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RESEARCH ARTICLE

ETHONOMEDICAL USES OF PLANTS AMONG FOREST DEPENDENT PEOPLE'S OF UTTARAKHAND

***Rahul Kumar Singh, Ajeet Kumar Negi, Kaiser Iqbal, Showkat Aziem and Karonga, S. S.**

Department of Forestry and Natural Resources, H.N.B. Garhwal University, Srinagar, Uttarakhand

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ABSTRACT

About 90 NTFP species belonging to 47 families of different life forms were recorded from the present study. The NTFPs were reported to be used for different quotidian uses with homogeneity of knowledge was found maximum for handicraft (ICF: 0.79), medicinal use (0.72), food (0.67) and perfumes/cosmetics (0.66). The fidelity value (FL) of 100 % was expressed by plant used for construction materials and maximum value was calculated for *Quercus leucotrichophora* (0.83) which is chiefly used for fodder purpose and that reveals direct pressure on the forest; followed by *Rhododendron arboreum* (0.47) as its leaves are feeded as fodder and flowers are harvested for beverages and natural colour and *Arundinaria falcata* (0.45) is used for fodder. The local communities are strongly dependent on NTFPs to fulfill their basic needs of food, fodder, shelter, storage articles and other quotidian needs. Most of the requirements are met from nearby forests than from agriculture thus enhancing the pressure on the forest. The work also sumarrizes the new recorded information of exotic plants viz., *Rosa damascena* mill L.: *Rosmarinus officinalis* L. for livelihood improvement.

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INTRODUCTION

All the biological materials other than timber that have been extrcated from the natural forests for human or animal consumption and have both consumptive and exchange value are reffered as Non Timber Forest Products (NTFPs) (Ahenkan and Boon, 2011). As a primary source of food, nutrition, and medicine estimated 350 million people depend on NTFPs in the world (Bauri *et al.,* 2015), where as around 275 million poor rural people depend on NTPFs in India (Malhotra and Bhattacharya, 2010). The extraction of NTFPs in India is potentially derived from 3000 species with its collection ranging from 5.4 to 55% for food or nutritional complement (Dembner and Perlis, 1999; Adepoju and Salau, 2007)), whereas 161 NTFPs are extracted from forest for livelihood support in Himalayan region (Subedi, 2006). The NTFPs that are extracted from the forest are fodder grasses, dry and fallen twigs and branches, leaf litter and leaves and where available mushrooms, edible tubers, flowers, fruits and medicinal herbs. Most of the poor people depend on range of NTFPs for their basic needs which contribute about 50% of their total family income (Pyakurel and Baniya, 2011). The increasing contribution of NTFPs as a source of income has been widely recognized in Himalayan region (Uprety *et al.,* 2010). NTFPs provide major source of income to the rural people and it is also one of the important source of income to the government (Schippmann *et al.,* 2006). One the meain reasons for the extraction of different parts of the plant are basically due to lack of modern facilities and medicines, with most people in rural Himalaya depending on extraction of NTFPs for their survival and basic needs (Rao *et al.,* 2003). Most of the NTFPs that are extracted from the forest are very trendy in national markets as they are important ingredients for several herbal cosmetics, herbal tea, food, medicines, etc (Shanley *et al*, 2008). Most of the species that are extracted from the forests are used for food and shelter (Karki, 2000). The present study was done by keeping in mind dependency of the people in the forests with study carried out in few villages of Joshimath. The study concentrated on extraction from agricultural as well as forest land with efforts made to assess the livelihood dependency of the local people towards NTFPs.

****Corresponding author:*** **Rahul Kumar Singh,**
Department of Forestry and Natural Resources, H.N.B. Garhwal University, Srinagar, Uttarakhand

MATERIALS AND METHODS

Study area and field survey

The present study was conducted in Joshimath block of Chamoli district of Garhwal Himalaya (N-E) with an elevational range of 1360 to 2600 masl around 30°55' N and 79°56' E (Fig.1). The region has very rich biodiversity of plant and animal species with both subtropical and temperate forests. The forests are dominated by *Quercus* species, *Rhododendron* species and *Cedrus deodara* with alpine range dominated by *Betula utilis*, *Abies* species, *Rhododendron anthopogon*, *R. campanulatum*, *Saussurea* species, *Aconitum* species, etc.

