Ruina	Euphorbiaceae	Tree	S	G
Maoutia puya Wedd		Urticaceae	Shrub	R	G

Continued on.....

Continue .....

Continue on..... **(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Melia azedarach L.	Daikan	Meliaceae	Tree	O	G
Meliosma dilleniifolia Walpers		Sabiaceae	Tree	A	G
Miscanthus nepalensis Hackel	Dab	Poaceae	Grass	W	G
Morus alba L.	Shatoot	Moraceae	Tree	S/W	G
Morus serrata Roxb	Kaimu	Moraceae	Tree	S	G
Murraya koeinghii Sprengel.	Kadipatta	Rutaceae	Shrub	S	G
Neolitsea cuipala Kostermans		Lauraceae	Tree	W	G
Nicandra physalodes Gaertner	Dhatura	Solanaceae	Herb	R	G
Oogeinia oojeinensis Hochreutiner	Sandan	Fabaceae	Tree	W	G
Oryza sativa L.	Dhan	Poaceae	Grass	S/W	D
Oxalis corniculata L.		Oxalidaceae	Herb	A	G/D
Pennisetum orientale L	Musaya	Poaceae	Grass	W	G/D
Persicaria capitata H. Gross	Rangaya	Polygonaceae	Herb	R	G
Persicaria nepalensis H. Gross	Sara	Polygonaceae	Herb	R	G
Phoebe laceolata Nees		Lauraceae	Tree	W	G
Pilea scripta Wedd.	Chau	Urticaceae	Herb	R	G
Pimpinella achilleifolia C.B. Clarke		Apiaceae	Herb	R	G
Pimpinella acuminata C.B. Clarke		Apiaceae	Herb	R	G
Pistacia khinjuk Stocks	kakhad	Anacardiaceae	Tree	S	G
Polygonum amplexicaule D.Don		Polygonaceae	Herb	R	G
*Polygonum capitatu*m Buch.-Ham. ex D.Don		Polygonaceae	Herb	S	G
Polypogon fugax Nees ex Steudel		Poaceae	Herb	A	G/D
Populus ciliata Wallich ex Royle		Salicaceae	Tree	S/R	G
Potentilla sp.		Rosaceae	Herb	R	G
Pouzolzia zeylanica J. Bennett & Brown		Urticaceae	Herb	R	G
Prinsepia utilis Royle	Bhainkal	Rosaceae	Shrub	R	G
Prunus armeniaca L	Chulu	Rosaceae	Tree	W	G
Prunus cerasoides D.Don	Painyaa	Rosaceae	Tree	W	G
Prunus cornuta Steudel		Rosaceae	Tree	S	G
Pyrus pashia Buch.-Ham ex D.Don	Melu	Rosaceae	Tree	S	G
Quercus leucotrichiphora A. Camus.	Banj	Fagaceae	Tree	W	G
Quercus semecarpifolia J.E. Smith	Kharsu	Fagaceae	Tree	W	G
Quercus floribunda Lindley ex Rehder.	Tilonj	Fagaceae	Tree	W	G
Quercus glauca Thunb.	Phaniyat	Fagaceae	Tree	W	G
Reinwartia indica Dumortier	Phyuli	Linaceae	Herb	R	G
Rhamnus persica Boissier	Jhnu	Rhamnaceae	Tree	W	G
Rhododendron arboreum Smith.	Burans	Ericaceae	Tree	O	G
Rubia manjith Roxb. ex Fleming		Rubiaceae	Climber	W	G/D
Rubus ellipticus Smith	Hisar	Rosaceae	Shrub	O	G
Rubus niveus Thunb.		Rosaceae	Shrub	O	G
Rubus paniculatus Smith		Rosaceae	Shrub	O	G
Salix acenophylla Boissier	Gad-bhains	Salicaceae	Shrub	A	G
Salix denticulata Anderson		Salicaceae	Tree	S	G
Salix tetrasperma Roxb.		Salicaceae	Tree	S/W	G
Sarcococca saligna Muell-Arg.	Chathul	Buxaceae	Shrub	R	G
Schleichera oleosa Oken	Kusum	Sapindaceae	Tree	S	G
Scurrula elata Danser		Loranthaceae	Shrub	R	G

Continued on.....

