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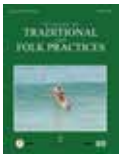

Traditional use of Non-Timber Forest Products in Kwar region of Shimla, Himachal Pradesh, NW India

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Abstract

This baseline study was carried out to ascertain the role of Non-Timber Forest Products (NTFPs) in the livelihoods among local communities of Kwar Panchayat, Rupin Valley of Shimla district. Qualitative data was collected through random sampling where a total of 100 households were sampled in the villages. Structured interviews, group discussion and participant observation were conducted as per methodology. Secondary data was collected from the Divisional Forest Office at Rohru along with the available literature in the form of regional floras and research publications. The results revealed that traditionally, the local communities rely a great deal on forest resources as 101 NTFPs were recorded for major livelihood activities like medicine, fuelwood and fodder. Animal husbandry (cattle, sheep and goats), horticulture, agriculture and forest gathering activities were the main livelihood approaches. Surprisingly, 100 % of the respondents were gathering NTFPs from the forest of which 75% utilized them for healthcare. Other local end-use of NTFPs included food, construction materials, in cultural and religious activities, preparation of agricultural implements/ tools, etc. The study recommends interventions for reducing people's dependence on this vital natural resource by giving them alternative avenues to reduce their collections from the wild. It also suggests vocational capacity building to enable them to take up the challenges of management of these forest resources in a more sustainable manner. Also, an exclusive quantitative study is required to provide a clear picture of the amount of NTFPs gathered and utilised over a period of time.

Keywords: NTFPs, Baseline survey, Capacity building, Forest resources

1. Introduction

Non-timber Forest Products (NTFPs) are defined as any product or service other than timber that is produced in a forest (CIFOR, 2004). They include fuel wood, fodder, tubers, fruits, nuts, vegetables, fish, medicinal plants and a range of other resources and are hence an indispensable part of the livelihood strategy of communities living in and near the forest. They have been contributing to the well-being of rural households, in terms of food security, nutrition, health and subsistence. At the global level, more than two billion people are dwelling in forest, depending on NTFPs for subsistence, income and livelihood security (Vantomme, 2003). World Health Organization reports that many local communities use varieties of wild plants in traditional ways for their daily requirements as well as primary health care. Some 80% of the population of the developing countries use NTFPs for health and nutritional needs (WHO, 2000). A number of attempts were made to quantify the value of household collections from

natural resources, that major contribution coming from forests. Such collections continue to make significant contributions to the livelihoods of the poor (Dasgupta, 2006).

Man has benefitted from the many uses and benefits of NTFPs that reflects the expertise of generations after generations of beneficial usage by ethnic communities worldwide. It represents an immensely valuable data base, of which very little has been recorded. The information has been passing from one generation to the next mainly by word of mouth, sometimes in ancient texts like the '*tankri*' in Himachal Pradesh. Today, the world is going through a period of fast paced development and the limited land resource is being encroached upon, which includes our pristine forests. Decisions to change the use of forest have often been taken without due regard to the values that millions of people are deriving and surviving on the NTFPs resource from these forests.

Likewise, in India too, the forests are associated with the socio-economic and cultural life of rural communities who have been collecting NTFPs primarily to meet their subsistence. Over the time, these NTFPs have acquired commercial value resulting from huge trade transactions and income levels due to rising demand. Himachal Pradesh is bestowed with a bountiful of this natural resource, being treasured in its vast forests. The NTFPs play a vital role in the day to day life of the rural communities, be it in the form of daily household use or as a source of subsistence income. The local flora plays a very important role in deciding the basis of NTFPs used by the majority of the people in remote locations and contributes to the total annual household income (Chauhan, 1999; Jishtu *et al.*, 2003; Kapoor *et al*., 2005; Gaur and Sharma 2011; Negi *et al.*, 2011). Various studies have been conducted on the contribution of NTFPs to household income and employment in the country (Tiwari and Campbell, 1995; Getachew *et al.*, 2007; Rasul *et al.,* 2008; Wagh *et al.,* 2010; Sarmah and Arunachalam, 2011; Ghosal, 2011; Ajaz-ul-Islam *et al.,* 2013; Sharif *et al.,* 2015) but no such studies have been reported from the present study area. Bhondge *et al*., (2018) have documented medicinal plants that are still being gathered and utilised for cure of common ailments by the people of Rupin Valley. In some basic studies on NTFPs of Himachal Pradesh, Chauhan and Negi (1988) looked at the production potential of medicinal and aromatic plants. Singh (2004) also studied the prospects of indigenous medicinal plants of Himachal Pradesh.

The use of plants in local traditional medicine for treatment of various diseases is a common practice in most of the rural households living in close proximity to the forest. The major part of traditional medicine is the herbal medicine that is used by 75–80% of the world's population especially in developing countries as it is considered safer than synthetic drugs (WHO, 2001; Al-Arifi, 2013). There is an increasing recognition that NTFPs play an important role in the socio-economic as well as traditional healthcare for people as well as livestock (Goraya *et al.*, 2013). NTFPs studies in Himachal Pradesh are few and that too targeting mainly the medicinal plant sector. Sharma and Tiwari (1992) studied the marketing of wild pomegranate as minor forest produce in Himachal Pradesh. Ferns have also contributed to the nutrition demands of rural parts of the State, but are being ignored in relation to flowering plants for fewer applications in medicines (Singh and Singh, 2013). It has been reported that medicinal plant trade in Himachal Pradesh is unorganized and about 95% of the plants are collected from wild in unscientific manner, it being the main reason for them being threatened. Three CAMP workshops have been held to assess the threat status of medicinal plants in the North West Himalayan regions of India (Ved and Tandon, 1998; Ved *et al*., 2005; Goraya *et al*., 2013). There are hardly any comprehensive studies conducted on economics of collection and contribution of Non-Timber Forest Products in Himachal Pradesh, none so in the area of study.

