
Development of NTFPs Sector for Income Generation and Environmental Conservation

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Abstract

Non-Timber Forest Products (NTFPs) are amongst the key global commodities and an important component of international trade. They are important in livelihoods of rural people all over the Himalayan region for meeting food, medicine, construction materials, and income needs of subsistence communities. The sector needs focused developmental planning that can bring substantial economic and environmental benefit in the Uttarakhand state. Based on an extensive analysis of three important categories of NTFPs, viz. medicinal plants, edible wild plants, and bamboo this paper highlights potential of this sector for food security, income generation and environmental conservation by adopting a pro-people approach in Uttarakhand state. Suggestions have been provided for improving the existing framework and programmes that can maximize economic, social, cultural and ecological benefits.

Keywords: Non-Timber Forest Products (NTFPs), Livelihood, Wild Edible Plants, Medicinal and Aromatic Plants, Bamboo and Ringal.

1 Introduction

Biodiversity is the main basis for sustainable food, health and livelihood (Myers et al. 2000). Non-Timber Forest Products (NTFPs) has been an important part of biodiversity that play an important role in the livelihoods of the rural poor as a source of food, fiber, fuel, medicine, bamboos, agricultural amenities, domestic materials, construction materials, incense, mushrooms, fruits, bark, leaves, flowers, seeds, honey, roots and tubers and various ritual needs all across the world. They are also an important source of income to many people. Worldwide over 1 billion people depend to some extent on NTFPs, several million for income as well (IUCN 2008, FAO 2020). It is said that recognizing NTFPs may generate new income and employment opportunities for women thus can play a critical role in providing both food and income for the poorest households (Belchar & Schreckenber 2007, Sundriyal & Masoodi 2020)). Sustainable extraction of NTFPs is considered best feasible strategy for forest conservation in biodiversity rich areas (Arnold and Perez 2001). Development of NTFPs sector could bring substantial economic, social, cultural and ecological benefits (Saha and Sundriyal 2012). Edible wild plants, bamboo and medicinal plants collectively comprise significant potential for development. In recent years significant efforts have been put to conserve biodiversity. In 1992 in U.N. Conference on Environment and Development in Rio de Janeiro a Convention on Biological Diversity (CBD) was adopted that focuses on triple goals of conservation, sustainable use, and equitable sharing of benefits out of biodiversity. Since India is a signatory to the CBD the country has enacted the National Biodiversity Act since 2002. Community dependence on bio-resources for diverse needs has high implications for long term management of such resources. In recent years land conversion, habitat degradation, and overharvesting have significantly threatened biodiversity thus impacting livelihood of a large section of society in many regions of the world. It is said that one in five medicinal and aromatic plant species have been found to be threatened with extinction, yet only 7 percent of MAPs have been assessed for the IUCN Red List of Threatened Species (TRAFFIC, 2018).

In Himalayan region there is high dependence on NTFPs for fulfilling the needs of food, medicine, fibre, fuel wood, fodder, dye, and various other material that are essential for the livelihood of local people. Using NTFPs is an integral part of local culture. Uttarakhand in Central Himalaya is no exception to that. Forests of the state provide wide variety of non-timber forest products (NTFPs) that are widely collected to meet local demands. Wild food plants are commonly collected for use at home. Similarly, a large

variety of medicinal and aromatic plants are also used in the state as an inexpensive substitute to costly allopathic drugs. Bamboo is also an important resource that is used for making diverse utility items and has significant potential to build houses, floors, roofs, bridges, and diverse other items and structures. Considering this the present paper provides an overview of the potential of wild edibles, medicinal and bamboo species in Uttarakhand state. It also access existing framework for development of these three sectors and suggest ways and means to mainstream them in developmental planning process. It is argued that the potential of these important natural resources need to be developed for diversification of agriculture and food security, alleviating malnutrition, and income generation and poverty eradication in the states.