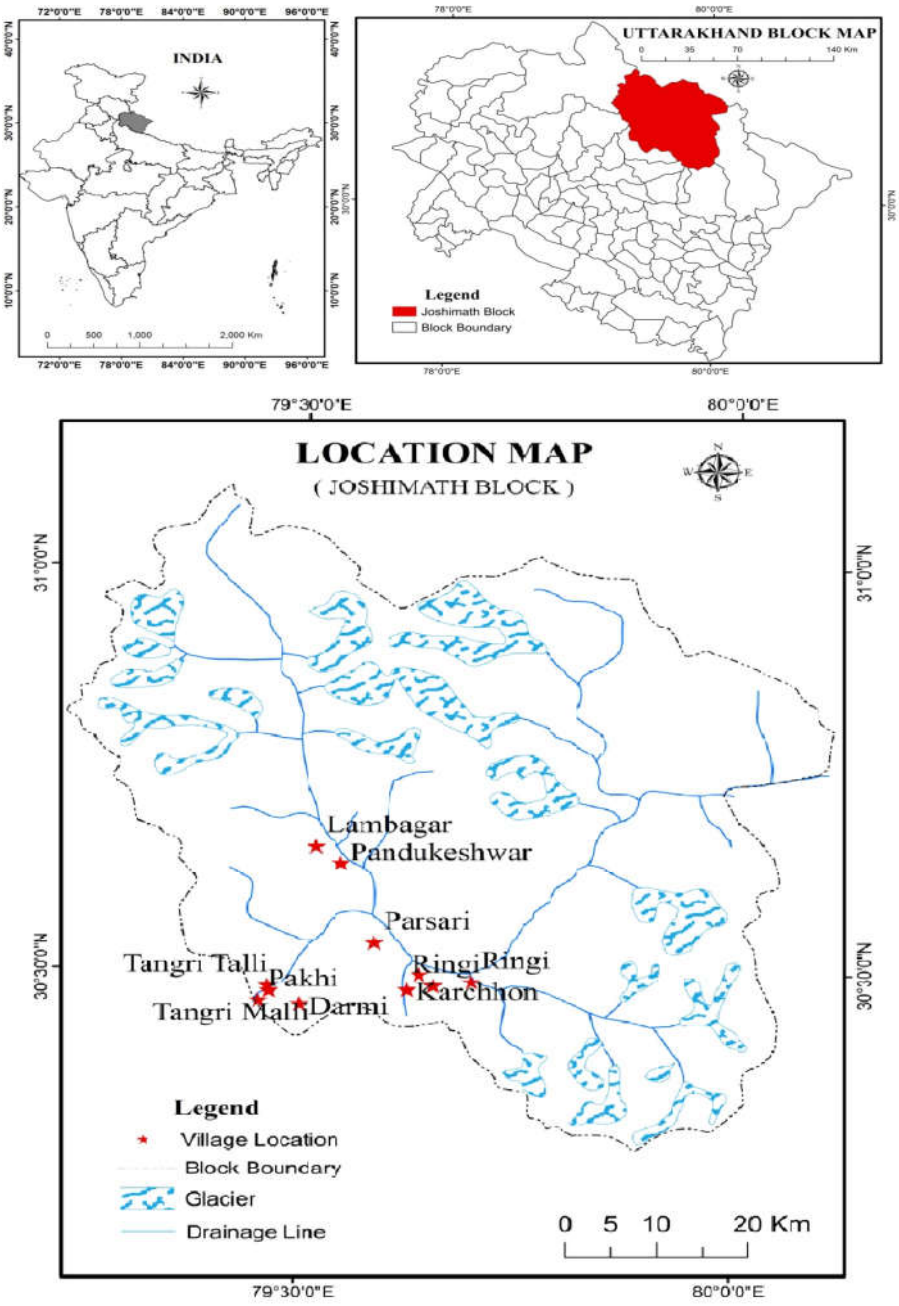

Figure 1. Map of the study area

The selection of villages was done in consultation with forest department and accessibility to the study site, 11 sites were selected for survey with a total of 110 respodents. The local names of each species were noted and were cross checked with the help of Flora of the District Garhwal, North West Himalaya' (Gaur 1999) and 'Flora of Chamoli' (Naithani, Vol I &II, 1985) to identify the species, for other species where it was difficult to note the local names, the plants specimen were collected and identified from Department of Botany (HNBGU). The detailed information of the plamts has been summarized in Table 3.

Sampling and data collection

NTFP data was collected through open ended questionnaires with randomly selected informants. The sampling and interview was conducted by asking questions and also requested them to show their farm land and stored commodities for visual authentication of the NTFPs collected by villagers. Ethno-botanical information was obtained through a series of interviews with villagers, who collected the NTFPs from agroforestry as well as forest land. The questionnaire was mainly focused on the collection practices of the NTFPs and uses of NTFPs for traditional use among local communities and nearby people.

Quantitative analysis

For the quantitative data analysis of NTFPs, fidelity level (FL) index (Friedman *et al*., 1986) was determined using the formula: FL (%) = (Np/N)×100; where, Np is the number of informants citing the use of species for a particular use and N is the total number of informants citing the species for any use. The use NTFP species was classified into different categories following the standard chart developed by (Shiva and Verma, 2002). To test the homogeneity of knowledge of plants in different use categories, Informant Consensus Factor (ICF) was calculated using the formula: ICF=Nur–Nt/(Nur-1); Where, Nur is the number of use reports for a particular use category and Nt is the number of taxa used for a particular use category by all informants. The relative importance of each

plant species based on its relative use among informants was calculated in Use Value (UV), as adapted by Ferreira *et al*. (2009) using the formula: UV=ΣU/N; Where, U is the number of times a species is cited and N is the number of informants. The use value of each species is therefore based objectively on the importance attributed by the informants and does not depend on the opinion of the researcher (Ferreira *et al.,* 2009).