In the Indian context, collection of minor NTFPs is more market driven than collections of the major NTFPs of fodder and fuel wood. Yet, there are few regulations on extraction of most NTFPs (Ravindranath *et al*., 2000) and this lack of regulations has arguably resulted in its over-extraction. A typical example for the region being the large scale exploitation of *Nagchatri* (*Trillium govanianum* Wall. ex D. Don) and *Van Lahsun* (*Fritillaria roylei* Hook.) as described

earlier. Alternatively, improving access to markets and higher returns from NTFPs based sales, could provide the motivating factor to the dependents for better preservation of the forest. A number of studies have been conducted to prove the role of NTFPs in rural economies and their commercialization (Malhotra *et al.*, 1993; Neumann and Hirsch, 2000; Marshall *et al*., 2003; Mamo *et al*., 2007; Duong, 2008; Ghosal, 2011).

Today, the fast increasing developmental pressure have degraded the natural habitats of NTFPs and put this invaluable resource under threat. Keeping in view of the significance of NTFPs in the livelihoods of the rural folks not only in Himachal Pradesh, but across the Himalayas, the present study was conducted as a part of a project with one of the objectives being to study the capacity building and community orientation for sustainable management of important NTFPs for future requirements. This study discusses the utilization of NTFPs by the local communities at Kwar village and hope that this will serve to aid further research efforts on this vitally important subject throughout the country.

2. Materials and Methods

2.1. Study Area

The area falls in the Rupin River valley, which further joins the Tons River, draining into the Yamuna River. Kwar Panchayat is located in the far flung remote, but pristine valley of Dodra – Kwar in the Chirgaon block of Rohru, district Shimla of Himachal Pradesh (Fig. 1). The study unit is a cluster of seven hamlets namely Pujarli, Katol, Kitarwari, Bukshar, Chaidhar, Golma and Geurari. Geographically it lies at 31°12'57.0"N latitude and 078°05'41.3"E longitude with an altitude of around 2300 m above sea level.

Kwar is connected by a narrow road which is not in good condition and is barely unusable during the monsoon rains and also during the winters when snow closes the high pass of Chanshal (3800 m). The forested area in the Rupin Valley is very dense and is considered amongst the best forests in the State. There is a sacred grove of Kala Ban, below the Chanshal Pass at the very entrance into the valley. This forest belongs to the temple and is thus strictly protected by one and all. The limited population, lack of all season

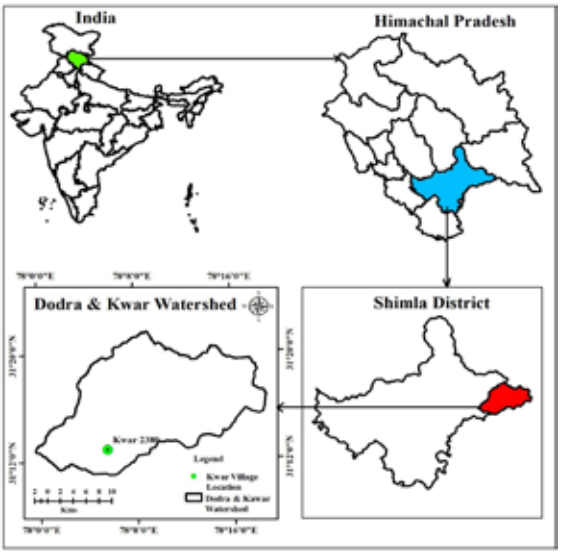

Fig. 1. Location of study site

road facilities, remoteness and a very slow rate of development are factors that contribute for such rich biodiversity. Majority of the villagers (80%) are engaged in agriculture or agriculture related work and the rest are engaged in small-scale craftsmanship, some as shepherds, while very few employed in the service sector away from the village. The land around this village is quite fertile and multi-cropping is practiced in terraces. The major crops cultivated are buckwheat, millets, maize and potato.

The region experiences moderate to heavy snow fall during the long winters from October to March. The monsoon rain are heavy with high humidity. Thus, the climate of the study area is generally temperate that is warm in summer, humid during monsoon and cold in winter. The trend in temperature of the region could be in the range from sub zero to 35° C.

2.2. Methodology

Both conventional and participatory techniques of data collection were used during the man to man surveys. The total number of respondents being the 100 households shortlisted under this mission project (NMHS) being implemented by the Ministry of Environment, Forest & Climate Change (MoEF&CC). To meet the objectives of the present study, both primary (in questionnaire) as well as secondary data (literature and forest officials) were collected.

- Primary data: It was collected with the aid of structured and comprehensive

questionnaire exclusively prepared for the study. The data collected included information on the NTFPs collected and their usage. The data obtained was through personal informal chats and interviews from September 2017 to September 2019. The voucher specimens of important NTFPs have been prepared as per standard herbarium methods and archived at the HFRI Herbarium at Shimla.