2 Profile of the State of Uttarakhand

Uttarakhand is located in north India and forms a well-known Hindu pilgrimage and tourist destination. It is bordered to the northwest by the Indian state of Himachal Pradesh, to the northeast by the Tibet Autonomous Region of China, to the southeast by Nepal, and to the south and southwest by the Indian state of Uttar Pradesh. The state has a total geographical area of 53483 sq. km and physiographical it is divisible into three zones namely, the Himalaya, the Shiwalik, and the Tarai region. The State has 13 districts, 78 Tehsils and 95 development blocks. Largely the state has a temperate climate in hills and tropical climate in plain areas. The average annual rainfall is 1550 mm. The terrain and topography of the state is largely hilly with large areas under snow cover and steep slopes. It has a total forest cover area of 3.47 million ha (i.e. 71% of the total geographical area of the state) that ranks it sixth among the other states in India in terms of percentage of recorded forest area. Forests are divisible into Tropical/Sub-tropical Moist Forest (500–1000 m), Sub-Tropical Pine Forest (1000–2000 m), Himalayan Moist Temperate Forest (2000–3000 m), Sub-Alpine Forests (3400–4000 m) and Alpine Forests 4000-5000m). All these forests harbor rich faunal and floral diversity, herbal and aromatic plants, rare and endangered species, and pristine ecosystems.

3 Importance of NTFPs Sector

Non-Timber Forest Products (NTFPs) are an important source of livelihoods of rural people and marginal communities. World over more than a billion

people are using NTFPs as a main source of livelihood (Belcher & Schreckenberg, 2007). They are good source of food, medicine, spices, construction material; poor people also generate some income by selling NTFPs products. In India over 275 million rural population depend on forest and NTFPs for livelihood (World Bank 2005). The extent of NTFPs business in the country is around Rs.6000crores per annum (Anonymous 2011). It also accounts for 50% of total forest revenues and 70% of forest based export income for the country. However, NTFPs have been largely considered as free access material, therefore remained neglected in the name of 'minor forest produce'. However, the conventional approaches of forest management have been focused largely on timber. In recent years NTFPs sector has emerged with tremendous potential to create large scale employment opportunity that may provide better income, employment of many people (Shanley, et al. 2002, Ojha et al. 2020). For many states NTFPs provide a major source of income even since the tree felling has been banned (Saha and Sundriyal 2012). From supporting food security to medicine and construction material NTFPs have the potential for establishing eco-friendly, and small to medium enterprises at local level that may provide better income, employment to many people. At the same time its sustainable management can improve the status of forest stands all over. In this paper an effort has been made to assess the potential of wild edible plants, medicinal & aromatic plants and bamboo in the context of Uttarakhand state so that these plants could be used for generating new opportunities for the local people. Uttarakhand state comprised 938 NTFPs that are used for different purposes, viz. medicinal plants (701), wild edibles (155), oil yielding (32), soap and detergent (22), insecticide/pesticides (15) and fiber (13), etc. (Figure 1) (Samant et al. 1998, Maikhuri et al. 1994, 2014, Kala et al. 2005, Negi et al., 2011). Further details of some potential sectors are narrated in subsequent paragraphs.

3.1 Wild Edible Plants

Globally over 20,000 plant species have been used for food purpose although fewer than 30 species now provide 90% of our food. A large variety of less well wild plants are consumed for vegetables, fruits, flowers, leaves, roots, rhizome, etc., which are both delicious and nutritious. It is reported that wild plants are good source of protein, fat, vitamins, fiber, N, P, K, Ca, Fe, and other nutrients (Table 1) (Sundriyal & Sundriyal 2001, 2003, Sundriyal, M. et al. 2004, Dhyani et al. 2007). Therefore consuming wild plants helps in food security as well as in nutritional balance of marginal

