PERGAMON

Natural Resources Forum 23 (1999) 65–77

Natural Resources
FORUM

Utility of non-timber forest products in a small watershed in the Indian Himalayas: the threat of its degradation

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Abstract

This study discusses the use of non-timber forest products (NTFP), especially medicinal plants, by traditional communities in the western Himalaya, India. The great socio-cultural diversity and ecological complexity of the region is also matched by an unusually large variety of forest species being used. A wide range of plants, comprising herbs, shrubs and trees are used for different domestic purposes, such as food, fodder, materials for construction and handicrafts. Wild plants also play a vital role in providing primary health care in the region. In earlier times, forest products were harvested only on a subsistence basis. However, in recent decades, factors such as rising market demand, increasing population pressure, and changes in socio-cultural and socio-economic values have led to overharvesting. It is now estimated that most of the useful wild herbs in the region are overexploited and some of them have become locally extinct. Government forestry policies have, in the past, exclusively emphasized plantation and management of trees and have, unfortunately, ignored non-timber products, as these are usually of comparatively lesser economic importance. However, it is suggested that proper management of NTFP will help upgrade rural economies. Recommended policies to this effect include empowerment of local communities and their involvement in development plans as well as strengthening of indigenous knowledge. To foster sustainable use of NTFP, the following steps are also suggested: integrating traditional and scientific knowledge; safeguarding regeneration potential; cultivating wild species, making appropriate changes to extraction processes used; and establishing more transparency in prices and marketing channels.

Keywords: NTFP; Western Himalaya; Commercialization

Introduction

Indigenous people of the western Himalayas, as elsewhere, utilize a wide range of wild forest products for their daily needs. Utilization of non-timber forest products (NTFP) has supported the rural economy and preserved biodiversity for generations. A combination of the socio-cultural and ecological characteristics of the region have led to the development of a variety of specific typical uses of NTFP by the local indigenous people (Gangwar and Ramakrishnan, 1990; Rao and Saxena, 1996; Singh et al., 1996). The use of NTFPs has evolved since time immemorial through a system of trial and error. Historically, the primary objective of resource use was to secure survival rather than economic gain. Indigenous people have traditionally maintained a symbiotic relationship with NTFPs, using the barter system to exchange medicinal plants and other forest products for other essential commodities. However, rising population pressure and commercial exploitation have, in recent decades, led to over-exploitation of certain habitats and species. This study explores the status of NTFP, especially as used in traditional primary health care, in the Chhakinal watershed in the western Himalayas.

Terminology

NTFP is broadly defined here to include fuelwood, fodder, biomass, bamboo, grasses, fibre, oil, tannins and dyes, gums, resins, medicinal plants, barks, leaves, flowers, fruits, tubers, mushrooms, seeds, honey, wild edibles, mammals, birds, insects and reptiles, etc. The term clearly indicates that these products have not, in the past, been thought to be of any economic importance to merit serious consideration. Only recently has the economic importance of non-timber forest resources been acknowledged, especially to local subsistence economies. It has also recently been realized that all forest-based resources spring from a complex ecosystem of interrelated phenomena, including landscape, geography, climate, and edaphic, environmental, and ecological factors. The term degradation is used here as

0165-0203/99/$19.00
PII: S0165-0203(98)00039-7

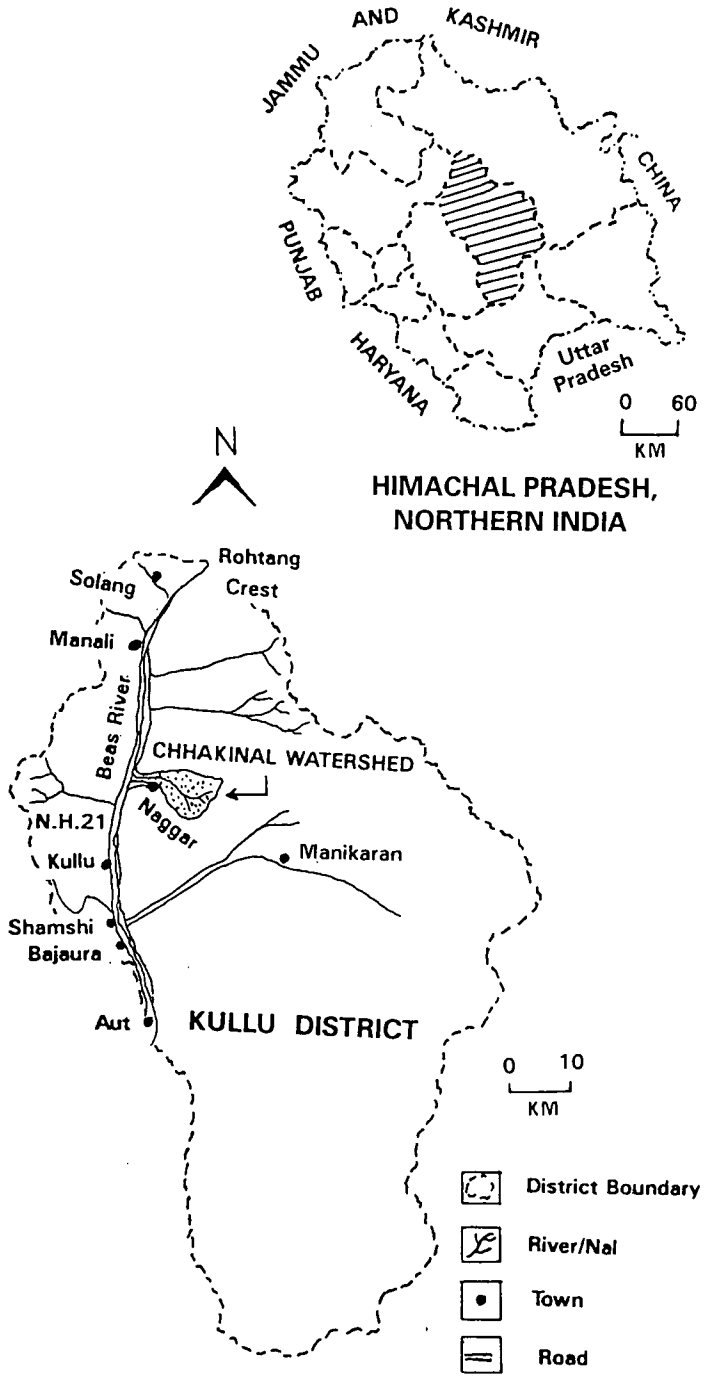

Fig. 1. Location map of Kullu District, Himachal Pradesh, northen India.

the qualitative and quantitative loss of renewable forest resources.