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(1)	(2)	(3)	(4)	(5)	(6)
Senecio nudicaulis Buch-Ham. ex D. Don		Asteraceae	Herb	R	G
S*etaria pumila* Roemer & Schultes		Poaceae	Grass	R	G/D
Smilax glaucophylla Klotzsch	Kukurdara	Smilacaceae	Climber	S/R	G
Solanum nigrum L.	Makoi	Solanaceae	Herb	S/R	G
Spiraea canescens D.Don	Mairad	Rosaceae	Shrub	R/W	G
Sterculia villosa Roxb.	Karnal	Sterculiaceae	Tree	A	G
Swida oblonga Sojak		Cornaceae	Tree	R	G
Symplocos paniculata Miq.		Symplocaceae	Tree	S/R	G
Symplocos ramosissima Wallich ex G.Don		Symplocaceae	Shrub	S/R	G
Synotis rufinervis C. Jeffrey & Y.L.Chen	Pharpatti	Asteraceae	Herb	W	G
Taraxacum officinale Weber		Asteraceae	Herb	R	G
Terminalia alata Heyne ex Roth	Asin	Combretaceae	Tree	W	G
Terminalia bellirica Roxb.	Baheda	Combretaceae	Tree	S	G
Terminalia chebula Retz.	Harara	Combretaceae	Tree	S	G
Thalictrum foliolosum DC.		Ranunculaceae	Herb	R	G
Thamnocalamus falconeri Hook. f. ex Munro	Ringal	Poaceae	Grass	S/W	G
Themeda arundinacea Ridley.	Ulla	Poaceae	Grass	R	G/D
Thysanolaena maxima Kuntze	Ball ghas	Poaceae	Herb	R	G
Toona Hexandra M Roemer	Toon	Meliaceae	Tree	S/R	G
Triticum aestivum L.	Genhu/ Chilau	Poaceae	Grass	R	D
Ulmus wallichiana Planchon	Mairu	Ulmaceae	Tree	S	G
Urtica dioica L.	Kandali	Urticaceae	Shrub	W	G
Viburnum erubescens Wallich ex DC.	Teeling	Carpifoliaceae	Shrub	R	G
Vigna vexillata A. Richard.		Fabaceae	Herb	A	G/D
Woodfordia fructicosa Kurz.	Dhaula	Lythraceae	Shrub	w	G
Rhus parviflora Roxb.	Tungla	Anacardiaceae	Shrub	w	G

Table 2: Seasonal availability of fodder from main species in Garhwal Himalaya.

Summer	**Rainy**	**Winter**
Tree leaves *Celtis australis* *Morus alba* *Machilus duthei* *Acer caesium* *Acer acuminatum*	-	*Quercus leucotrichophora* *Q. floribunda* *Q. semicarpifolia* *Grewia optiva* *Machilus duthei* *Oogeinia oojeinensis*
Other green fodder		
Weeds from field	Weeds from field	Weeds from field Mustard (*Brassica spp*.) *Urtica dioca*
Green grasses		
	Echinochloa crus-galli *Apluda mutica* *Brachiaria villosa* *Chrysopogon gryllus*	
Dry fodder		
Rice straw	Wheat straw	Rice straw Finger milletstraw Barnyad millet straw Grass hay

125 genera belonging to 60 families have been identified and documented (table 2). Amongst the families, maximum species were represented in family Poaceae (27 spp.) followed by Moraceae (12 spp.), Rosaceae (12 spp.) Urticaceae (10 spp.), Asteraceae and Polygonaceae (6 spp. Each) and Fabaceae, Fagaceae, Salicaceae, Caesalpiniaceae and Lauraceae (4 spp. Each) (fig 1). In remaining families <3 species were recorded. Poaceae is the dominant family with 26 genera followed by Rosacease and Urticaceae (7 genera each), Asteraceae (7 genera), Lauraceae (4 genera) and Acanthaceae, Betulaceae, Fabaceae, Moraceae and Polygonaceae (3 genera each). Species richness was highest in the genus Ficus (9 spp.), followed by Bauhinia and Quercus (4 spp. Each), Prunus, Rubus, Boehmeria, Salix, Terminalia (3 spp. Each) (fig 2). In the remaining genera <3 species were present.