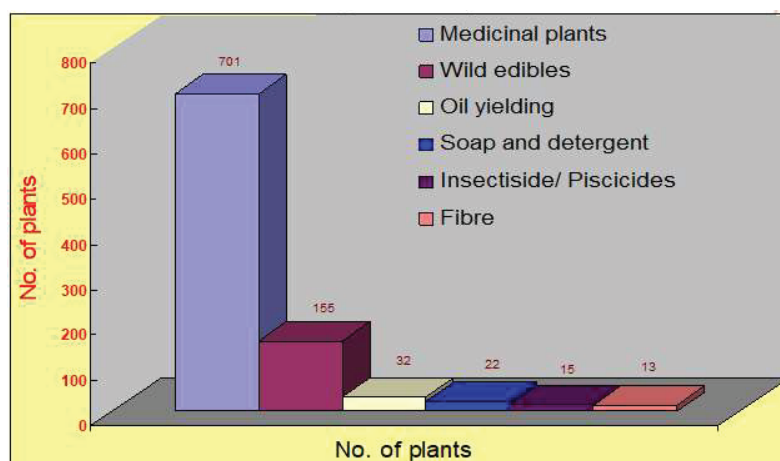


Figure 1 Diversity of Non-timber forest products (NTFPs) used in the state of Uttarakhand.

rural communities. Some people also sell edible wild plants in market and earn income. Some potential wild edible fruit species of Uttarakhand state are provided in Table 3. With value addition these plants can fetch better market price and can play an important role as a high price commodity. Based on a survey of select workers ($n = 20$) these species have been categorized in different developmental potential. The analysis revealed that some species have been rated excellent and very good thus comprise huge prospects for future. There is a need of undertake full-scale ethno botanical investigation, developing propagation and cultivation protocols, value-added product development and marketing, value chain development, and implementing appropriate conservation measures for select species Sundriyal M. et al. 1998). Domesticating and integrating promising species into existing crops and agricultural systems would help in food security, maintenance of biodiversity and environmental integrity. Currently there are very limiting policy and programs on mainstreaming wild edible plants. Therefore, it is desired that the state government should consider developing an appropriate framework for development of wild edible plant sector to diversify food sources and ensuring food security even during lean period.

There is vast scope for value addition by making of products like squash, juice, jam, pickle, sauce, etc. from wild plants (Maikhuri et al. 2004, 2014). Fortunately some NGOs, private agencies and research institutions have initiated work related to value additional and product development from less known edible plants. Amla, Bel, Burans, Kaphal, Apricot, Naspati, Malta,

Table 1 Wild plants as a source of nutrients (Sundriyal and Sundriyal 2001)

Plant Parts	No. of Species	Moisture (%)	Ash (%)	Protein (%)	Fat (%)	Fibre (%)	N (%)	P (%)	K (%)	Ca (%)	Fe (%)	Zn (ppm)	Mg (ppm)
Leaves	10	20.0–30.0	15.5–25.0	4.65–22.43	1.20–4.50	10.1–22.0	2.50–3.77	0.28–0.69	1.87–2.40	0.034–1.31	0.32–1.31	–	–
Tender shoots	4	30.3–83.0	5.20–10.32	3.90–15.56	0.30–0.63	16.00–36.00	2.16–3.43	1.87–2.40	1.30–2.37	0.56–1.02	0.36–0.56	445–607	470–540
Fruit	19	7.23–89.0	2.10–4.13	1.25–1.32	0.35–30.50	2.10–21.20	0.28–3.79	0.42–1.27	0.42–2.18	0.124–1.84	0.021–0.831	202–1186	285–611
Fruiting bodies	2	70.0–90.0	1.30–5.67	18.56–25.00	1.19–2.01	2.23–4.11	4.00–4.30	1.92–2.18	1.92–2.18	1.53–1.84	0.11–0.13	666–738	239–344
Roots/ rhizomes	2	30.2–40.4	3.56–8.32	4.75–10.75	0.56–1.08	10.00–12.10	0.66–1.59	0.003–0.124	0.004–0.11	–	0.13–0.66	–	–

Table 2 Ediblewild fruits used in the state of Uttarakhand and their developmental prospects