Note on methodology

Data for this study were collected during three consecutive years, 1993 to 1996. Medicinal properties of plants were learned through interviews with heads of families. Men and women were interviewed separately. In order to ensure the accuracy of the information, individual statements were double checked with other members of the community. A number of formal and informal group discussions were also conducted during the period of investigation. Factors responsible for the degradation of the NTFP were analyzed and documented with the help of villagers and through direct observation. Detailed information was collected pertaining to indigenous skills and tools pertaining to the use of wild plants in traditional primary health care and for other purposes. Archival information on NTFP was obtained from the Himachal Pradesh Forest

Table 1
Summary of salient features of the study area

Attributes	
Geo-climatic features	
Geographical setup	32°3′–32°7′N & 77°9′–77°15′E
Geographical area (ha)	4500
Number of villages	10
Number of households	322
Population	2340
Elevation gradient (m asml)	1500–4500
Average annual rainfall (mm)	1200
Monthly mean temperature (°C)	− 1.6–25.4
Annual snowfall (m)	3–5
Land use types (ha)	
Forest area	1936
Alpine pastures	1172
Open grazing and scrub lands	722
Agriculture and settlements	670
Cultivable lands	272
Terrace land	213
Valley land	59
Agriculture and animal husbandry	
Number of cultivated crops	17
Livestock population	2184
Buffalo and cattle	1076
Sheep and goats	1108

Department. A field survey of the study area was also undertaken. Plant specimens were collected during their flowering and fruiting season and identified by appropriately qualified experts. A topographical map obtained from the Survey of India (scale of 1: 50,000) was used to calculate the acreage of areas allotted to different types of land use.

Study area

The study area is a small area in the north-western part of the Himalayan range. The Himalayas are vast, extending from Afghanistan and Central Asia in the west and north to western China and northern Burma in the east, forming an almost unbroken mountain chain. In India, it extends about 2500 km in length and 250 km in width covering an area of about 590,000 km^2; the population of the Himalayan region is approximately 51 million people. Its major portion lies within India between the rivers Indus and Brahmaputra. The Himalayas are characterized by great ecological diversity and landscape variability. Although the region corresponds to only 18% of the geographical area of India, it is home to more than 50% of the country's forest cover and some 40% of the species endemic to the Indian subcontinent.

The study area comprises what is popularly known as the Chhakinal watershed. It is located in the north-western part of Kullu district in central Himachal Pradesh, India (see Fig. 1). Salient statistics of the study area are summarized in Table 1. Although a small area, the Chhakinal watershed displays great variety of socio-economic conditions; levels of accessibility; climate; geographic characteristics such as altitude and land-use; and village and population size. The study area that is popularly known as the Chhakinal watershed has altitudes varying between 1500 m up to well over 4500 m amsl. The sparse population of some 2,340 is concentrated between elevations 1500 m and 2200 m amsl, and dispersed among 10 villages or hamlets, all within a radius of 3–5 km of each other. Six hamlets are located on south-facing slopes, three on north-facing slopes and one at the base of the watershed facing west. All villages in the watershed lack access to motorable roads, except one village at a lower elevation. During the rainy season, roads are frequently blocked as a result of landslides.

The study area has three main seasons: summer, monsoon and winter. The climate is generally cool and dry. Snowfall occurs during the period from December to February and rain falls mainly during July/August and December/January. Out of a total annual precipitation of 1200 mm, 41% occurs during the rainy season (July–November), 47% in winter (December–February), and 12% in the summer months.

Vegetation

About 27 km^2 of the study area is covered by forest, and 12 km^2 is covered by alpine pasture. Trees in the study area include semi-evergreen, evergreen and deciduous species, varying from subtropical types at lower elevations to temperate and alpine types at higher elevations. Based on the dominance of extant species, namely *Pinus wallichiana*, *Cedrus deodara*, *Abies pindrow*, *Aesculus indica*, *Quercus semecarpifolia*, *Betula utilis*, broadly seven vegetation and landscape types were recorded, including closed canopy forests, scrub, open grazing land, alpine meadows, waste lands and agricultural fields. The forest can be generally divided into three zones. Coniferous species occur at lower elevations (1600 m–2300 m) while broad leaf bearing trees are usually found at higher elevations (2300 m–3200 m), although some species are common at both elevations. Coverage in the alpine zone is sparse, consisting of a few species of small shrubs and low trees. The alpine pastures are ecologically conditioned to host a large variety of traditional medicinal herbs, which dominate the area.

Abundance and use of medicinal plants

In Himachal Pradesh alone, around 3300 herb species have been recorded. Of these, 150 species are generally credited with medicinal properties, out of which about 100 are of confirmed medical value. About 40 plant derived medicines are regularly produced in the state (Anonymous, 1993).

Out of the total number of plant species constituting the NTFP resource base in the study area, 55% are used for medicinal purposes, while 16% are used as fodder, fuelwood and leaf litter; the litter is used for animal bedding and organic manure preparation. Of the 134 plant species in

the Chhakinal watershed that are being used for various purposes, 115 are wild and 19 are cultivated (mainly food items). A total of 73 plant species are being used for their medicinal properties (Singh, 1998b). All these plants grow sparsely in agricultural fields, forest areas and alpine pastures. Ten species commonly found close to settlements and farm fields are used as fuel and fodder. Prominent species include *Quercus dilatata*, *Q. incana*, species of *Pyrus* and *Prunus*, and *Ulmus wallichiana*. Coniferous species such as *Abies pindrow*, *Cedrus deodara*, *Picea morinda*, *Pinus wallichiana* and *Taxus baccata* are concentrated just above the settlements and are also widely used as animal bedding and fuel. The litter of these species mixed with livestock dung is used as organic manure for indigenous farming. Fibrous plants such as *Cannabis sativa*, *Girardiana heterophylla* and *Urtica parviflora* are used to make domestic items such as ropes, mats and traditional footwear. Traditionally, the leaves of *Rhododendron anthopogon*, *Saussurea lappa* and *Taxus baccata* were used to make tea but such usage has declined progressively because of the introduction of commercial tea. The powder extracted from the rhizomes of *Dioscorea deltoidea* and *Salvia moorcroftiana* is used by indigenous people as a laundry detergent. Seven species of plants are used as incense in religious ceremonies. Of these, *Juniperous communis* and *Jurinea macrocephala* are marketed on a large scale.