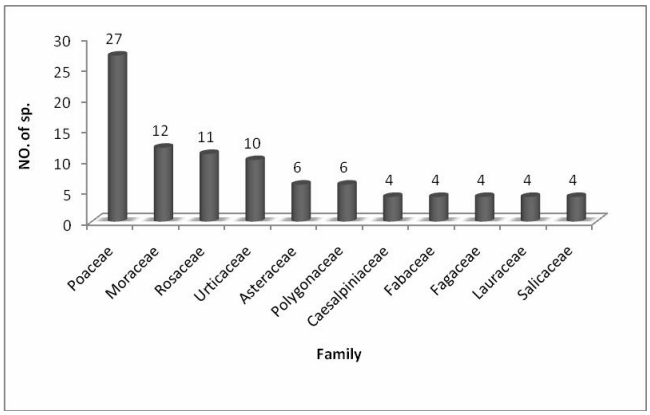

Fig 1: Dominant families of the study area.

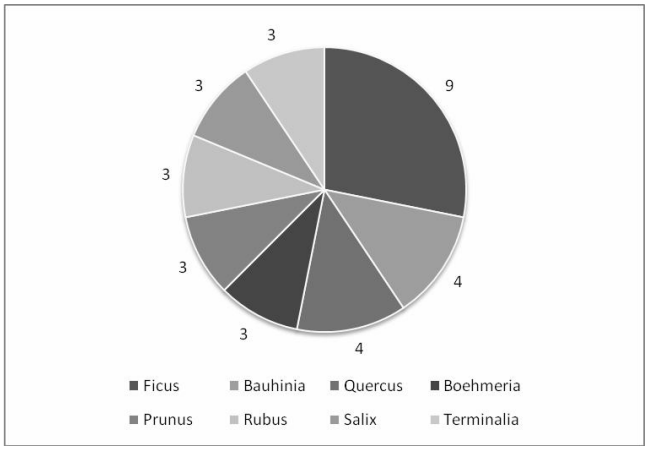

Fig 2: some dominant genera of study area.

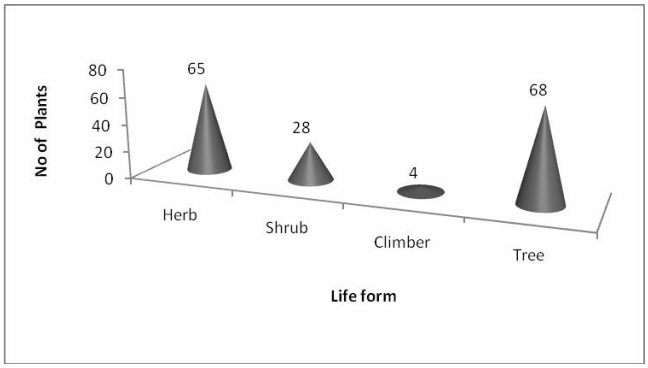

Fig 3: Diversity of fodder plants in different life forms.

Out of 165 fodder soecies, 68 were trees, 28 shrubs, 65 were herbs and rest are climbers. (fig 3).

Utilization pattern

The utilization pattern of fodder species varied from season to season. This variation in utilization pattern is due to the availability of species in respective seasons. Majority of the tree fodder species were used in summer due to availability of deciduous species. However some tree species are also used in winter, when the availability of fodder was scarce, due to evergreen. Rainy season helps to produce plenty of green grasses and other herbaceous plants which are used as fodder.