	Species Name	Local Name	Family	Use	Value Addition and Developmental Prospects
1	<i>Aeglemarmelos</i>	Bel	Rutaceae	Edible	+ + + + +
2	<i>Aesculusindica</i>	Pangar	Hippocastanaceae	Eaten roasted	+ +
3	<i>Berberisaristata</i>	Kingore	Berberidacea	Dyes	+ +
4	<i>Celtisaustralis</i>	Kharik	Cannabaceae	Raw fruits	+
5	<i>Cornuscapitata</i>	Bhamor	Cornaceae	Eaten raw	+
6	<i>Deplokenemabutyryacea</i>	Cheura	Sapotaceae	piscicides	+ +
7	<i>Eleagnusangustifolia</i>	Giwain	Eleagnaceae	Eaten raw	+ +
8	<i>Emblicaoofficinalis</i>	Amla	Phyllanthaceae	Eaten raw	+ + + + +
9	<i>Ficustroxburghii</i>	Timla	Moraceae	Eaten raw	+ +
10	<i>Ficuspalmata</i>	Bedu	Moraceae	Eaten raw	+ +
11	<i>Fragariavesca</i>	Bhuinkaphal	Rosaceae	Eaten raw	+
12	<i>Grewiaoptiva</i>	Veemal	Malvaceae	Eaten raw	+ +
13	<i>Hippophaerhamnoides</i>	Amesh	Eleagnaceae	Non alcoholic beverage	+ + + +
14	<i>Juglensregia</i>	Akhore	Juglandaceae	Dry fruits	+ + + + +
15	<i>Morus alba</i>	Kimu	Moraceae	Raw fruits	+ +
16	<i>Myricaesculenta</i>	Kaphal	Myricaceae	Raw	+ + + +
17	<i>Prinsepiaumilis</i>	Bhaikal	Rosaceae	Ghee, blue dye	+
18	<i>Prunuscerasoides</i>	Paiyun	Rosaceae	Raw	+ +

(Continued)

Table 2 Continued

	Species Name	Local Name	Family	Use	Value Addition and Developmental Prospects
19	<i>Pyricanthacremulata</i>	Ghingaru	Rosaceae	Raw fruit	+
20	<i>Pyruspashia</i>	Mehal	Rosaceae	Edible	+ + + + +
21	<i>Rhusparviflora</i>	Tunga	Anacardiaceae	Eaten raw	+ +
22	<i>Ribeshimalense</i>	Kimkolia	Grossulariaceae	Raw & as pickle edible	+ +
23	<i>Rubusellipticus</i>	Hisalu	Rosaceae	Edible raw	+ +
24	<i>Rubusvivues</i>	Kailashi	Rosaceae	Raw	+ +
25	<i>Sorbuscuspidata</i>	Papamoli	Rosaceae	Raw and as pickle	+
26	<i>Spondiaspinnata</i>	Labsi	Anacardiacea	Medicinal	+ + +
27	<i>Terminaliachebula</i>	Harra	Combretaceae	Medicinal	+ + + + +
28	<i>Terminaliabellerica</i>	Bahera	Combretaceae	Medicinal	+ + + + +
29	<i>Zanthoxylumacanthopodium</i>	Timru	Rutaceae	Spice/condiments	+ + + + +
30	<i>Zizyphusnummularia</i>	Ber	Rhamnaceae	Raw	+ + +

Value addition and developmental prospects: + + + + + Excellent, + + + + Very good, + + good, + fair.

Table 3 List of medicinal and aromatic plants (MAPs) that prohibited and allowed for collection in the state of Uttarakhand**1. Prohibited for collection (15 nos)**

Dactylorhiza hatagirea, Habenaria intermedia, Habenaria edgeworthii, Fritillaria roylei, Lilium polyphyllum, Malaxis muscifera, Aconitum heterophyllum, Swertia chirayita, Picrorhiza kurrooa, Taxus baccata, Berberis aristata, Valeriana wallichii, Angelica glauca, Tinospora cordifolia, Acorus calamus

2. Open for collection (12 nos)

Phyllanthus niruri, Azadirachta indica, Sida spp., Abutilon indicum, Phaseolus trilobus, Ricinus communis, Eclipta alba, Origanum vulgare, Calatropis spp., Tribulus terrestris, Achyranthes aspera, Mentha arvensis

3. Sustainable collection allowed (17 nos)

Bergenia ciliata, Murrayakoenughii, Callicarpum macrophylla, Vitex negundo, Asparagus racemosus, Aegle marmelos, Cinnamomum tamala, Plumbago zeylanicum, Hedychium spicatum, Celestrus paniculata, Emblica officinale, Terminalia bellirica, Terminalia chebula, Adhatoda vasica, Peuraria tuberosa, Abrus precatorious, Cassia fistula