Traditional village management of NTFP

The villages located nearest to forest resources are usually more intimately linked with forest-based products. Traditional utilization of NTFP subsidizes the local economy and decreases local people's dependence on market-based commodities. The collection of NTFP, particularly medicinal plants, is undertaken by the local people under the *bartandhari* or right-holder system. This system permits villagers to collect plants required for their daily needs, for sale, or to exchange for other essential commodities. Within a village, NTFPs are not sold or purchased within families of the same social group. Village tradition favours the production and marketing of NTFP by members of scheduled castes[1] having smaller and more marginal lands compared to more important landowners of higher caste groups[2]. Bamboo articles, such as baskets and fibre products for personal use may be handicrafted by people of all classes, but marketing and selling is undertaken only by people from lower castes, who often also supply distant villages and urban markets.

A number of village level institutions called village committees, or *panchayats*, have been effectively operating in the area during recent years for the better management of NTFP (Singh *et al.*, 1996). Socially harmonious use and management of NTFPs were not the only objectives of traditional institutions. They also serve to maintain the ecological diversity of the area. Indeed, the collective culture of community survival has helped to protect forest resources from overexploitation. Also, worship of local nature deities has led to the creation of sacred groves, which has protected biodiversity in the area. Sustainability has also been furthered by the geographic characteristics of the region, such as inaccessibility, rough terrain, environmental uncertainty and precariousness of agriculture. These are reinforced by local institutions, social control mechanisms, customs and mores concerning access and property rights to extraction, which have served as unintended but sophisticated conservation strategies.

Simple systems for obtaining maximum harvests are being practiced in the villages. Branches and leaves of tree species such as *Quercus dilatata*, *Q. incana* and *Ulmus wallichiana* are lopped in alternate years. Grasses are fully harvested from traditionally divided area. Once drying is completed, NTFP or fodder products are stored in houses or other shaded places. Leaf litter of *Pinus wallichiana*, *Abies pindrow*, *Cedrus deodara* and *Picea morinda* is collected from traditionally divided forest areas. There is, however, a strong need to introduce alternate systems of grazing in the area. Allowing cattle to graze freely should be generally avoided in order to achieve maximum fodder production from the open uncultivable land and abandoned fields.

Gathering

The tradition of communal excursions to gather NTFP is considered to be a mechanism for minimizing the chances of unequal sharing, overexploitation, and also for providing security from wildlife, uncertain weather conditions and loneliness. Sometimes people take their livestock with them on collecting excursions. Shepherds may engage in collecting NTFPs while rearing and grazing their livestock in the alpine region. Traditionally, the collection of NTFPs was assigned to women and children, who engaged in this activity during their free time, and gathered forest produce with the sole objective of meeting their day-to-day needs. Women and children usually collect herbs that are found close to settlements and low-lying forest, like *Dioscorea deltoidea* and *Morchella esculenta*; also during their spare time while grazing cattle during the months from April through June and while collecting other useful NTFP, such as fodder and fuelwood. However, medicinal herbs are collected in all seasons, and by people from all categories and economic groups.

Species found at higher altitudes and alpine regions are usually collected by men. Parties are organized of 5–15 men, carrying food and supplies on their heads or on horses.

[1] Scheduled castes are granted special rights and privileges for their sustenance. Scheduled castes are mainly untouchables (*harijans*), who constitute an important component of the scheduled castes, as do also the tribals. Untouchables also include those who perform lowly menial tasks, e.g. cobblers and undertakers.

[2] Average land holding per family in the study area is 0.84 ha (Singh et al., 1997b).

Table 2
Forest resources (NTFP) used in the study area

Use category	No. of plant species
Medicinal plants	
Stomach problems	32
Boils, cuts and wounds	13
Pain killers	10
Gum and tooth diseases	5
Colds and cough	6
Eye disorders	6
Fever	5
Diuretics	5
Child birth	2
Cancer treatment	1
Plants used for food	
Spices and condiments	10
Mushrooms, roots and vegetables	12
Fruits	25
Household uses	
Dye materials	4
Fibre yielding plants	3
Bamboo species	1
Incense	7
Tea	3
Soap	2
Poisons	2
Fuelwood	21
Animal fodder	14
Animal bedding	7

The group will live together in tents or temporarily constructed sheds for a period of 15–20 days. However, high market value species such as *Picrorrhiza kurrooa*, *Jurinea macrocephala* and *Rheum australe*, exclusively confined to high altitudes, are also collected by women. Increasing commercialization has undoubtedly accelerated the involvement of women and children in the collection of highly marketable species of medicinal plants.

Preparation of medicinal plants

Medicinal plants have been collected in the study area for generations. Traditional medicine is inexpensive and locally available. It also enjoys wider social acceptance than western medicine and sometimes meets psychological needs better. Local knowledge about the NTFPs in these traditional villages has existed at the level of essential needs of a subsistence economy.

Medicinal plants grow in a range of habitats. The majority of medicinal herbs of the region have very short life spans; if not tapped at the appropriate point in time, herbs will die and decay naturally, and thus be wasted. All parts of plants are collected: leaves, shoots, rhizomes, roots, flowers, seeds, inflorescences and whole plants. Leaves, stems, flowers, fruits, seeds, barks, roots and rhizomes are used for different ailments mostly prepared as powder, paste, juice, decoction or infusion. Sometimes fresh or dried plant parts are taken orally. Out of 73 plants of traditional medicinal value, about 32 plants are used to cure digestive problems. Thirteen plants are used to cure boils, ten plants are used as analgesics, five for dental and gum-related problems, five for fever and diuretic problems, and one for curing cancer (Table 2). Some plants like *Acorus calamus*, *Ainsliaea aptera*, *Berberis aristata*, *Jurinea macrocephala*, *Oxalis corniculata*, *Plantago major*, *Rheum emodi*, *Thalictrum javanicum* and *Viola odorata* are used to treat a variety of ailments. If a patient does not recover from an ailment during a specific period of time, a different remedy is tried.