- Secondary data: It was collected from the records of the Divisional Forest Office, Rohru and discussions with the frontline field staff of the forest department.

Limitations of the Study: Most of the NTFP trade from the region is unregulated, thus exact trade and revenue numbers could not be ascertained. With regard to the NTFP collection for livelihood sustenance, even though vague to approximate estimates were provided by some respondents, the reluctance of some others was evident on a regular basis.

3. Results and Discussion

3.1. Collection source of NTFPs

A total of 101 higher plant *taxa* were recorded as NTFPs in this study. Among them about 60 % of the livelihood requirements were being relied upon the forest, 10 % was being collected in the sub alpine and alpine slopes while 20 % was met from their horticultural and agricultural practices. The remaining (10 %) resources were collected in the nearby vicinity of their homesteads, especially from nurtured oaks and chuli trees (Fig. 2).

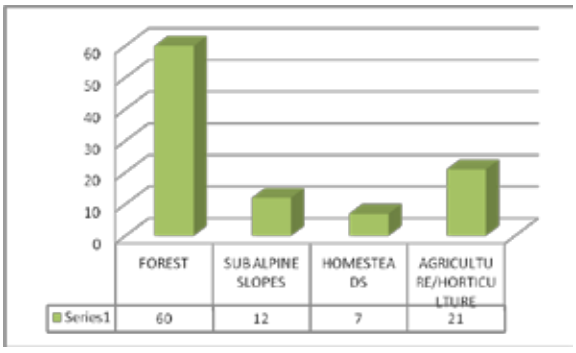

Fig. 2. Collection source of NTFPs

Data suggests that contribution of NTFPs from the forest is an important source of livelihood for them and its collection forms an important part of their livelihood. Moreover, during the months of March – April, people visit the forest for mushroom collection and likewise during the late monsoons, medicinal herbs collection becomes the primary activity. Thus, the households also depend on NTFP from the forest to earn the much required income.

There is, however, variation in the extent to which NTFPs are used from household to household. Because of this variation, it is difficult to abstract generalizations about their use. The various NTFPs gathered/collected are classified into different categories, based on the purpose of use (healthcare, fruits, fuel wood, fodder and wild pot herbs).

3.2. Healthcare

The region is totally rural and had been locked from other parts of the state and it was only during the latter part of the first decade of this century that a road was developed to connect it. Being remotely located, the use of plants in healthcare for treatment of various diseases and ailments is very common. As informed by the respondents, most of the plants have multiple usage and the common ailments treated upon include fever, cough and cold, to expel intestinal worms, influenza, stomach related ailments, healing cuts and wounds among many others. A total of 40 NTFPs have been documented as medicinal (Annexure-A), being used for the treatment of various ailments. This resource is being collected by the community from the surrounding areas of the village, forests within the valley and the sub-alpine and moist alpine meadows including that of Chanshal and Pandhar. These plants are being used for remedies as per the traditional knowledge passed on orally from one generation to another. Among various ways of utilisation, the application of applying plant material on the affected part and dried powder smoked with tobacco are most commonly followed. The reason for this large number of plant usage in healthcare can be attributed to the remoteness of the area and rich forest biodiversity nearby.

The plant species collected/gathered belongs to 25 families in 29 genera, prominent families being Amaryllidaceae, Asteraceae, Berberidaceae, Ericaceae, Polygonaceae,

Liliaceae, Ranunculaceae, Rosaceae and Saxifragaceae. Likewise, the major genera include *Aconitum, Allium, Berberis, Bergenia, Rhododendron, Polygonatum* and *Prunus.*

If we look at the plant utilization pattern (Fig. 3) of all the plant resource utilised by the people (Annexure-A), it indicates that the underground parts (Roots/Rhizomes/Bulb/Corm/Tuber) were used more (28) in comparison with the aerial parts (Leaves (4), Seed (2), whole plant (1), twig (1), flower (1), etc. It is mainly the underground plant parts (70%) that are being used by the village people; this itself is a point of concern as it amounts to destructive harvesting, which may not be sustainable in the years ahead.

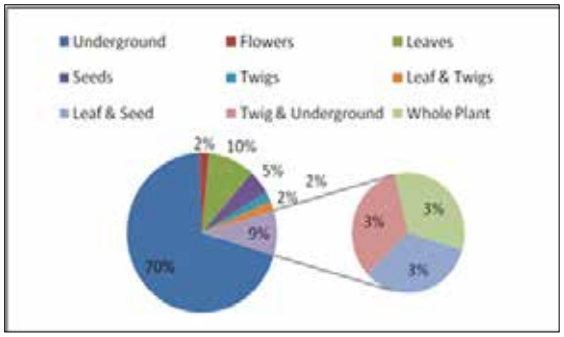

Fig. 3. Utilisation pattern of NTFPs

If we look at the plant habit (Fig. 4), it clearly shows that majority of the plants used are herbs (70%) followed by shrubs (17%) and trees (13%).