Hisalu, Kingore, Nigro are used for developing value added products in recent years in the state (HARK 2018). Such products are in high demand and are good source of income. The cost benefit analysis of value added products shows promising economic potential in income generation because of the total output, as well as the net return. If the quality and packaging of local products is improved their demand in market will go many-fold high. It would also provide employment of youths thus reduce outmigration to some extent. Therefore, linking wild plants with microenterprise development has huge prospects for the state of Uttarakhand. As such, a lot needs to be done to mainstream development of edible wild plant sector in the state.

3.2 Medicinal Plant Sector

Uttarakhand has age old tradition of using folk medicine by using local plants. There is high medicinal plants diversity (700+) in the state that grows in diverse agro-climatic conditions (Samant et al. 1998, Bisht et al. 2013). Some commercially important medicinal and aromatic plants (MAPs) of the state are *Aconitum sp., Acorus calamus, Adhatoda vasica, Swertia chirayita, Nardostachys grandiflora, Berberis aristata, Hedychium spicatum, Juniperus communis, Picrorhiza kurrooa, Podophyllum emodi, Rauwolfia serpentina, Emblica officinalis, Aegle marmelos, Terminalia chebula, Terminalia bellirica, Cedrus deodara, Sapindus emarginatus, Rheum emodi, Saussurea lappa, Swertia chirayita* and *Valeriana jatamansi* etc. The State has vast economic

opportunities in medicinal plant sector by adopting People centered policies and program (Kala 2015). Selected medicinal plants could be USP items for income and revenue. Fortunately in past 1–2 decades the state has made significant strides in this sector. There are a large number of institutions working the MAP sector, such as State Medicinal Plant Board (SMPB), Herbal Research & Development Institute (HRDI), Centre for Aromatic Plants (CAP), Bhesaj VikasIkai (BVI), Bhesaj Sangh, and various universities and agencies (including NGOs). The state has totally prohibited 15 species from wild collection, 12 species are open for collection, and 17 species-for cyclic collections after 3–5 years (Table 3). The govt. has prioritized medicinal and aromatic plants for cultivation at different altitudinal zones (Table 4).

Other important policy initiative that the state govt. has taken up comprise prioritization of species for cultivation and subsidy (28 species), establishment of herbal Mandis at Tanakpur, Ramnagar and Rishikesh, simplification of transit mechanism (pass system) for cultivated MAPs, establishment of MAP nurseries for supply of quality planting material, providing subsidy for cultivation of prioritized species (28 species), establishment of Field distillation unit (FDU) with 95% subsidy, creating revolving funds for MAP, Minimum Support Prices (MSP) on selected MAP produces. The local government has initiated registration of medicinal & aromatic plant cultivators and taken up training and capacity building to various stakeholders. So far over 25000 MAP cultivators have been registered that are doing cultivation in over 3000 ha land area.

Seven Medicinal plant conservation areas (MPCAs) have been designated at different places in the state to conserve threatened species, such as *Aconitum heterophyllum*, *Aconitum balfourii*, *Arnebia benthami*, *Dactylorehiza hatagirea*, *Emblica officinalis*, *Malaxis acuminata*, *Malaxis muscifera*, *Nardostachys grandiflora*, *Paris polyphylla*, *Picrorhiza kurrooa*, *Pterocarpus marsupium*, *Swertia chirayita*, *Taxus baccata*, *Terminalia bellerica*, and *Terminalia chebula*.

Promoting cultivation and sustainable use of medicinal and aromatic plants can be preferred as it is very friendly to learn for farmers with quick returns which may lead to rural employment and, ultimately, the increased state economy (Nainwal 2020).