Skills

Local village people engaged in collecting herbs may not be technically skilled in extraction, but they are extremely skillful in the identification, collection, processing, grading, trading and use of NTFP. Older generations of people were even more skilled than the younger generations.

Tools and techniques

The method of collection involves the uprooting of useful plants using a locally designed sharp-edged trowel although people can also often be seen uprooting plants by hand. There is a strong need for the introduction of appropriately designed technology and tools for extraction, although people have over the generations developed a variety of extraction practices through trial and error. For example, in the case of *Acorus calamus*, *Dioscorea deltoidea*, *Rheum australe*, *Selinum tenuifolium*, *Valeriana jatamansii*, *Jurinea macrocephala*, *Podophyllum hexandrum* and *Nardostachys grandiflora*, fine roots, leaf scars and soil particles are removed from main roots and rhizomes. Then, rhizomes are sliced into small pieces and dried in the sun or in open air for about a week. If the weather is not clear, the plant is dried with the help of smoke in thatches either in the forests or at home. Not all plants are dried in direct sunlight. For instance, drying the roots of *Aconitum heterophyllum* in direct sunlight would lead to the evaporation of its active ingredients. The root bark of *Juglans regia* is peeled off and immediately folded in small pieces of about 10 cm in length and dried in the sun. Flowers of *Viola odorata* are collected while in the case of *Morchella esculenta*, whole fruiting bodies are uprooted. Chains of *Morchella esculenta* are prepared with the help of needle and thread and hung above the kitchen roof just above the locally designed oven for a period of 10–15 days. This method protects the plant's active ingredients from deterioration.

Drug preparation techniques are very simple. Powders and pastes are prepared with the help of traditionally designed flat stones and pestles. Small pieces of cloth are used to extract juices. Fibre extraction processes are also archaic. Dried plants are tied in small bundles, and

submerged in water till the bark decomposes in about 30–40 days. Once the bark has decomposed, the bundle is taken out, beaten on stone and cleaned with water. The woody portion is removed manually after drying leaving a dull coloured fibre. It is desirable to make available a more efficient process to the indigenous people to accelerate the decomposition process, reduce time and water consumption, and produce optimal quality fibre. The fibre is used for the preparation of handicrafts and also as fuel.

Forest policy — a long journey

The history of forest management in Himachal Pradesh can be divided into three phases: the era of princely states, the British era, and the post-Independence era.

Era of princely states

The modern state of Himachal Pradesh was formed after Independence by the integration of some 30 princely states. Not much is known about forest conservation policy prior to the initiation of regular forest management by the British. It is possible that forests were not demarcated for preservation because of their abundance.

Colonial era

In 1850, the British colonial rulers that replaced the princely states identified the need for forest conservation in the area. New legislation in 1859 forbade the felling of trees without the prior permission of the Deputy Commissioner. However, for commercially inferior trees, the permission of the village headman was deemed sufficient. Ancient rights, such as grazing of cattle and the collection of dry wood and leaves, were allowed to continue, although one third of each forest area was required to be closed entirely for three years on a rotating basis. In 1864, the Forest Department was established and the following year the first Indian Forest Act (1865) was passed. However, these developments at the political level did not affect existing rights of individuals and communities. Permanent demarcation of forests in the area that is now Himachal Pradesh commenced in the year 1884 and has continued to be one of the pressing needs facing the area. Even today, most forest areas are not properly demarcated, resulting in illegal felling, encroachment, quarrying, mining, and a host of additional problems threatening the sustainable use of forest resources.

In 1894, the first Forest Policy was enunciated and later became the basis of forest management and working plans in India. In 1902, proper silvicultural systems for selective felling were introduced in the working plans; working plans prepared in previous years had prescribed clear cutting of forests. By the year 1935, most of the forests that had been declared as reserved, were brought under working plans.

Post-Independence era

A new National Forest Policy was enunciated in 1952, building on and enlarging the first forest policy of 1894. It prescribed the maintenance of forest cover over 66% of the total area of the hilly states. This policy has helped in formulating management plans for the state forests. Subsequently, in 1980, a State Forest Policy for Himachal Pradesh was enunciated under the ambit of the National Forest Policy to meet the specific requirements of the state. The National Forest policy was revised in 1988 to emphasize environmental stability and maintenance of ecological balance, among other related objectives.

National parks

In 1972, a unified National Act came into being under which areas could be constituted and managed as national parks, sanctuaries, game reserves and closed areas. This resulted in the establishment of 30 wildlife sanctuaries, two national parks and three game reserves in Himachal Pradesh, covering an area of about 5940 km^2 to preserve its unique natural heritage. This encompasses more than 8% of the total area of the state (Anonymous, 1993). There has been a complete ban on hunting in the state since 1983, and all tree felling has been stopped in national parks and sanctuaries.

Sustainable management of NTFP

Despite the existence of much legislation based on management and endowment, not a single policy was implemented for the better management of NTFP. Most legislation emphasizes revenue generation rather than resource management. Integrated policy should be framed assigning management responsibilities to local institutions, and community based resource management systems. A variety of property rights and land tenure arrangements that reinforce the positive effects of sustainable and fiscal policies should be formulated. These measures could safeguard traditional NTFP, resource management policies and practices, and could focus the attention of the local community on the value of indigenous knowledge and experience.