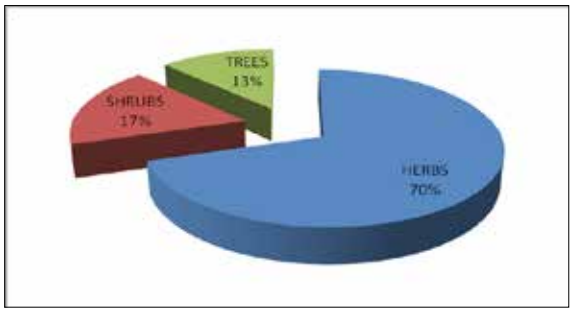

Fig. 4. Habit of NTFPs

Upon discussion with the villagers it was informed that the plants are collected during late August and early September for most species, dried and kept in storage for later use; a practice of sustainable resource use. Some of these species are gathered for commercial sale too (*Kutki, Panja*, etc.) and over the past few years the race to gather *Trillium govanianum* (*Nagchatri*) and *Fritillaria roylei* (*Van Lahsun*) has totally destroyed the fabric of sustainable harvest practiced in the region. The information obtained supports the fact that, people residing in the remote villages bordering forests possess good knowledge about plants and have been using them in their traditional local healthcare system for long.

3.3. Commercial collection of NTFPs

Some medicinal plants like *Kutki* (*Picrorhiza kurroa* Royle ex Benth.), *Dhoop* (*Jurinea macrocephala* DC.), *Ateesh/Patish* (*Aconitum heterophyllum* Wall. ex Royle), *Sugandhbala/ Mushkbala* (*Valeriana jatamansi* Jones), *Khanor* (*Aesculus indica* (Wall. ex Cambess.) Hook.) and fungal species such as *Lingur* (*Diplazium* spp.), *Guchhi* (*Morchella esculenta* (L.) Pers.) and are gathered exclusively for sale. However, obtaining quantitative data pertaining to these NTFPs proved unattainable due to the shady and unregulated trade prevalent in this region.

As mentioned earlier, the past decade or so has seen a destructive large scale extraction of *Trillium govanianum* and *Fritillaria roylei*. The extraction begins with the sprouting of the plant and is removed even before it flowers. As the forest is under the temple, permission is obtained from the presiding local deity and then the entire village moves together to collect the herb. As these herbs are in high demand, the people have started to break away from the sustainable fabric practiced uptill now.

3.4. Fodder and fuel wood

Fodder and fuel wood are major resources for the inhabitants of remote villages in the Himalayas and in the present study 61 plant species were documented of which 45 plants were recorded as fodder while 50 as fuelwood; among these 35 were being of common use as fodder and fuel wood (Annexure B). The study site being a temperate hill zone with the temperate for most part of the year being cold to very cold throughout the long winters.

Thus, fuel wood is required not only for cooking but also to keep the houses warm. This fact is also strengthened in Fig. 5, which depicts the maximum number of plant species (50) for use as fuel wood use. Likewise, the dominant families being Fabaceae, followed by Rosaceae, Pinaceae and Ericaceae (Fig. 6).

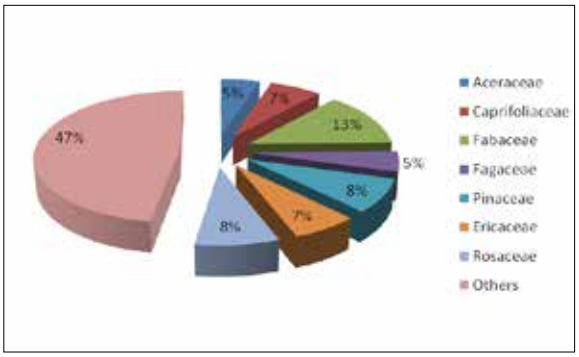

Fig. 5. General use of NTFPs as fodder and fuel wood

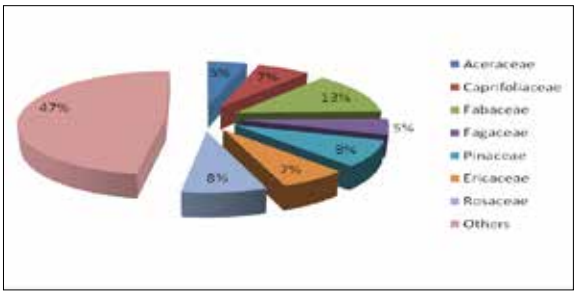

Fig. 6. Dominant families of NTFPs used as fodder and fuel wood

Looking at the habit of the plants, deciduous plants, both trees as well as shrubs (74%) find more usage than the evergreen (Fig. 7).

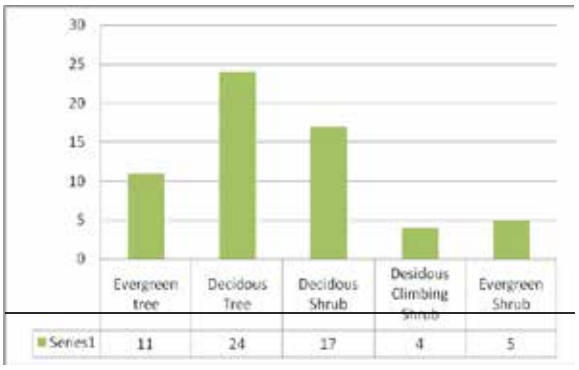

Fig. 7. Plant habit of NTFPs used as fodder and fuel wood

It was estimated that the total energy consumed in a household (Table 1), fuel wood alone account for more than 70%. The other forms of energy being used were LPG (15%), Coke (10%) and Kerosene (5%). A large volume of fuel wood is also consumed in religious and social occasions, including the cremation of bodies. Fuel wood consumption is maximum owing to its availability whereas kerosene is low as it is not easily available. The information on coke use is doubtful as it is an illegal activity and people seemed reluctant to share information.