Most MAPs are not damaged by wild animals, and these species are climate resilient crop. Cultivation can be targeted in abandoned and barren non-irrigated lands as there is low cost of cultivation. Besides, local government is providing free planting material as well as subsidy on the cultivation

Table 4 Prioritized species for cultivation in the state of Uttarakhand

Local Name	Botanical Name	Family	Elevation for Cultivation (Meter)	Uses
Atis	<i>Aconitum heterophyllum</i>	Ranunculaceae	3000–4000	Fever and anti- poisonous
Kutki	<i>Picrorhizakarrooa</i>	Scrophullariaceae	3000–4000	Liver tonic and blood purifier
Kuth	<i>Saussureacostus</i>	Asteraceae	2500–4000	Leprosy and skin diseases
Jatamansi	<i>Nardostachysgrandiflora</i>	Valerianaceae	3000–4500	Blood purifier and brain tonic
Chirata	<i>Swertiachirayta</i>	Gentianaceae	1500–2500	Blood purifier&immune enhancer
Van Kakdi	<i>Podophyllumhexandrum</i>	Podophyllaceae	3000–4500	Anticancer
Jamboo/Faran	<i>Allium stracheyi</i>	Aliaceae	3000–5000	Seasoning and flavoring agent
Kalajeera	<i>Carumcarvi, Buniumpersicum</i>	Apiaceae	3000–5000	Seasoning agent digestive
Pyrethrum	<i>Chrysanthemum cinerariaefolium</i>	Asteraceae	300–1500	Bioinsecticide
Tagar	<i>Valerianawallichii/ V. officinalis</i>	Valerianaceae	1500–2700	Epilepsy and sedative
Manjisht	<i>Rubiaccordifolia</i>	Rubiaceae	1500–2500	Skin diseases and cosmetics
Large Cardamom	<i>Amomumsubulatum</i>	Zingiberaceae	500–1600	Spice and digestive tonic
Patharchoor	<i>Coleus barbatus</i>	Lamiaceae	300–1500	Heart tonic and anti-cancer
Geranium	<i>Pelargonium graveolens</i>	Geraniaceae	300–2500	Cosmetics and aromatherapy
Sargandha	<i>Rauwolfiaserpentina</i>	Apocynaceae	300–1500	high blood pressure
Kalihari	<i>Gloriosasuperba</i>	Liliaceae	300–1000	Ulcer and piles

(Continued)

Table 4 Continued

Local Name	Botanical Name	Family	Elevation for Cultivation (Meter)	Uses
Satavar	<i>Asparagus racemosus</i>	Liliaceae	300–1800	Tonic and aphrodisiac
Rosemary	<i>Rosmarinus officinalis</i>	Lamiaceae	300–2500	Culinary and antioxidant
Lemon grass	<i>Cymbopogon flexuosus</i>	Poaceae	300–1500	Cosmetic and aromatherapy
Chamomile	<i>Matricaria chamomilla</i>	Asteraceae	300–2500	Cosmetic, herbal tea and aromatherapy
Sylibum	<i>Silybum marianum</i>	Asteraceae	300–1200	Liver tonic
Stevia	<i>Stevia rebaudiana</i>	Asteraceae	300–2500	Calorie free sweetener
Pippali	<i>Piper longum</i>	Piperaceae	300–1000	Cough, jaundice and as a spice
Brahmi	<i>Centella asiatica Bacopamoni</i>	Apiaceae Scrophulariaceae	300–2000	Brain tonic and antioxidant
Ammimajus	<i>Ammimajus</i>	Asteraceae	300–1200	Leucoderma
Tilpushpi	<i>Digitalis lanata</i>	Acanthaceae	300–2500	As heart stimulant
Tejpat	<i>Cinnamomum tamala</i>	Lauraceae	300–2200	Diabetes and spice
Chyura	<i>Madhuca butyratea</i>	Sapotaceae	300–1500	Herbal Ghee and cosmetic

of selected species. Since many farmers are already doing the cultivation, such skilled people need to be to train other farmers in same village or vicinity. There are also a few issues of concern for the State (Kuniyal et al. 2013, 2014, 2015, Negi et al., 2011, 2018). Since there are many agencies working in this sector there is a need of proper synergy among them. Also, a single window system for cultivators and nursery growers for registration, procuring permit, marketing and value addition is also highly desirable. The cultivation, post-harvest management, product development, and value addition need to be done as per approved international protocols. Plantation of medicinal plant species in Van Panchayat areas can increase the bulk of production that is essential for creating a niche based market. There is also a need of community facilitation centre in MPCA sites to promote conservation of MAPs. Since National Medicinal Plant Board (NMPB) is the nodal body of development of MAP sector the benefit of such schemes should be taken up on a larger scale. As such the MAP sector has significant potential that can create a large number of jobs and employment opportunities (Sundriyal 2005, Kala 2015).