Legal status of forest lands

In principle, all lands and forests in the study area belonged to the ruler, but the rights of the people to use the NTFP for domestic or agricultural purposes were never denied. However, after the annexation of the area by the British, there was a reorganization in management of the forest areas. The British recognized the traditional right of the local people to collect and use NTFP from the forested areas. Forest land was brought under state ownership through the Government Forest Act of 1865 which was later replaced by the Indian Forest Act of 1878. These Acts

Table 3
Royalty fee (Rs per 100 Kg) charged by the village *panchayat* and Forest Department

Botanical name	Local name	Village *Panchayat* since 1964	Forest Department since 1993
Abies webbiana	Ialis patra	—	85
Aconitum chesmanthus	Patish, atish	750	7500
Aconitum heterophyllum	Patis (mithi)	—	1500
Aconitum violaceum	Mitha tejla	—	500
Acorus calamus	Buch	—	130
Adiantum lanalatum	Dusgtuli	—	80
Ainsliaea aptera	Sathjalori	15	50
Angelica glauca	Chora	26	125
Artemisia bravifolia	Seski	27	50
Atropa accuminata	Jharka	70	60
Banium paralcum	Kalazira	—	2000
Berberis lycium, B. aristata	Pasaunt, kashambal	—	500
B. assiatics, B. vulgaris			
Dioscorea deltoidea	Singli-mingli	4	900
Ephedra spp.	Dutohur, ephederina	—	50
Girardiana heterophylla	Bichhu buti	—	150
Hedychium acuminatum	Kapper kachri	—	70
Heracleum spp.	Patishan	—	25
Hyoscyamus niger	Kharasani, ajwain	—	150
Jurinia macrocephala	Dhoop	52	500
Lichens	Chalora	—	225
Morchella esculenta	Guchhi	—	10,000
Nardostachys jatamansi	Jatamanshi, balchora	—	690
Orchis latifolia	Salam punja	—	6000
Picrorrhiza kurreoa	Karoo	52	540
Pinus wallichiana	Kail	—	1000
Pistacia integerrima	Kakarsinghi	—	1000
Podophyllum hexandrum	Bankakri	40	450
Polygonatum verticillatum	Salam mishri	—	1000
Potentilla nepalensis	Dori	—	40
Rheum emodi	Rewandchini	38	110
Rhododendron campanulatum	Kashmiri patta	—	150
Salvia moorcroftiana	Thuth	—	180
Saussurea lappa	Kuth	—	300
Selinium vaginatum	Dutkash	—	400
Swevtia chirata	Chiryata	—	700
Taxus baccata	Dirmi, rakhal	—	600
Thalictrum spp.	Mamiri	38	335
Thymus serphyllum	Banjawain	25	100
Tinospora cordifolia	Gloe	—	100
Valeriana hardwickii	Nihani	—	300
Valeriana wallichii	Mushakbala	6	590
Viola odora	Banfsha	200	2250

are the basis of the current legal classification that identifies four classes within forests. These are as follows: 1. Reserve forest (RF) - area of minimal use and rights for the local people for which there is a revenue record; 2. First Class Protected Forest (FCPF) – with more local use rights, but limited to less commercially valuable parts of the forest; 3. Second Class Protected Forest (SCPF); and 4. Waste Forest. In general, land use rights in FCPF areas are more specific while those of SCPF support more general village rights. The rules regarding the use of SCPF areas are not clear. There is a disagreement regarding their use right status even among various government departments. Village land-holder rights were defined by Anderson (1886) and form the basis of current user rights in protected forest lands. These include grazing rights, timber for house construction, fodder for bedding collection, wood for fuel and tool-making, and NTFPs such as medicinal herbs.

Information on the legal aspects of NTFP uses is based primarily on people's perceptions and what is locally understood as a right to herb collection. All the herb collectors encountered during the course of the study identified themselves as right-holders. There is an urgent need to develop and design strategies for revising the land-holder rights, in order to resolve the conflicts and confusion among villagers with the objectives of protecting resources for local people, upgrading village economy, and implementing a sound ecological resource management system.

Table 4
Evidence of the overexploitation of NTFP or medicinal plants in the study area

Attributes	% Response
1. Increase in time and labour needed to collect medicinal plants	96
2. Greater distances to travel to gather medicinal plants	78
3. Problems in finding certain medicinal plants	70
4. Larger numbers of persons per family needed to collect medicinal plants	86
5. Medicinal plants extracted before they are mature	82
6. Disappearance of certain species near settlements	94
7. Poor regeneration results, low availability	68
8. Reduction in yield (root material) of certain medicinal plants	72
9. Climate change responsible for reduced availability of medicinal plants	56
10. Over-exploitation linked to increased population pressure	90
11. Market demand linked to over-exploitation of certain kinds of medicinal plants	98
12. Unscientific methods of collection used	42
13. Reduced area available for litter collection caused by loss of forest cover	76
14. Reduced amounts of fodder available as fodder-trees lost due to agriculture expansion	94
15. More time and labour needed to collect fuelwood, fodder and litter caused by loss of nearby forest cover	70

The role of village *panchayat*-needs to be strengthened

The Forest Department itself has a minor involvement in the collection of medicinal plants and other NTFP resources. Prior to 1993, this department did not charge any royalty fee for the collection of medicinal plants, although a 1964 notification empowered the village *panchayat* to charge one when the collectors were agents or contractors and not villagers native to the area. The income generated from this scheme was to be used for village development. In 1978, the Forest Department issued export permits to those who sent the medicinal plant material elsewhere. Except for *Morchella esculenta*, locally known as *gucchi* and cones, a nominal fee of Rs 5 was charged per export permit irrespective of the quantity and type of the material being exported. In addition to the ordinary fee, a sum of Rs 150 was charged as forest revenue for the collection of 100 kg of *gucchi* and Rs 25 for the collection of 100 kg of cones.

In 1993, the Government of Himachal Pradesh issued a notification suggesting that export fees of forest produce be raised (Table 3). This was the first time that the Government had initiated the collection of royalty for a variety of important NTFPs. Before 1993, there were 14 plants for which export permits were issued. After 1993, the number increased to 42 plants of these 32 are found in the study area. This royalty will certainly increase the amount of revenue to the Forest Department substantially, but will have little relevance to the principles of sustainable resource exploitation or management of economic interests of the indigenous people directly involved in the collection of NTFP.

Increased market demand and substantial price increments for NTFP have inevitably increased extraction. *Panchayat* level policy needs to be strengthened to bridge the gap between sustainable utilization for basic needs and over extraction to fulfill market demand. Ideally, village level operating committees under the guidance of the village *panchayat* should police and control the exploitation of NTFP.