RESULTS AND DISCUSSION

Classification of NTFPs

Present study recorded a total of 90 NTFPs belonging to 47 families of different life forms *viz*., fungi (2), epiphytic lichens (2), grasses (18), herbs (22), shrubs (9) and trees (34), of which 19 species were harvested from agricultural/horticultural, 29 were harvested from forest whereas 42 species were collected from both agricultural and forests.

collection of leaves and twigs (20 species); whole plant and aerial parts (16 species each); fruits and cones (13 species); leaves and fruits (12 species); roots or rhizomes (7 species); leaves and flowers (2 species); flowers (2 species) and bark (2 species) revealed diverse utilization pattern to full-fill quotidian needs for nourishment in present study (Table 3). Homogeneity of knowledge was found maximum for handicraft (ICF: 0.79), followed by medicinal use (0.72); food (0.67); perfumes/cosmetics (0.66), construction material (0.62); dye (0.62) and fodder/bedding (0.61) (Table 1). Fidelity Level (FL) of a plant species for a specific use varied remarkably and the100 % FL was expressed by 2 plant species for construction materials, followed by 13 food, 23 fodder, 10 medicinal, 1 perfume and cosmetic and 2 handicraft species (Table 2). Use Value (UV) of *Quercus leucotrichophora* (0.83) and *Rhododendron arboreum* (0.47) for fodder purpose revealed direct pressure on the forest; *Arundinaria falcata* (0.45) for fodder and handicraft; *Juglans regia* (0.38), *Pyrus*

Table 1. Category of uses of NTFPs and their informant consensus factor (ICF)

Use Category	Use Report of category	Number of taxa	ICF
Food	102	34	0.67
Fodder	105	42	0.61
Colour/Dye	14	6	0.62
Construction	25	10	0.62
Perfumes/ cosmetics	13	5	0.66
Medicines	79	23	0.72
Handicrafts	77	17	0.79

Table 2. Fidelity level (FL) of NTFPs of the study area

Food purpose (Fruits, vegetable, spices and condiments)	*Allium schoenoprasum*, *Citrus aurantifolia*, *Citrus medica*, *Citrus sinensis*, *Dioscorea pentaphylla*, *Juglans regia*, *Morchella esculenta*, *Paeonia emodi*, *Phyllanthus emblica*, *Prinsepia utilis*, *Prunus persica*, *Pyrus communis*, *Pyrus malus*, Pyrus pashia, *Rosmarinus officinalis*, *Rubus ellipticus* (100), *Diplazium esculentum*(83.9), *Phytolacca acinosa* (75.0), *Urtica* dioica (73.7), *Prunus armeniaca* (66.7), *Angelica glauca*, *Ficus palmata*, *Morus serrata*, *Myrica esculenta*, *Origanum vulgare*, *Pyracantha crenulata*, *Taxus wallichiana*, (50.0), *Bauhinia variegata* (40.0), *Rhododendron arboreum* (35.4), *Ficus roxburghii*, *Flacourtia indica*, *Pinus roxburghii* (33.3), *Berberis* chitria (28.6), *Zanthoxylum armatum* (20.0), *Indigofera dosua* (16.7)
Fodder	*Aesculus* indica, *Alnus nepalensis*, *Andropogon munroi*, *Apluda aristata*, *Boehmeria platyphylla*, *Brachiaria villosa*, *Celtis australis*, *Danthonia jacquemontii*, Debregeasia salicifolia, *Dichanthium annulatum*, *Echinochloa colona*, *Lyonia ovalifolia*, *Neolitsea pallens*, *Panicum paludosum*, *Persea duthiei*, *Polypogon fugax*, *Prunus cerasoides*, *Quercus dilatata*, *Quercus leucotrichopora*, *Sacciolepsis indica*, *Sporobolus fertilis*, *Sporobolus spicatus* (100); *Imperata cylindrica* (80.0), *Pennisetum orientale* (75.0), *Apluda mutica* (66.7), *Flacourtia indica* (66.7), *Thalictrum foliolosum* (66.7), *Grewia optiva* (64.3), *Bauhinia* variegata (60.0), *Indigofera dosua* (58.3), *Ficus palmata* (50.0), *Morus serrata* (50.0), *Myrica esculenta* (50.0), *Salix acutifolia* (50.0), *Usnea longissima* (50.0), *Eriophorum comosum* (41.7), *Arundinaria falcata* (35.5), *Ficus roxburghii* (33.3), *Pinus roxburghii* (33.3), *Rhododendron arboreum* (28), *Hedychium spicatum* (22.2)
Medicinal Use	*Aconitum heterophyllum*, *Acorus calamus*, *Cladonia cartilaginea*, *Cotoneaster lindleyi*, *Dactylorhiza hatagirea*, *Geranium wallichianum*, *Gerbera gossypina*, *Ophiocordyceps sinensis*, *Picrorhiza kurroa*, *Rheum australe* Don, *Swertia chirayita*, *Thymus serpyllum* (100); *Angelica glauca*, *Origanum* vulgare, *Taxus wallichiana*, *Usnea longissima* (50), *Arnebia benthamii* *Zanthoxylum armatum* (40), *Rhododendron arboreum* (35.4), *Prunus armeniaca*, *Thalictrum foliolosum* (33.3) *Berberis chitria* (28.6), *Hedychium spicatum* (22.2) *Urtica dioica* (15.8)
Perfumes and cosmetics	*Rosa damascene* (100); *Nardostachys jatamansi* (77.8); *Valeriana jatamansi*, (66.7); *Arnebia benthamii* (40.0); *Hedychium spicatum* (22.2)
Handicrafts	*Betula utilis*, *Cupressus torulosa*, *Cynodon dactylon*, *Sapindus mukorossi* (100), *Arundinaria falcata* (64.5); *Dendrocalamus strictus*, Pyracantha *crenulata* (50), *Eriophorum comosum*, 41.7, *Zanthoxylum armatum* (40.0), *Ficus roxburghii*, Valeriana *jatamansi*, *Pinus* roxburghii (33.3), *Hedychium spicatum*, *Nardostachys jatamansi* (22.2), *Grewia optiva* (16.7), *Urtica dioica* (10.5), *Rhododendron arboreum* (1.4)
Construction materials	*Dryopteris juxtaposita*, *Pteris aquilina* (100); *Dendrocalamus strictus*, *Salix acutifolia* (50.0); *Apluda mutica* (33.3); *Pennisetum orientale* (25.0); *Imperata cylindrica* (20.0); *Eriophorum comosum* (16.7); *Diplazium esculentum* (16.1); Grewia *optiva* (11.9)
Dying and tanning	*Berberis chitria* (42.9); *Indigofera dosua* (25.0); *Phytolacca acinosa* (25.0); *Arnebia benthamii* (20.0), *Hedychium spicatum* (11.1); *Grewia optiva* (7.1)