3.3 Bamboo & Ringal Resources

Bamboo(Family *Gramineae/Poaceae*, sub-family *Bambusoideae*, tribe *Bambuseae*) is a tall perennial grass of tropical and sub-tropical region. It plays important role socially, economically, and ecologically in rural areas (Upreti T. C. & Sundriyal 2000, Sundriyal et al. 2002). Bamboo forms not only as an importation material for livelihood of rural communities but also as an important middle storey forest crop that has greater role in maintaining forest structure and wildlife. Other than supporting a large section of society many wild animals are dependent on bamboo for its fodder and habitats. It is considered a primary succession species that helps in conservation of the forest stand. Bamboo absorbs huge quantity of CO₂ in photosynthesis thus lead to quick carbon sequestration. Globally there are 1250 species of bamboo, whereas in India 136 species in 36 genera are found. Uttarakhand state has just 8 bamboo species (Table 5) (Sundriyal & Sundriyal 2011). Bamboo flowers once in life time that varies from 7 to 120 years.

In Uttarakhand the bamboo is found abundantly growing in low-hill forests (<900 m) that are under the control of Forest department. At mid (900–1800 m) and high-hills (1800–2800 m) bamboo grow in Van panchayat as well as in individual farmer's lands. Bamboo artisans (*Barurees*) and ringal artisans (*Rudias*) are solely dependent on bamboo trade for livelihood. These

Table 5 Major bamboo and ringal species growing naturally in Uttarakhand state, India

Species	Local Name	Distribution (m msl)	Habitat	Uses
Bamboo:				
<i>Dendrocalamus strictus</i>	Lathi bans	325–1000	Low-hill moist forests (Siwalik) – Lansdowne forest Division	For making bamboo articles and extensively raw material is used in paper industry
<i>Bambusa bambos</i>	Choya bans	500–1000	Sub-Himalayan tracts	For household articles
<i>Dendrocalamus somevae</i>	Khokhal bans	600–1500	Mid-hills, homesteads and on common land	For making baskets and other house hold articles
<i>Dendrocalamus patellaris</i>		1200–1500	mid hills	basketry work
Ringal-bamboo:				
<i>Drepanostachyum falcatum</i>	Ghadringal	1500–2100	Found as dense or moderately dense undergrowth in evergreen forests of oak, deodar, chir and rhododendron species	For making baskets, fishing rods, mats and animal fodder in lean period
<i>Chimonobambusa ajansarensis</i>	Jumraringal	2100–2700	Grow naturally in clusters inside the forest	For a few agricultural implements
<i>Thamnocalamus falconeri</i>	Devringal	1900–2750	Grow naturally on the hills and/or under oak forests	For making fans, umbrellas, crowns, baskets, trays for offerings to gods, and other household items
<i>Thamnocalamus spathiflorus</i>	Thaamringal	2500–3500	On moist and shady slopes within and outside forest areas	Agricultural implements and pipes for Hookahs

communities come from the backward section of the society. They make large variety of local utility items that are procured by villagers to that are used to carry out day-to-day works. The items comprised big basket (*tokri*), winnowing tray (*supa*), small basket (*dalia*-small), handle basket (*kandi*), round basket (*chapri*), food grain storage basket (*topra*), round basket for sleeping small baby (*choura/jhuger*), carrying baskets (*doka* and *solta*), floor mat (*mosteo*, *bishal*), and hat. Many villages at mid and high hills have such artisans. Unfortunately they have very poor socio-economic status (Sundriyal & Joshi 2015). In recent years artisans are also facing problem of raw material availability. They (artisans) lack plantation and propagation skills of bamboo. The village communities do not promote bamboo plantation due to superstition/myths. Contrarily, the low hills of Uttarakhand state still comprises of bamboo, which is under the control of Forest Department. Such bamboo is auctioned annually through depots, thus rarely available to artisans. There is a challenge to conserve wild and farm grown bamboo stalk. Most products carry domestic use value only, which is low profit earning opportunity.