In Kwar, like other villages in the region, people spend a major portion of their daily chores in collection of fuel wood and fodder. The green fodder is in plenty during the rainy season in the agricultural fields as well as community grasslands, on borders of fields and as also the weeds of cultivation. In winter, particularly when the green grass is not available and during summer, when the green grass is scarce, there

Table 1. Energy consumed

Resource	(%)	Usage
Fuel Wood	70	Cooking/room & water heating/social & religious functions
LPG	15	Cooking
Coke	10	Room heating
Kerosene	5	Cooking/wtaer heating

is much dependence on tree for fodder. Come autumn, and the entire village is working from dawn to dusk cutting grass up in the sub alpine slopes and open forests for stacking the same for the approaching harsh and long winters. It is a sort of ritual, where the entire family is involved; even serving employees come home on leave to help. Likewise, fuel wood is also collected the year round and stacked near homesteads for use during monsoons and winters.

It was observed that stall feeding was limited and cattle along with sheep and goats are taken out for grazing/feeding. Goats and sheep mainly browse the shrubs like *Berberis, Plectranthus, Rubus* and *Prinsepia.* The trees are in general lopped between April and December with greater frequency during the winter months of November to February. During July and August, enough green fodder in crops is available thereby sparing the tree for some vigorous growth. The main fodder trees of the area include *Bauhinia variegata* L., *Ficus palmata* Forssk., *Grewia optiva* J. R. Drumm. ex Burret, *Morus alba* L., *Pistacia chinensis* Bunge, *Ulmus villosa* Brandis ex Gamble, *U. wallichiana* Planch., *Populus*

ciliata Wall. ex Royle, *Quercus oblongata* D. Don, *Q. floribunda* Lindl. ex A. Camus, *Q. semecarpifolia* Sm., *Toona serrata* (Royle) M. Poem and *Prunus cerasoides* Buch. Ham. ex D. Don. Among the tree species *Mohru* (*Q. floribunda*) is the most favoured tree species, as they have multiple uses in terms of both fodder and fuel-wood. In addition to this, the other prominent fodder tree species found in the area are Kimmu (*Morus* sp.), Khirik (*Celtis* sp.), Moran (*Ulmus* sp.), Pabun (*Pyrus* sp.) and Kunish (*Alnus* sp.).

3.4.1. Preferred fodder and fuel wood species

Due to the long harsh winters, the requirement of fuel wood is very high and as such all woody biomass is considered as fuel. The preference to various species in terms of fuel wood and fodder by the villagers is primarily dependent on its easy availability from the nearby forest, homestead, field bunds and community land. The main criteria for fuel wood selection was that the villagers preferred fuel that produced less smoke but more coal. From the data obtained during the study, the preferred firewood species were the three oaks (*Quercus oblongata, Q. floribunda* and *Q. semecarpifolia*), phedu (*Ficus palmata*) and kail (*Pinus wallichiana* A. B. Jacks.). The preferred fodder species were *Q. floribunda, Morus alba, Celtis australis* L. and *Grewia optiva*. Wood is generally collected as dry wood in addition to cutting the live branches of trees. The autumn season is considered most favourable for gathering fuel wood as well as fodder, which is then stacked in the vicinity of their homes for use during winter.

3.5. Miscellaneous

A good number of fruits are collected and consumed raw (species of *Rubus, Berberis, Rosa, Corylus, Cotoneaster, Fragaria, Duchesnea, Prinsepia, Ficus, Pyrus, Prunus, Hippophae, Debregeasia, Juglans*, etc). Many wild plants including ferns and fungi are also being consumed as pot herbs. The important ones include *Phytolacca acinosa Roxb., Urtica dioica* L., *Stellaria media (L.) Vill., Rumex hastatus* D. Don*, Helvella crispa* (Scop.) *Fr., Cantharellus lateritius* (Berk.) *Singer, Diplazium esculentum* (Retz.) Sw., *D. maximum* (D. Don) C. Chr. and *Bergenia ciliata* (Haw.) Sternb.

A number of NTFPs like *Juniperus indica* Bertol.*, J. communis* Thunb.*, Rhododendron anthopogon* D.Don*, R. arboreum* Sm.*, Asparagus adscendens* Roxb., *Prinsepia utilis* Royle, *Saussurea obvallata* (DC.) Edgew.*, Pleurospermum candollei* Benth. ex C. B. Clarke, *Artemisia* spp.*,* etc. also find popular use in cultural and religious activities. Besides, many other arboreal plant taxa find common use in the preparation of agricultural implements/tools, etc.

4. Conclusion

NTFPs have been traditionally gathered from the forests by the people of Kwar region, for meeting their household needs and also for generation of income to some extent. NTFPs thus play an important role in their livelihood and have been meeting the necessary needs of the community as a traditional flow. However, in recent years due to rising population, forest degradation, large scale commercial herb extraction, this resource is becoming scarce.