Maximum number of species were confined in Poaceae (18 species), followed by Rosaceae (11 species); Rutaceae (4 species); Lamiaceae, Moraceae and Urticaceae (3 species each); Betulaceae, Ericaceae, Fabaceae, Fagaceae, Lauraceae, Ranunculaceae and Sapindaceae (2 species each) and rest of families have single species. The finding also revealed a seasonal variation in collection practices and maximum species were harvested in the summer than the rainy and winter. The

malus are fruit plants which covers great part of the rural economy whereas, *Allium schoenoprasum* (0.26) is used and traded as spice (Table 3).

NTFPs for food management

In the present study collected NTFPs revealed more dependency on forest than agricultural land.

Table 3. Brief description of NTPs

Plant Species and Vernacular name	Family	Elevation (m)	LFS	DIV	CS	PU	CL	HT	CS	UV
Aconitum heterophyllum Wall. ex Royle (Atis, Indian Atees)	Ranunculaceae	3000-4000	H	DC	C2	RR	En	S1	STU	0.045
Acorus calamus L. (Bach, Sweet Flag)	Acoraceae	1600-2000	H	MC	C2	RR	T	S1	SU	0.018
Aesculus indica (Colebr. ex Cambess.) Hook. (Pangar)	Sapindaceae	1500-2500	TR	DC	C3	LT	LC	S1	SU	0.227
Allium schoenoprasum L. (Faran,)	Amaryllidaceae	3500-4000	H	MC	C3	LT	LC	S1	STU	0.264
Alnus nepalensis D.Don (Utees, Alder)	Betulaceae	1000-2500	TR	DC	C3	LT	LC	S1	SU	0.055
Andropogon munroi C.B.Clarke (Musliya ghas)	Poaceae	1550-2500	G	MC	C3	AP	LC	S4	SU	0.055
Angelica glauca Edgew. (Choru,)	Apiaceae	3000-3500	H	DC	C2	RR	En	S1	STU	0.091
Apluda aristata L. (Annual grass)	Poaceae	2000-3000	G	MC	C3	AP	LC	S4	SU	0.073
Apluda mutica L. (Tachula)	Poaceae	Upto 1000	G	MC	C3	AP	LC	S4	SU	0.036
Arnebia benthamii (Wall. ex G. Don) John. (Balchar)	Boraginaceae	3300-4200	H	DC	C2	WP	C En	S1	STU	0.036
Arundinaria falcata Nees (Ringal)	Poaceae	1750-2500	G	MC	C3	AP	LC	S4	STU	0.445
Bauhinia variegata L.(Kuiral)	Fabaceae	800-2000	TR	DC	C3	LFL	LC	S1	SU	0.109
Berberis chitria Buch.-Ham. ex Lindl.(Kingora)	Berberidaceae	1800-2500	SH	DC	C3	WP	LC	S4	STU	0.036
Betula utilis D. Don. (Bhojpatra)	Betulaceae	2700-3500	TR	DC	C2	Bk	En	S1	STU	0.018
Boehmeria platyphylla D. Don (Khagsi)	Urticaceae	2000-3000	H	DC	C3	LT	LC	S1	SU	0.145
Brachiaria villosa (Lam.) A. Camus(Malchhu)	Poaceae	2200-2800	G	MC	C3	AP	LC	S4	SU	0.045
Celtis australis L. (Kharik)	Ulmaceae	2400-3200	TR	DC	C1	LT	LC	S1	SU	0.136
Citrus aurantifolia (Christmann) Swingle (Kagzinimbu)	Rutaceae	800-1200	TR	DC	C1	FC	LC	S5	SU	0.055
Citrus medica L. (Nimbu)	Rutaceae	1000-2000	TR	DC	C1	FC	LC	S5	STU	0.064
Citrus sinensis L. (Malta)	Rutaceae	1000-2800	TR	DC	C3	FC	LC	S5	STU	0.200