The State government has set up Uttarakhand Bamboo and Fiber Development Board (UBFDB) since 2003 that has been the nodal agency for undertaking bamboo & natural fiber based development in the State of Uttarakhand. It has taken various R&D projects to promote this sector in the state. UBFDB has been promoting the growth and sustainable management of bamboo. It has taken up community plantation in Van Panchayats, watersheds and agro forestry systems. The department has also taken up training programmes related to bamboo processing, designing, hardening, and market oriented product development so as to increase trade in domestic and export markets. It has also taken up demonstration work on bamboo-housing and furniture making.

Despite of all these efforts still a significant work is to be done to shape the bamboo-based development in the state. Unfortunately the status of bamboo resource has been declining sharply over the year that is affecting resource as well as the artisans. This desires immediate attention for large scale plantation and resource management along with an effective bamboo value chain development for better income to artisans. Also, there is need to address awareness for bamboo conservation and augment stakeholders' role for this. It will help to plan and develop bamboo trade value chain for upgrading socio-economic status of marginalized artisans, and to establish bamboo-artisans cooperatives for advocacy of artisans cause. It will also strengthen local institutions for bamboo plantation to spearhead environmental conservation, and cultivate sense of ownership and integration among bamboo stakeholders. The

dwindling status of bamboo has also attracted forest department's attention. Therefore in many forest areas bamboo plantations is being promoted. An effective conservation planning, ecological and social consideration based on local socio-cultural-ecological setups may strengthen bamboo development in the state. Also, there is a need to establish a Common Facility Centre on bamboo in various districts to address this issue along with capacity building of local communities in that. A diversification of livelihood based on bamboo resources will not only lead to provide good income opportunities to local communities but also lead them to cope up with dynamic change process that is being observed all over. Moreover it is expected that appropriate efforts for value addition and income generation from bamboo will also lead to conserve this resource sustainably.

4 Mainstreaming NTFPs Development in the State

There are many challenges for development of NTFPs sector in the state. There is continuous pressure on most NTFPs in view of indiscriminate collection and forest degradation. Besides, there is a complete lack of organized collection, market and economic benefits to primary collectors and producers. Tenure rights of community along with different conservation status of species also bring many certification challenges and traceability problems. For many species there is a paucity of harvesting and cultivation protocols. Moreover, there are scattered producers and lack of standard quality of produce that hampers worth of produce. There are also risks of user's conflicts. Most of the available information is not updated with the time. The state has to overcome such situations. Mainstreaming of NTFPS development in the state policy makers, development and conservation professionals and local communities needs to give importance of this sector.

5 Conclusion

The linkages between NTFPs and poverty reduction are needed to be explored properly. Many NTFPs are potential food material that is rich in proteins and micronutrients promotion of such species will help in increasing food security as well as climate-resilient ability of communities. Many plants have therapeutic characteristics that can be developed for new drugs and medicines. There is a need for good cultivation and collection practices for select species. Medicinal plant sector also deserves following international

standards. Also, bamboo sector needs proper strategy for development. If local tradition of using NTFPs and its conservation is properly rejuvenated it can bring rewarding economic opportunities for local people by cultivation, value addition, product development, and marketing.

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Biography



Manju Sundriyal, M.Sc, Ph.D. (Botany), is a senior scientist in Uttarakhand Science Education and Research Centre (USERC) and specializes in Ethnobotany and Rural livelihoods. She has extensively worked on wild edible plants and bamboos in the eastern and western Himalayan region. She has been conferred Young Scientist and Women Scientist Scholarships by Department of Science and Technology, Govt. of India and is also recipient of Senior Research Associateship (Pool Scientist) of CSIR, Govt. of India.

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To her credit she has many research papers published in national and international journals. At present she is focusing on projects on rural livelihoods, empowerment of rural communities particularly rural women through training and capacity building. Her goal is to promote local resource based sustainable livelihood development for the Himalayan communities.