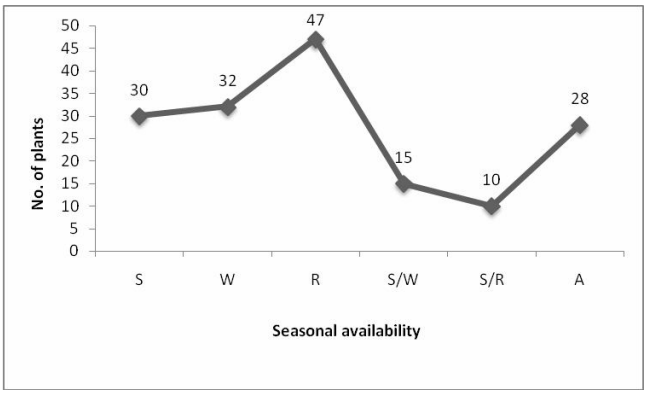

Fig 4: occurrence of fodder plants in different seasons.

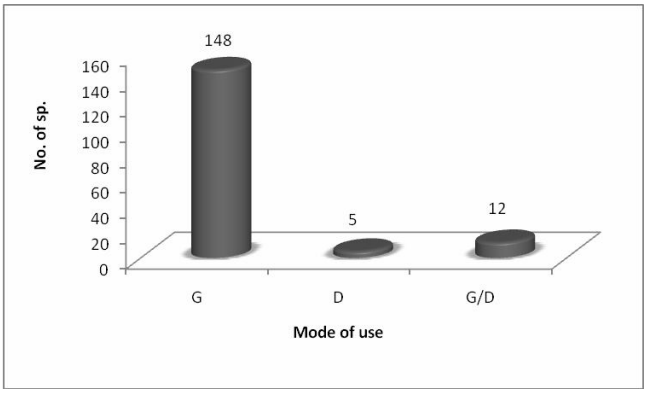

Fig 5: Graph showing mode of use of fodder plants.

Out of 165 species, 30 species were used in summer, 32 in winter, 47 in rainy, 28 in all the three seasons, 15 in summer and winter both, 10 in summer and rainy 9 (fig 4). *Quercus leucotrichophora, Q. floribunda, Q. semicarpifolia, Machilus duthei, Grewia optiva, Bauhinia spp.* and *Ficus spp*. are the major fodder, which are topped during winter season. *Celtis australis, Morus serrata, Oogeinia oojeinensis, Acer spp., Ficus spp., Machilus duthei* are the main fodder trees that are lopped during summer. Dry fodders (crop residues and grass hay) are often feed to livestock in winter season (table 1). It was observed that shrubs atre chiefly browsed by goats and sheep. The leaves of *Rubus, Ficus palmata, Prinsepia utilis, Rhamnus persica* were feed to sheep and goats. Amongst the recorded species, 148 species were used as green and 5 as dry. The remaining species were used both as green and dry in the studied villages (fig 5). Plant species such as *Setaria pumila, Galinsoga parviflora, Themeda arundinaceae, Chrysopogon fulvus, Rubia manjith, Polypogon fugax, Boehmeria macrophylla, Heteropogon contortus* were used both as green and dry in the studied villages

Discussion and Conclusion

According to the respondents, there are seasonal variations in fodder availability. It was observed that trees

are generally lopped in summar and winter seasons. During rainy season, abundant green fodder is available while shrubs are chiefly browsed by goats and sheep. The findings agree with that of Samant *et al.* 2007 who listed 150 species of fodder including trees, shrubs and herbs which are used as fodder for livestock in the Indian Himalayan Region. Some of the species are similar with that of our findings. Generally the local peoples cut fodder and then transport it as head load to their houses. This fodder can be used both in fresh and dried form. This agrees with the findings of Gali *et al.* 2006 that species were used both as fresh and dried fodder in Argentina. Similarly Singh *et al.* 2008, reported 300 species of trees , shrubs and herbs, which were found in the mid – altitude rangelands of Uttarakhand and used as fodder in both fresh and dried condition. It is clear from the study that there is a shortage of the fodder in the area. Plants are heavily graed round the year. The 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 Garhwal Himalaya but due to reductions in grazing areas it was hard to find fodder in enough quantity to fulfil the daily nutritional requirement of livestock.

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