Cladonia cartilaginea Müll. Arg.	Lecanoraceae	1200-2400	LC	LC	C2	WP	LC	S1	STU	0.018
Cotoneaster lindleyi Steud. (Dhuis)	Rosaceae	2500-3000	SH	DC	C2	LFU	LC	S3	SU	0.045
Cupressus torulosa D. Don (Surai)	Cupressaceae	1800-3200	TR	GY	C2	FC	LC	S5	STU	0.018
Cynodon dactylon (L.) Persoon (Dubaghas)	Poaceae	Up to 3500	G	MC	C3	WP	LC	S2	SU	0.073
Dactylorhiza hatagirea (D.Don) Soó (Hattajari)	Orchidaceae	2500-4000	H	MC	C2	RR	C En	S1	STU	0.045
Danthonia jacquemontii Bor. (Grass)	Poaceae	2000-4000	G	MC	C3	WP	LC	S4	SU	0.127
Debregeasia salicifolia (D. Don) Rendle (Syanru)	Urticaceae	1200-2000	TR	DC	C3	LFU	LC	S3	SU	0.064
Dendrocalamus strictus (Roxb.) Nees (Bans)	Poaceae	300-1800	G	MC	C1	AP	LC	S4	SU	0.009
Dichanthium annulatum (Forsk.) Stapf (Perennial Grass)	Poaceae	1800-2800	G	MC	C3	AP	LC	S4	SU	0.118
Dioscorea pentaphylla L. (Gajaria)	Dioscoriaceae	1500-1800	H	DC	C3	WP	LC	S1	SU	0.064
Diplazium esculentum (Retz.) Sw. (Lingura)	Athyriaceae	600-1500	F	PT	C2	LT	LC	S1	SU	0.236
Dryopteris juxtaposita Christ.	Dryopteridaceae	600-2000	F	PT	C2	LT	LC	S1	SU	0.018
Echinochloa colona (L.) Link (Jharwa)	Poaceae	2000-2800	G	MC	C3	AP	LC	S4	SU	0.136
Eriophorum comosum Wall. (Babula)	Poaceae	600-1500	G	MC	C3	AP	LC	S4	SU	0.091
Ficus palmata Forsk. (Bedu)	Moraceae	900-1800	TR	DC	C1	LFU	LC	S3	SU	0.027
Ficus roxburghii Wall. (Timla)	Moraceae	600-1800	TR	DC	C1	LFU	LC	S3	SU	0.145
Flacourtia indica (Burm. f.) Merrill (Bilangra)	Flacourtiaceae	1600-2600	TR	DC	C2	LFU	LC	S1	SU	0.036
Geranium wallichianum D. Don (Laljari/Ratanjot)	Geraniaceae	2500-3500	H	DC	C3	WP	LC	S1	SU	0.027
Gerbera gossypina (Royle) G. Beauv. (Kapasee)	Asteraceae	2500-400	H	DC	C2	WP	LC	S1	SU	0.036
Grewia optiva J.R. Drummond ex Burret (Bhimal)	Tiliaceae	1600-2000	TR	DC	C1	LT	LC	S1	STU	0.245
Hedychium spicatum Buch-Ham. Ex Smith (Banhaldu)	Zingiberaceae	1500-2800	H	MC	C2	WP	T	S5	STU	0.018
Imperata cylindrica (L.) P. Beauv. (Sirau)	Poaceae	2000-2500	G	MC	C3	AP	LC	S4	SU	0.109
Indigofera dosua L. (Sakina)	Fabaceae	1600-1800	SH	DC	C3	LFL	LC	S1	SU	0.064
Juglans regia L. (Akhort)	Juglandaceae	700-2500	TR	DC	C1	FC	LC	S5	STU	0.382
Lyonia ovalifolia (Wallich) Drude (Anyar)	Ericaceae	1000-3000	TR	DC	C2	LT	LC	S1	SU	0.036
Morchella esculenta Fr. (Guchchhi)	Morchellaceae	1600-2500	FG	FG	C2	WP	LC	S1	STU	0.036
Morus serrata Roxb. (Kimu)	Moraceae	1600-1900	TR	DC	C1	LFU	LC	S1	SU	0.082
Myrica esculenta Buch.-Ham- ex D.Don (Kaphal)	Myricaceae	900-2000	TR	DC	C2	LFU	LC	S1	SU	0.018
Nardostachys jatamansi (D.Don) DC. (Masi)	Caprifoliaceae	2500-4000	H	DC	C2	RR	C En	S1	STU	0.064
Neolitsea pallens (D. Don) (Bilaru)	Lauraceae	2000-3000	TR	DC	C2	LT	LC	S1	SU	0.091