Marketing patterns — a challenge to evolve new options

Commercial markets for NTFPs or medicinal herbs opened at different points in time for different species. At the village level, there are no commercial outlets that sell medicines derived from local herbs. While the exchange of medicinal plants for domestic use is common among people in the area, the major commercial activity is related to the export of the produce outside the village boundaries. Prices at which herbs are sold to agents are almost never standardized; a high variability in prices may occur within very short distances. Village level agents sell the produce to wholesalers who operate in nearby towns and district headquarters. The produce is exported from these areas to other metropolitan cities after payment of export fees to the Forest Department. Species like *Juglans regia*, *Morchella esculenta* and *Picrorrhiza kurrooa* are marketed every year while *Dioscorea deltoidea*, *Jurinea macrocephala*, *Podophyllum emodi*, *Valeriana jatamansii*, *Aconitum heterophyllum*, *Rheum austale*, *Angelica glauca* and *Berberis aristata* are collected depending upon market demand. Commercial extraction of most plants began roughly 10 to 15 years ago. Because most local people lack knowledge of market channels, most of these valuable drugs are sold at very low prices to local contractors and traders who take the lion's share of the profits. An example is one kilogram of dried *Morchella esculenta* which costs Rs 1500–2000 in the village, while in the nearby towns in the same district a kilogram of the same costs Rs 3000–4000. Therefore, while villagers do most of the work, they retain the lesser share of the earnings; the opposite condition applies to agents and middlemen. As a result of these inequalities, it has become necessary to devise new strategies for strengthening the village level economy and marketing channels. A cooperative system that would make the role of the middleman redundant and retain substantial amounts of money in the villages, would be ideal. Government initiatives to this effect would go a long way to improve marketing facilities at the village level.

Commercial exploitation — evidence of overexploitation

No studies have yet been conducted to assess the impact of herb collection on the habitat. Limited studies of Joshi

and Edington (1990) in Nepal, Cunningham (1991) in South Africa and Farooquee and Saxena (1996) in India, indicate that increased marketing and commercialization, especially in response to demand from urban areas, are likely to lead to overexploitation of certain species. Gaston and Garson (1992) pointed out in their study in the Great Himalayan National Park in Kullu district of Himachal Pradesh that most of the medicinal herbs have been overexploited, as is obvious from the fact that they are becoming harder and harder to find. Some of the species collected earlier are no longer found and might even have become locally extinct. In the villages, medical practitioners harvest plant materials from local environments in ways that ensure sustainable supply. With the trends towards extensive and widespread use of NTFPs and medicinal plants, and the recent development of infrastructure and trade to urban markets, the question must be asked whether this leads to overexploitation. There appears to be mixed evidence as to whether medicinal plants are becoming scarce in the study area. A majority of herb collectors interviewed in the area believe that medicinal plant resources in the area are dwindling. Many traditional practitioners continue to believe that medicinal plants are God-given products of nature and will therefore have eternal supplies. However, some are less optimistic and feel that forest reserves have to be protected more stringently to ensure a supply of wild medicines for posterity.

Evidence related to the progressive decline in quantity and quality of NTFP and related medicinal plants was recorded from several villages in the study area (Table 4). One of the plausible explanations offered for the decline in availability and quality of herbs is early or premature extraction of plants immediately after the seedling stage. Natural regeneration is also hampered because of early extraction as plants are unable to mature to the flower and seed formation stage. Reckless extraction combined with lack of biological knowledge exacerbates the situation. Collectors have also mentioned that the size of underground plant materials like rhizomes and roots is declining because of frequent digging. As an example, it was described that the roots of four to five year-old *Jurinea macrocephala* were as thick as human forearms six to eight years ago. Today, the same roots are much more difficult to find and are apparently no thicker than thumbs! Rhizomes of plants like *Saussurea lappa*, *Picrorrhiza kurrooa*, *Jurinea macrocephala* and *Aconitum heterophyllum* are known to yield plentiful harvests when collected every two to three years. Increasing market demand has resulted in annual collection and compromised both yield size and quality. Frequent harvesting has been identified as a problem with several other species in the area.

The rapid depletion of NTFP appears to be a direct result of growing demand and overexploitation in several other species. *Taxus baccata* is a good example. This species has naturally poor regenerating ability. Traditionally, this species was used as a constituent of tea. In recent years, it was discovered that the species yielded an alkaloid that could be used in the treatment of cancer. The state government granted permission for commercial extraction in 1996. A majority of the people interviewed responded that local and less distant areas have almost lost the species as a result of reckless and rampant collection.

Local people have reported that commercialization has changed the collection strategy. Previously, individual families harvested plants for domestic use. Now two to four households group together to facilitate maximum collection. Further, the period of collection has increased to six or seven months (April to October) from the previous norm of three to four months (May to August). Some people feel that changes in climatic patterns such as low snowfall, irregular rainfall and increasing temperatures may be partially responsible for poor regeneration and scarcity of NTFPs. Previously, the collection of herbs in the alpine meadows was done together with livestock grazing. Nowadays, more effort is expended collecting herbs in the alpine areas than grazing because it is perceived to be more economically beneficial. Consequently, people now have to travel further, and are able to collect smaller quantities of herbs of a poorer quality compared to earlier times. The social consequences of overexploitation inevitably have an impact on the poor and the marginalized people of the community.

Locally bred food crops and agroforestry tree species that were of great value for fodder and fuelwood are being rapidly replaced by the incessantly growing agribusiness (Singh *et al.*, 1997a,b). Forest areas that have been taken over for agricultural use also pose a threat to the NTFP. Growing market demand for charcoal, especially during severe winters, is threatening to render species used for fodder and fuelwood locally extinct, e.g. *Quercus*.

The factors most responsible for overexploitation can be summed up as follows: slow growing species; poor regeneration and replicability; increasing agribusiness; conflicts over property rights; growing urban demands; increasing population pressure; geoclimatic factors; prevailing ecological and environmental conditions; fragile landscape; lack of scientific knowledge; poor policy for NTFP management; and the socio-economic circumstances of people.

Commercialization — unsustainable to hill people

Like other parts of the Himalayan region, the primary occupations of people in this area are animal husbandry, production of woolen garments and collection and trade of medicinal herbs and other NTFPs. Increased awareness of herbal medicine in the recent past combined with the growth of infrastructure tremendously increased the market value of medicinal plants in the area.