The study documents much useful information for research interested in studying the effect of traditional plants and the possibility of commercializing them. This valuable traditional knowledge on NTFPs being commonly used here by the people of Kwar and also in other parts of the region, today face a number of challenges. Foremost being the globalisation and digital invasion, especially a sudden surge in this once land locked remote region. It has weaned away people outside the valley in search of jobs and greener pastures. This resulted in the onward transmission of traditional knowledge from one generation to the next, which has been greatly hampered. It was observed that there was a steady decline in expertise capable of recognizing the wild plants, especially in the case of plants for medicinal usage. Besides, the over exploitation for commercial uses of certain herbs (*Trillium govanianum, Fritillaria roylei, Aconitum* spp.*, Picrorhiza kurroa*, etc.) had reduced the stock of wild medicinal plants thus resulting in a corresponding drop in their availability. Therefore, it becomes even more important to document this fading valuable knowledge for future reference and uses. Literature review also revealed that some of the plants used traditionally by the communities have been supported by experimental data. However, most of the plants used locally were not subjected to any studies and suggests further investigation.

From the study we conclude that, this region has good forests which were known for a regular sustained supply of NTFP resources. However, very little is known about the condition of this resource or the levels of its exploitation. Though, majority of these NTFPs are widely distributed across the valley, their abundance varies significantly resulting in patchy distribution. Also, the greed for commercial gains has torn away the fabric of sustainability which was religiously being followed here. A more focussed study needs to be undertaken on this vital forest resource supply and how to counter the evident degradation of the NTFPs, which used to provide a sustainable supply to the multitude of rural folk not only in the Kwar region, but across the State.

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Annexure A

Enumeration of the plant species in tarditional healthcare

Sl. No.	Botanical Name	Vernacular Names	Family	Habit	Part Used	Disease/Ailment
1	*Aconitum deinorrhizum* Stapf	*Mohra/Mohrabish/ Telia*	Ranunculaceae	H	UN	Toothache/ diarrhoea/ paralysis/ antidote.
2	*Aconitum heterophyllum* Wall. ex Royle	*Atish/Patish*	Amaryllidaceae	H	UN	Analgesic to cure headaches/ sedative.
3	*Aconitum violaceum* Jacq. ex Stapf	*Dudhiya Mohra*	Amaryllidaceae	H	UN	Colds and cough/ digestive disorders/ antidote for poison.
4	*Allium carolinianum* DC.	*Dunu*	Amaryllidaceae	H	UN	Tonic for the digestive system/ cure for joint pain.
5	*Allium humile* Kunth	*Ladu/Jangli Pyaz*	Apiaceae	H	UN	Tonic for the digestive system/ cure for joint pain.
6	*Allium wallichii* Kunth	*Jambu/dunu*	Asteraceae	H	UN	Tonic for the digestive system/ cure for joint pain.
7	*Anaphalis triplinervis* (Sims) Sims ex C. B. Clarke	*Baj/Bouj*	Asteraceae	H	UN	Check bleeding/ cleansing sores and wounds of the toes.
8	*Angelica glauca* Edgew.	*Chora*	Asteraceae	H	UN	Digestive/ cure for gastric related problems.
9	*Arnebia benthmii* (Wall. ex G. Don) I. M. Johnst.	*Massarohi*	Berberidaceae	H	UN	Hair tonic for dark healthy hair and for checking hair fall.
10	*Artemisia roxburghiana* Wall. ex Bess.	*Kubash*	Berberidaceae	H	LV	Digestive conditions like diarrhoea, constipation, cramps, worm infestations, and persistent vomiting
11	*Berberis aristata* DC.	*Kingod/Chotre/ Kashmal*	Berberidaceae	S	UN	Anti-inflammatory use in painful swellings/ check diabetic effect/ remove stones (pathri).
12	*Berberis chitria* Buch.-Ham. ex Lindl.		Boraginaceae	S	UN	
13	*Berberis lycium* Royle		Ericaceae	S	UN	