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Ophiocordyceps sinensis (Berk.) Sung, Sung, Jones & Spata. (Kidajadi)	Ophiocordycipitaceae	2700-4000	FG	FG	C2	WP	LC	S1	STU	0.100
Origanum vulgare L./ Bantulsi	Lamiaceae	600-3800	H	DC	C3	LT	R	S4	SU	0.027
Paeonia emodi Wall. ex Royle/ Chandra	Paeoniaceae	1500-3000	H	DC	C2	LT	LC	S1	SU	0.136
Panicum paludosum Roxb. / Annual Grass	Poaceae	2000-2500	G	MC	C3	AP	LC	S4	SU	0.309
Pennisetum orientale L.C. Richard / Perennial Grass	Poaceae	2000-2800	G	MC	C3	AP	LC	S4	SU	0.027
Persea duthiei King ex Hook. f./ Bhadrao	Lauraceae	2200-3000	TR	DC	C3	LT	LC	S1	SU	0.027
Phyllanthus emblica L./ Amla	Euphorbiaceae	Upto 1800	TR	DC	C1	FC	LC	S5	SU	0.018
Phytolacca acinosa Roxb./ Jagra	Phytolaccaceae	2400-3200	H	DC	C1	LFU	LC	S3	SU	0.027
Picrorhiza Kurroa Royle ex. Benth/ Kutki	Plantaginaceae	3000-4000	H	DC	C2	RR	LC	S1	STU	0.118
Pinus roxburghii Sarg./ Chir	Pinaceae	900-2500	TR	GY	C2	FC	LC	S4	STU	0.045
Polypogon fugax Nees ex Steud/ Grass	Poaceae	2000-2500	G	MC	C3	AP	LC	S4	SU	0.064
Prinsepia utilis Royle / Bhainkal	Rosaceae	2500-3000	SH	DC	C3	FC	LC	S1	SU	0.064
Prunus armeniaca L./ Chuli	Rosaceae	2000-3000	TR	DC	C1	FC	LC	S2	STU	0.109
Prunus cerasoides D. Don / Panyyan/Padam	Rosaceae	2400-3000	TR	DC	C3	LT	LC	S1	SU	0.082
Prunus persica (L.) Batsch./ Aaru	Rosaceae	2000-2600	TR	DC	C1	FC	LC	S2	STU	0.082
Pteris aquilina L./ Rainnu	Dennstaedtiaceae	600-2000	F	PT	C2	LT	LC	S1	SU	0.027
Pyracantha crenulata (D.Don) M. Roemer / Ghingaru	Rosaceae	1500-2500	SH	DC	C3	LFU	LC	S3	SU	0.027
Pyrus communis L./ Naspati	Rosaceae	300-2000	TR	DC	C1	FC	LC	S2	STU	0.036
Pyrus malus L./ Seb	Rosaceae	1000-2500	TR	DC	C1	FC	LC	S2	STU	0.264
Pyrus pashia Buch.-ha. ex D. Don/ Mehal/Melu	Rosaceae	2400-3000	TR	DC	C3	FC	LC	S2	SU	0.036
Quercus dilatata Royle./ Moru	Fagaceae	2000-2800	TR	DC	C3	LT	LC	S4	SU	0.227
Quercus leucotrichopora A. Camus/ Banj	Fagaceae	800-2200	TR	DC	C3	LT	LC	S4	SU	0.827
Rheum australe Don/ Dolu	Polygonaceae	3500-4500	H	DC	C2	RR	LC	S1	STU	0.027
Rhododendron arboreum Smith/ Buransh	Ericaceae	1500-2700	TR	DC	C2	Flr	LC	S1	STU	0.473
Rosa damascene/ Himrose	Rosaceae	800-2400	SH	DC	C1	Flr	LC	S1	STU	0.045
Rosmarinus officinalis L./ Rosemary	Lamiaceae	800-2000	SH	DC	C1	LT	LC	S4	STU	0.027
Rubus ellipticus Smith / Hisalu	Rosaceae	500-2000	SH	DC	C3	LFU	LC	S1	SU	0.018
Sacciolepsis indica (L.) A. Chase / Annual Grass	Poaceae	2000-3000	G	MC	C3	AP	LC	S4	SU	0.091
Salix acutifolia Willd./ Manju	Salicaceae	1000-2400	TR	DC	C3	LT	LC	S1	SU	0.009
Sapindus mukorossi Gaertn./ Ritha	Sapindaceae	Upto 1800	TR	DC	C1	LFU	LC	S4	STU	0.018
Sporobolus fertilis (Steudel) Clayton / Grass	Poaceae	2000-2500	G	MC	C3	AP	LC	S4	STU	0.109
Sporobolus spicatus (Vahl) Kunth grass	Poaceae	1800-2500	G	MC	C3	AP	LC	S4	STU	0.027
Swertia chirayita (Wall.) Cl./ *Chirata*	Gentianaceae	2000-2800	H	DC	C2	WP	CEn	S1	STU	0.109
Taxus wallichiana Zucc./ Tuhuner	Taxaceae	2000-3000	TR	GY	C2	Bk	T	S1	STU	0.018
Thalictrum foliolosum DC./ Mameri	Ranunculaceae	1200-2500	H	DC	C3	WP	R	S1	SU	0.055
Thymus serpyllum auct. non L./ Ban ajwain	Lamiaceae	3000-4000	H	DC	C3	WP	En	S1	SU	0.064
Urtica dioica L./ Sisuna /Bichchhu	Urticaceae	1000-3000	H	DC	C1	LT	LC	S1	SU	0.127
Usnea longissima Ach./Jhula	Parmeliaceae	600-2400	LC	LC	C2	WP	LC	S1	STU	0.018
Valeriana jatamansi Jones/ Samewa/Sumaya	Valerianaceae	2000-3000	H	DC	C3	WP	T	S4	STU	0.036
Zanthoxylum armatum DC. / Tumuru	Rutaceae	1500-2500	TR	DC	C3	LFU	V	S3	STU	0.036