Commercialization of NTFPs has led to reckless and unsustainable extraction patterns. Earlier, extraction was done by skilled people who were well informed about the biology of the plant species they were extracting. Rising

Table 5
Ethnobotany of some of the commercially exploited medicinal herbs in the study area

Description (Botanical name, local name, family name)	Usage	Productive life of plant (years)
Achillea millefolium (L.) Chuna Fam. Compositae	Juice from crushed leaves used for gastric problems and toothache	5
Aconitum heterophyllum (Wall) Partish, atees, mithipatish Fam. Ranunculaceae	Root powder used to cure gastric diseases	10–12
Acorus calamus (L.) Banj, buch, bach Fam. Araceae	Powder made from rhizomes used to heal cuts and wounds and for dysentery and fever	5
Ainsliaea aptera (DC.) Suthjalari, sathjalori, karvi booti Fam. Compositae	Powder from roots used to heal cuts and wounds and for stomach ailments and as a diuretic	5–6
Angelica glauca (Edgew.) Chorah, budhchorah Fam. Umbelliferae	Powder from roots used for colds and stomach disorders	7–8
Atropa accuminata (Royle) Jharka Fam. Solanaceae	Powder from roots and leaves used as sedative and diuretic	8–10
Berberis aristata (DC.) Kashamal, Kashambal Fam. Berberidaceae	Root used for rheumatic, jaundice, diarrhea and skin diseases	6–7
Dactylorhiza hatagirea (D.Don) Hathpanja, hathjari, panja Fam. Orchidaceae	Paste made from tubers applied on cuts and wounds	10
Dioscorea deltoida (Wall) Singli, singli-mingli Fam. Dioscoreaceae	Powder from rhizomes used as soap	10
Heracleum canescens (Lindl.) Patishan Fam. Umbelliferae	Powder made from roots used for stomach ailments	8
Junglans regia (L.) Akhrot Fam. Juglandaceae	Twigs and bark used for gum and tooth diseases	20–25
Jurinea macrocephala (Royle) Dhoop, guggal Fam. Compositae	Powder from roots used to cure recurrent fever	10–15
Morchella esculenta (L.) Guchchhi Fam. Dioscomycetes	The fruiting body boiled with milk is used as a remedy for colds and cough	10–12
Nardostachys grandiflora (DC) (*N. Jatamansi* DC) Balchora, jatamansi Fam. Valerianaceae	Root used for stomach ailments	3–5
Physochlaina praealta (Dence) Bajarbhang, jangali bhang Fam. Solanaceae	Powder from seeds used as narcotic and for urine disorders	5–8
Picrorrhiza kurrooa (Royle ex Benth.) Karoo, Kodu Fam. Scrophulariaceae	Powder from roots used for jaundice and stomach disorders	20–25

Table 5 (*continued*)

Description (Botanical name, local name, family name)	Usage	Productive life of plant (years)
Podophyllum hexandrum (Royle) *Podophyllum emodi* (Wall) Bankakroo, bankakra Fam. Berberidaceae	Root powder used for stomach ailments	10
Polygonum amplexicaule (Don) Doriga Fam. Polygonaceae	Paste made from leaves used for boils and skin diseases	6–7
Rheum australe (Don) Chuchchi, rewandchini Fam. Polygonaceae	Roots and rhizomes used for gastric disorders, boils, headaches and muscular pain	5
Saussurea lappa (Clarke) Kunth, kuth Fam. Compositae	Root used to cure colds and cough	20–25
Selinum tenuifolium (Wall.) Mutoshal, benug Fam. Umbelliferae	Powder from roots mixed with mustard oil applied to swollen and painful joints	3–5
Valeriana jatamansii (Jones) Mushkbala Fam. Valerianacea	Root powder used for gastric disorders	5–6

market demands have favoured the overextraction of some species threatening to render them locally extinct.

The direct local use of plant resources contributes to the preservation of species and habitats and can be used as the basis for conservation policies geared toward indigenous management regimes and utilization. However, commercial extraction has threatened traditional conservation mechanisms. Frequent extraction has threatened the existence of several species. New on-farm activity in the form of commercial agriculture has already threatened the loss of crop biodiversity. Three traditional food crops have already disappeared from the area (Singh, 1998a; Singh and Ram, 1996; Singh *et al.*, 1996). Local collectors stated that species such as *Morchella esculenta, Dioscorea deltoidea Dactylorhiza hatagirea, Ainsliaea aptera, Juglans regia* and *Aconitum heterophyllum,* which were once locally available, are now very difficult to find. In fact *Saussurea lappa* is likely to disappear from the area.

The important western Himalayan wild medicinal plants that have become endangered (Pushpangadan, 1996) in recent years as a result of overexploitation and unscientific collection include *Aconitum ferox, A. heterophyllum, A. balfourii, Angelica glauca, Atropa acuminata, Colchicum luteum, Delphinium denundatum, Dioscorea deltoidea, Ephedra gerardiana, Heracleum canescens, Inula recemosa, Orchis latifolia, Juniperus communis, Paeonia emodi, Picrorrhiza kurrooa, Podophyllum hexandrum, Polygonum alpinum, Polygonatum verticillatum, P. graminifolium, Nardostachys grandiflora, Physochlaina praealta, Rhododendron hypenanthum, Skimmia laureola, Sorbus cuspidata, Swertia chirayita, Tanacetum longifolium, Typhonium diversifolium* and conifers like *Abies webbiana, Abies pindrow,* etc. Of the above, 10 species are found in the study area (Table 5). The table also shows the botanical description and uses of some of the commercially exploited medicinal plants.

NTFP conservation — sustainable development priorities

Sustainable development and conservation are two sides of the same coin. The term conservation here refers to both protection and sustainable use of NTFP in the area. Therefore, sustainable development in this context does not refer only to mobilizing a variety of integrated action-oriented land-use production systems and emphasizing indigenous land-use based crop production systems by incorporating appropriate technical know-how for capitalizing resources and upgrading livelihood in the area. It should also be extended to involve local institutions in participatory development management approaches through functional grassroots level institutional mechanisms and incorporation of appropriately designed technology for the better use and management of NTFP. Such an integrated holistic approach will serve to improve the economy of the rural people, satisfy human needs, provide equity and social justice, and maintain social, cultural and biological diversity as well as the ecological integrity of the system. Consideration of environmental and socio-economic aspects reveal that an alternative sustainable integrated management strategy is required for both land use and income generation.