14	*Bergenia ciliata* (Haw.) Stemb.	*Daklambu/Dhekdu*	Ericaceae	H	UN	Remove stones (pathri)/ urinary troubles/acute back pain and to cure internal injuries.
15	*Bergenia stracheyi* (Hk. f. & Thom.) Engl.		Ericaceae	H	UN	
16	*Dactylorhiza hatagirea* (D. Don) Soó	*Hattajodi/Salam Panja*	Geraniaceae	H	UN	Dysentery, diarrhoea, chronic fever, stomach problems, wounds, cuts, burns, fractures, and aphrodisiac.
17	*Datura stramonium* L.	*Dhatura*	Juglandaceae	H	LV/ SD	Injuries, wounds bleeding and in acute ear ache.
18	*Doronicum kamaonense* (DC.) Alv. Fern.	*Kaunl*	Liliaceae	H	UN	To treat high altitude sickness/nausea/to treat acute headache.
19	*Geranium wallichainum* D. Don ex Sweet	*Ratanjot/Laljari*	Liliaceae	H	UN	Check bleeding of fresh cuts/toothaches/joint pains.
20	*Hedychium acuminatum* Roscoe	*Kapar kachli*	Liliaceae	H	UN	Treating painful inflammation, bad breath, diarrhoea, hiccups.
21	*Juglans regia* L.	*Akhrot/Dandasa*	Orchidaceae	T	TW/ UN	Toothache/ skin problems/piles/brain tonic.
22	*Persicaria vivipara* (L.) Ronse Decr.	*Ninaie*	Polygonaceae	H	UN	Mouth ulcers in infants/to treat sore throats and loose gums.
23	*Phytolacca acinosa* Roxb.	*Jharga/Jalga*	Phytolaccaceae	H	LV	In constipation as laxative/antidote in poisoning cases/ helpful in asthmatic conditions.
24	*Polygonatum verticillatum* (L.) All.	*Meda/Salam Misri*	Asparagaceae	H	UN	Energy booster/tonic/energizer and aphrodisiac.
25	*Polygonatum cirrhifolium* (Wall.) Royle	*Maha-Meda/Salam Misri*	Asparagaceae	H	UN	Energy booster/tonic/energizer and aphrodisiac.
26	*Picrorhiza kurroa* Royle ex Benth.	*Kutki/Kadwi*	Plantaginaceae	H	UN	High fever, cough and cold/skin problems and in diabetes.
27	*Podophyllum hexandrum* Royle	*Ko-kakri/Ban-kakri*	Berberidaceae	H	UN	Chronic fever/jaundice/dysentery/aphrodisiac/ energy booster.
28	*Prinsepia utilis* Royle	*Bekhal*	Rosaceae	S	SD	Joint pains/cough and cold/to treat skin diseases.

29	*Prunus armeniaca* L.	*Chuli*	Rosaceae	T	SD	Treating asthma/cough/constipation/joint and muscular pain.
30	*Prunus cornuta* (Wall. ex Royle) Steud.	*Jamu*	Rosaceae	T	UN	Aids digestion and provides a sense of well-being.
31	*Rheum australe* D. Don	*Chukri /Tatri*	Polygonaceae	H	UN	Setting broken bones/checks inflammation of the muscles.
32	*Rhododendron anthopogon* D. Don	*Talish*	Ericaceae	S	LV	Acute cough/kin disorders/leaves used as snuff to produce sneezing for curing common colds.
33	*Rhododendron arboreum* Sm.	*Burash*	Ericaceae	T	FL	Treat diarrhoea/coolant in nose bleed/ for good glowing skin.
34	*Rhododendron campanulatum* D. Don	*Simris*	Ericaceae	S	UN	Treat skin problems/leaves with tobacco used as snuff in headaches.
35	*Taxus baccata* ssp. *wallichiana* (Zucc.) Pilger	*Thuna/Thunder/Birmi*	Taxaceae	T	LV/ TW	Treating chest problems like asthma and bronchitis/seed aril has laxative effect.
36	*Trillium govanianum* Wall. ex D.Don	*Nagchatri*	Melanthiaceae	H	UN	Treating headaches/stomach aches/ aphrodisiac.
37	*Urtica dioica* L.	*Kungush/Kandali*	Urticaceae	H	LV	To treat urinary problems/painful muscles and joints.
38	*Valeriana jatamansi* Jones	*Sugandh/Mushk Bala*	Valerianaceae	H	UN	Used to treat ulcers, jaundice/sleep enhancement/stress.
39	*Viola pilosa* Blume	*Banaksha*	Violaceae	H	WP	Cold/fever.
40	*Zanthoxylum armatum* DC.	*Timber/Timru*	Zingiberaceae	S	TW	Toothache.

H=Herb; S=Shrub; T=Tree ; UN=Underground; FL=Flower; LV=Leaves; SD=Seed; TW=Twigs; LV/ TW=Leaf and Twigs; LV/ SD=Leaf and Seed; TW/ UN=Twig and Underground; WP=Whole Plant

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Annexure B

Enumeration of the plant species used as fodder and fuelwood

Sl. No.	Botanical Name	Family	Local Name	Habit	Fodder	Fuel wood
1	*Abies pindrow* (Royle ex D.Don) Royle	Pinaceae	*Tosh*	ET		√
2	*Abies spectabilis* (D.Don) Mirb.	Pinaceae	*Kali Tosh*	ET		√
3	*Acer caesium* Wall. ex Brandis	Aceraceae	*Maniora*	DT	√	√
4	*Acer caudatum* Wall.	Aceraceae	*Kanjula*	DT	√	√
5	*Acer villosum* C. Presl	Aceraceae	*Tiwane*	DT	√	√
6	*Aesculus indica* (Wall. ex Cambess.) Hook.	Sapindaceae	*Khanor, Kondhor*	DT	√	√
7	*Ailanthus altissima* (Mill.) Swingle	Simaroubaceae	*Mahrukh*	DT	√	√
8	*Alnus nitida* (Spach) Endl.	Betulaceae	*Champ, Kunish*	DT	√	√
9	*Bauhinia variegata* L.	Fabaceae	*Kadhau*	DT	√	√
10	*Berberis angulosa* Wall. ex Hook.f. & Thom.	Berberidaceae	*Chotre, Kashmal*	DS	√	√
11	*Berberis aristata* DC.	Berberidaceae	*Simbulo*	DS	√	√
12	*Berberis lycium* Royle	Berberidaceae	*Chotre*	DS	√	√
13	*Betula utilis* D. Don	Betulaceae	*Bhojpatra, Bhuj, Bhojlu*	DT	√	√
14	*Toona ciliata* M. Roem.	Meliaceae	*Toon*	DT	√	√
15	*Cedrus deodara* (Roxb. ex D.Don) G.Don	Pinaceae	*Deyar, Deodar*	ET		√
16	*Celtis australis* L.	Cannabaceae	*Kharik*	DT	√	√
17	*Clematis buchananiana* DC.	Ranunculaceae	*Berkalu*	CS	√	
18	*Clematis gouriana* Roxb. ex DC.	Ranunculaceae	*Tootal*	CS	√	
19	*Clematis montana* Buch.-Ham. ex DC.	Ranunculaceae	*Chanda*	CS	√	
20	*Corylus colurna* L.	Betulaceae	*Ban Shirol, Sholi*	DT	√	√
21	*Cotoneaster acuminatus* Wall. ex Lindl.	Rosaceae	*Reonsh*	DS	√	√
22	*Desmodium multiflorum* DC.	Fabaceae	*Pothiat*	DS	√	√
23	*Desmodium elegans* DC.	Fabaceae	*Pothiat, Sambar*	DS	√	√