The local communities are strongly dependent on agriculture land and nearby forest for NTFPs to fulfill their basic needs of food, fodder, shelter, storage articles. The consumption of food items *viz.,*fresh or dry fruits; veberages (leaves, flower buds, fuuits, roots and tubers); spices, condiments, concentrates, beverages as well as seed oil is age-long and effective for sustenance in the hars climatic conditions which reflects good management skill of the available NTFPs for availability across the year (Table 3). The families with small land holdings are mostly dependent on wild edible fruits, seasonal vegetables, and other NTFPs for their basic needs (Rao *et al.,* 2000). Belcher *et al*. 2005, Negi *et al.,* 2013 also provided an emphasis on dependency of local villagers for NTFPs in rural households.

NTFPs for fodder management

Several multipurpose trees and grasses are managed on field margins or agricultural bunds and harvested during adversity due to heavy rain or snow fall. Broadleaf species and small grasses are utilized for regular fodder whereas, the long grasses are stored and piled in *lutta or parkhunda* (piled hay). The routine grass collection from both of the agricultural and nearby forest as well as lopping and pollarding of fodder trees is common. The workload of fodder collection is mitigated through driving the cattle to nearby forest for free grazing during crop season and grazing in agricultural land is allowed at *Mogosar* (gap between one crop completely harvested and another to be sown). In summer, seasonal shifting towards higher altitude is common along with live stock where animals graze in alpine meadows and *Kharak* (seasonal shuttlements in the forest) (Table 3). The scarcity of irrigation and small land holdings have resulted people to depend mostly on adjoining forests to meet the fodder requirements (Gairola *et al.,* 2009; Hobby *et al.,* 2010). Majority of tree species that are harvested for fodder are either lopped/pollarded with some grasses that are browsed by sheep and goat (Rawat, 2013) the use of fodder and grasses species revealved similarities with earlier reports from Singh *et al.,* 2008; Negi *et al*., 2013. The fodder availability remains throughout the year, particularly during winter months by evergreen trees and during summer months by deciduous trees.

NTFP based handicrafts

The handicrafts include weaving of baskets and making ropes from available local resources for collection, drying, processing and storage of NTFPs as well as transportation of goods and human being. *Arundinaria falcata* is used to make baskets or containers of different shape and size viz., *Daliya* (basket)*,Chapari, Bisawa, Kandi, Mosta* (mats), *Supa*, *Chhalni* (sieve) etc *doka* or *byan* whereas, *Grewia optiva* and *Urtica dioica* fibers are used for fine ropes, floor matting, mask and collar belt of cattle and for various agricultural and household activities. *Betula utilis* bark, pine cone and *Rhododendron* bouquet are sold to pilgrims and tourist. *Valeriana jatamansi* and *Nardostachys jatamansi* are mixed with cow dung for *Dhoop* (insence fire) for self consumption and also retailed at the nearest shrine *Lord Badrinath*. The area has potential of traditional handicrafts, using mostly local raw materials. The production from handicrafts is mostly for domestic consumption and for sale to the tourists, with some part of the production is sold in the local or nearby towns, which are demanded from both within and outside state (Negi *et al.,* 2010). At present the *Arundineria* is being harvested from forest sites and large scale production needs an immediate cultivation prospects.

NTFPs based perfumes and cosmetics

Powdered or dry roots of *Valeriana jatamansi* and *Nardostachys jatamansi* are kept with cloths for aroma. Flower extract of *Rosa damascene* is applied on skin and sprayed for pleasant aroma.