Government programmes usually focus on the management of timber producing trees for economic, commercial

and industrial benefits. However, NTFPs have so far not been adequately managed even for these aspects. Some sporadic efforts have been made in the past by the forest agency to control herb collection. Extraction of *Dioscorea deltoidea* and *Taxus baccata* is allowed by the state government on a three to four year rotation basis. However, most gatherers have never even heard of such a system and have been collecting and marketing the herb every year. Increasing the export fee of some of the medicinal plants would not only be financially beneficial to the government but would also help the local people.

In principle, NTFPs can be harvested without damaging the forest ecosystem. The first step to achieving this is developing an intimacy between the forest ecosystem and the people who utilize its resources. Harvesting procedures, processing practices, storage techniques, increased value added and marketing channels need to be explored. Information related to various stages of the trade should be collected and made available to the villagers. Systems of regeneration, cultivation and domestication should be evolved. Wild medicinal plants like *Saussurea lappa*, *Inula racemosa* and *Carum carvi* were cultivated in Lahaul and Spiti districts in the early 1940s, making the state the largest grower of these important herbal drugs (Anonymous, 1993; Singh *et al.*, 1997a,b). As *Saussurea lappa* is found in and around the study area and is likely to become extinct, this plant should be cultivated in the area. Cultivation of medicinal plants has been recommended by several researchers (Zhou, 1993; Singh *et al.*, 1997a,b). In one study, Rao and Saxena (1994) studied the viability of medicinal plant cultivation with mixed cropping in the Central Himalayas. They had very positive results. Commercial scale plantations should be encouraged both within (in situ cultivation) and outside (ex situ cultivation) forested areas, as most of the medicinal plants and lichens are shade and moisture loving. NTFP plantations would be better suited to agroforestry systems on uncultivated private and government land and land that fulfils the basic objectives of genetic resource conservation, maintenance of biodiversity and improvement of the rural economy. Ex situ conservation should be linked with commercial cultivation. Indigenous knowledge will have to be complemented with affordable appropriate scientific knowledge to improve the livelihoods of local people. Mere planning and use of NTFP would not be conducive to both habitat and genetic resource conservation. Crucial actions needed include: conserving natural ecosystems (in situ conservation) as protected areas; and declaring biosphere reserves, national parks and sanctuaries using sacred groves as cultural relicts for managing and enhancing biodiversity (Khiewtam and Ramakrishnan, 1989; Ramakrishnan, 1992; Singh *et al.*, 1996). An integrated training programme for sustainable use of NTFP should be organized in collaboration with local users, managers and policy managers.

Summary and conclusions

The dependence of local communities on the use of NTFPs cannot be ignored and must be an important consideration in the development of programmes and policies (Singh and Singh, 1989; Moench, 1989; Ramakrishnan, 1992; Gadgil *et al.*, 1993; Davis and Wali, 1994; Singh *et al.*, 1996). Development of infrastructure in the form of roads and market facilities has led to rapid commercialization in an area earlier characterized by inaccessibility, marginality, fragility, climatic variability, landscape diversity and precarious environmental conditions. These facilities have accelerated the flow of NTFP or medicinal plants to the urban-industrial sectors, causing severe damage to the traditional subsistence societies and degrading natural forest resources. Local people are not aware of the potential monetary benefits of the NTFPs. The margin of profits for local people could be raised through education about dynamic market demand, commercial values of products and scope for local value addition to the products. It seems imperative that local knowledge be complemented by scientific knowledge in the cultivation of economically important NTFP species. This study suggests that the cultivation of medicinal herbs in uncultivated lands and abandoned fields of the study areas will help in conservation of potential traditional knowledge and forest wealth.

Broadly, three major threats to medicinal plants in particular were observed. They are: loss of habitat because of factors such as land conversion; agricultural expansion; and loss of natural vegetation cover. The overexploitation of some of the commercially viable species caused by increasing commercial demand for herbal medicines in urban areas pose the next threat. Overall gradual loss of the traditional primary health care system and indigenous knowledge is the third most prominent threat. The implementation and enforcement of harvesting restrictions, regulations and restraints are essential if ecological security is to be attained. Socio-economic circumstances, increase in population pressure and uncontrolled market demand culminate to give rise to unrestricted, unrestrained and unregulated use of NTFP. The same factors have contributed to the scarcity and impending extinction of some medicinal plants. Commercialization of medicinal herbs has introduced middlemen and contractors into an activity that was previously managed purely by local people. Extraction of NTFPs before maturation has contributed to poor regeneration in some species. Government policies and programmes combined with local institutions could lead the way for better management and use of NTFPs and also improve the rural economy. Ex situ cultivation of over-extracted NTFP resources should be started soon in uncultivated farms and waste forest land.

NTFPs play a significant role in supporting the local economy and traditional health care system in a large number of developing countries where a sizeable portion of the population depends on traditional medicine (Rao, 1981; Gangwar and Ramakrishnan, 1990; Medley, 1993;

Cunningham, 1991; Chhabra and Mahunnah, 1994; Manandhar, 1995). Farnsworth et al. (1985) have also reported that about 80% of the people in developing countries continue to use traditional folk medicines obtained from the natural world. The preservation of forests in tropical regions is complicated by the high levels of dependence of local people on land and forest resources (Dasmann, 1976; Olindo, 1989), but for the same reason is also essential for their future. Their knowledge of traditional plant use and resource management processes contributes significantly towards assessing the economic value of indigenous biotic resources and establishing effective strategies for conservation (Balick and Mendelsohn, 1992; Nicholson and Arzeni, 1993; Denslow and Padoch, 1988; Prance, 1989). Their participation is crucial to the conservation and preservation of their forest areas and the survival of threatened forest species.

Acknowledgements

The author is indebted to the Director of the G.B. Pant Institute of Himalayan Environmentald Development, Kosi-Almora, for providing infrastructural facilities. Constructive comments and suggestions received from Dr. Gulab Singh on an earlier draft is gratefully acknowledged, as well as anonymous comments on the present article. Thanks are owed to Drs. A.K. Das, K.G. Saxena, K.S. Rao and S.C. Ram for their support and discussion. Last, but not least, the author is also thankful to the staff of the Himachal Pradesh Forest Department, as well as the villagers of the study area, for their sincere cooperation and assistance in providing much useful information, without which this study would not have been possible.

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