24	*Drepanostachyum falcatum* (Nees) Keng f.	Poaceae	*Gorh*	ES	√	
25	*Ficus palmata* Forssk.	Moraceae	*Phegra*	DT	√	√
26	*Grewia oppositifolia* Roxb. ex DC.	Malvaceae	*Beol*	DT	√	√
27	*Hedera helix* L.	Araliaceae		ES	√	
28	*Hippophae salicifolia* D. Don	Elaeagnaceae	*Soocha, Chharma*	DS	√	√
29	*Ilex dipyrena* Wall.	Aquifoliaceae	*Kantaroo*	ET	√	
30	*Indigofera heterantha* Brandis	Fabaceae	*Neel*	DS	√	√
31	*Jasminum officinale* L.	Oleaceae	*General ghass*	CS	√	
32	*Juglans regia* L.	Juglandaceae	*Okhod, Akhrot*	DT	√	√
33	*Juniperus communis* L.	Cupressaceae	*Thalu*	ES		√
34	*Juniperus recurva* Buch.-Ham. ex D.Don	Cupressaceae	*Theluath, Juniper*	ES		√
35	*Lyonia ovalifolia* (Wall.) Drude	Ericaceae	*Oon, Airan*	DT		√
36	*Morus alba* L.	Moraceae	*Toot*	DT	√	√
37	*Parthenocissus semicordata* (Wall.) Planch.	Vitaceae	*Anee*	DS	√	
38	*Picea smithiana* (Wall.) Boiss.	Pinaceae	*Rai*	ET		√
39	*Pinus wallichiana* A.B. Jacks.	Pinaceae	*Kail*	ET		√
40	*Pistacia chinensis* Bunge	Anacardiaceae	*Kakarsinghi*	DT	√	√
41	*Populus ciliata* Wall. ex Royle	Salicaceae	*Bewan, Poplar*	DT	√	√
42	*Prunus cornuta* (Wall. ex Royle) Steud.	Rosaceae	*Jangli Jamun, Jamu*	DT	√	√
43	*Prunus persica* (L.) Batsch	Rosaceae	*Aru*	DT	√	√
44	*Pyrus pashia* L.	Rosaceae	*Mole, Kainth*	DT	√	√
45	*Quercus floribunda* Lindl. ex A.Camus	Fagaceae	*Mohru*	ET	√	√
46	*Quercus oblongata* D. Don	Fagaceae	*Rein,Bunjk*	ET	√	√
47	*Quercus semecarpifolia* Sm.	Fagaceae	*Kharsu*	ET	√	√
48	*Rhododendron anthopogon* D. Don	Ericaceae	*Tochat*	DS		√
49	*Rhododendron arboreum* Sm.	Ericaceae	*Buras, Burans*	ET		√
50	*Rhododendron campanulatum* D. Don	Ericaceae	*Simras*	DS		√
51	*Ribes orientale* Desf.	Grossulariaceae	*General ghass*	DS	√	
52	*Robinia pseudoacacia* L.	Fabaceae	*Robinia* (introduced)	DT	√	√

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53	*Salix tetrasperma* Roxb.	Salicaceae	Bisa	DT	√	√
54	*Sorbaria tomentosa* (Lindl.) Rehder	Rosaceae	Guktianda	DS	√	√
55	*Taxus wallichiana Zucc.*	Taxaceae	Thuno	ET		√
56	*Thamnocalamus spathiflorus* (Trin.) Munro	Poaceae	Nirgal	ES	√	
57	*Ulmus wallichiana* Planch.	Ulmaceae	Manu	DT	√	√
58	*Viburnum cotinifolium* D. Don	Caprifoliaceae	Mole, Telne, Tustus	DS		√
59	*Viburnum grandiflorum* Wall. ex DC.	Caprifoliaceae	Bhatianda	DS		√
60	*Viburnum mullaha* Buch.-Ham. ex D. Don	Caprifoliaceae	Echa, Tilanj	DS		√
61	*Viburnum nervosum* D. Don	Caprifoliaceae	Tini	DS		√

ET: Evergreen tree; DT: Deciduous Tree; DS: Deciduous Shrub; CS: Climbing Shrub; ES: Evergreen Shrub