NTFPs based colour and dyes

The traditional colour and dye making for colouring wooden articles and the woolen cloths is common. The herbal colours are still used in the *Holi* festival. The Herbal dye is also used to mark the livestock (sheep and goat) to differentiate one's stock as the pets move and garage together in the herds. The informants told that the pilgrims and tourists appreciate and purchaise the herbal dye and colours to replace the synthetic health hazardous chemical colours. The declining knowledge of fast colour synthesis and far-flung/ remote location are the hurdle for cottage trade. The ancestors had perfection in this art whereas the availability of modern facilities as well as time taking traditional practices is gradually decreasing. The root of the *Berberis chitria*is used for yellow dye (especially the inner bark of it, and also of the stem and branches) for woolen stuff. *Phytolacca* fruits, *Arnebia benthamii* roots, seeds of *Grewia optiva* are used for red dye, *Indigofera* flowers are used to prepare purple dye.

NTFPs based medicines

The informants reported that most ailments are treated at a household level, with some of the dry herbal medicines are available in their home and some medicines are maintained in home or kitchen garden. Large number medicinal plants are used by the local villagers for various medicinal purposes e.g., root powder and extract of *Aconitum heterophyllum*, *Picrorhiza Kurroa* and leaf of *Swertia chirayita* are useful against fever, leaves of *Thymus serpyllum* and *Origanum vulgare* are used for cold and cough, *Zanthoxylum armatim* for dental decay, pyorrhea and gum bleeding and *Urtica dioica* were used for sprain and to improve blood level. Most of the remedies are prepared with some sort of spiritual or ritual peocedures (Singh *et al*., 2014), with most of the respondents did not disclose ritual procedures involved in preparations of the medicines. Sharma *et al*., 2006; Uniyal *et al*., 2006; Giday *et al*., 2010 have also reported that knowledge about medicinal use are kept secret and are only transferred from their kith to kin.

NTFPs based construction material

For temporary settlement along with livestock during the summer season, a yearly nomadic life style is followed by some villagers, they use *Dendrocalamus strictus* (bamboo) for roof framework of the thatch, twigs of *Salix acutifolia* and *Grewia optiva* for gap filling and other grasses viz., *Apluda mutica, Imperata cylindrical, Pennisetum orientale* for covering material are commonly used by nomadic people. In the traditional houses fern leaves are laid and covered with mud to make pal (earthen floor), that helps in resistant to mites. Informants have reported that *Dendrocalamus strictus* (bamboo) plantation have reduced pressure on the nearby forest as it also reduced time in collection of fuelwood.

New reports

The recorded information of NTFPs was compared with those gathered by earlier published ethno-botanical surveys of the area and 7 out of the 90 plant species viz., *Rosa damascena* mill L., commonly provide an alternative source of income. *Rosmarinus officinalis* L., a commonly used therapeutic potential with fresh and dry leaves of *Rosmary* used for herbal tea. *Zanthoxylum armatum* DC, are used against high bold pressure. Leaves of *Origanum vulgare* L. are usful against cold and cough and offered as tea, its leafy garland is also offered to lord Badrinath. *Ophiocordyceps sinensis*, the catterpiller fungus, its diverse pharmacological uses are common in china and Tibet. *Betula utilis* bark were used for paper making in ancient culture with bark of the tree is also provided to pilgrims and tourists that might affect the growth and regeneration of the species.

Conservation and domestication of NTFPs

Among 90 plant species recorded in the present study, some plants species are under serious threat of extinction, listed in various local and red data list viz., *Zanthoxylum armatum* (Vulnerable), *Origanum vulgare* and *Thalictrum foliolosum (*Rare), *Acorus calamus, Hedychium spicatum, Taxus wallichiana* and *Valeriana jatamansi* (Threatened), *Arnebia benthamii, Dactylorhiza hatagirea, Nardostachys jatamansi* and *Swertia chirayita* (critically endangered), *Aconitum heterophyllum, Angelica glauca, Betula utilis* and *Thymus serpyllum* (endangered) are some of the Rare, Endangered and Threatened (RET) NTFPs which were used by the natives whereas, 75 species are out of the fringe (Table 3). A large number of aromatic plants are popular for domesticated use with very few plants used for cultivation (Rao at al., 2004). There is the possibility of cultivating some high-valued NTFPs as Valeriana jatamansi and other listed threatened plants due to over-exploitation. The current scenario has also resulted in cultivation and domestication of threatened NTFPs so that pressure on naural population will be less (Hamilton, 2004).

Conclusion

Small agricultural land might be a better approach for cultivation and conservation of NTFPs for livelihood and livestock to produce edible fruits, seasonal vegetables, fodder, and medicinal plants. All these species show variation in the timing, duration and frequency of flowering and fruiting across altitudinal gradient. Therefore, an appropriate information/ knowledge of phenophases of these wild edibles is utmost needed so that round the year resources could be made available on sustainable basis for small household/village level cottage industries and some basic problems of raw material, marketing, design, tools, etc., should be solved out through training and skill development. Small part of root or rhizomes must be left in the collection area to facilitate natural regeneration. Harvesting of leaves, flowers, and fruits are considered to be less destructive and most can be domesticated or cultivated in private or fallow lands at small scale. Along this conservation of medicinal plants and traditional knowledge should also be focused to strengthen the local; communities.

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