CBCS PG: Botany Elective, Semester-II

Paper-II: Plant Resources II

Topic: Emerging trends in Ethnobotany

Ethnobotany

The term "ethnobotany" was first coined in 1896 by the American botanist John Harshberger as the study of plants used by primitive and aboriginal people. Since then it has been defined as the traditional knowledge of indigenous communities of the surrounding plant diversity and the study of how the people of a particular culture and region make use of indigenous plants. Ethnobotany has its roots in botany.

Botany, in turn, originated in part from an interest in finding plants to help fight illness. Ethnobotany is the most important approach to study the natural resource management of indigenous people. The issues of economic compensation and protected areas raise the problem of the divergence between conservation managers and village communities in their perception, mode of presentation, and system of resource appropriation and allocation. Conservation managers recognition of the knowledge and practices of indigenous people would help reduce tension and conflict between these two parties. Ethnobotany includes all types of relationships between people and plants. The definition of ethnobotany can be summed up in four words: people, plants, interactions, and uses.

"Ethnobotany is the study of how the people of a particular culture and region make use of indigenous plants," while the ethnobotanist explores how plants are used as food, shelter, medicine, and clothing, for hunting, and in religious ceremonies. It is the science studying "the relationship between a given society and its environment and in particular the plant world".

The Swede naturalist Carl Linnaeus actually invented ethnobotany as a student during his journey in 1732 to Lapland. On July 4, 1732, Linnaeus recorded in his diary some medical remedies used by the Sami people: They apply a piece as large as a pea upon the afflicted part". He published the *Flora lapponica* in 1737, which included a discussion of the ways in which specific plants were utilized by the Laplander (Sami) people.

Recent definitions of ethnobotany demonstrate a consensus on the move to include more than just use by focusing on the relationship between people and plants. However, there is not a consensus on whether the discipline should focus on all people or on traditional and indigenous peoples. It is evident that people who have lived in one locality for a long time have particularly rich sets of knowledge about and cognition of plants and local ecology. A more fundamental issue relative to knowledge, however, is found within the discussion of the relationship between knowledge as practice and knowledge as heritage.

Medicinal Uses

In India and Pakistan, three traditional systems of medicine, namely, Ayurveda, Siddha, and Unani, are distinguished. Ethnomedicine is an area of research that deals with medicines derived from plants, animals, or minerals and used in the

treatment of various diseases and ailments based on indigenous pharmacopoeia, folklore, and herbal charm. Ethnobotany has an important role in the conservation of nature, culture, and, in particular, the biological diversity and the diversity of traditional human cultures in the world. In fact, conservation and bio-diversity are linked with each other. Traditional knowledge systems are hundreds or even thousands of years old and involve not only the knowledge of plants for medicine and food but also strategies for the sustainable utilization of plant resources. In these respects, ethnobotany has played a vital role in describing traditional knowledge about medicinal uses of plants and will continue to do so in the future. To discover the practical potential of native plants, an ethnobotanist must be knowledgeable in the study of plants themselves and must also understand and be sensitive to the dynamics of how cultures work. Ethnobotanists have helped us to understand the frightening implications the loss of the rain forests would bring, not only the consequent lost knowledge about tropical plants, but also the damage brought about by the loss of native cultures in their entirety, as well as the damage to the Earth's ecological health. Out of necessity, ethnobotany is a multidisciplinary science. This multidisciplinary approach gives ethnobotanists more insight into the management of forest reserves in a period of tremendous environmental stress. Unfortunately, due to human factors that have influenced the ecological balance of these delicate ecosystems, we are presently faced with the possibility of losing our forests. Ethnobotany as an emerging science has a vital role in the improvement of plants and plant products. It certainly adds to conservation and can also be utilized for value addition. The two fundamental strengths of applied ethnobotany are:

To allow the knowledge, wisdom, and practices of local people to play fuller roles in identifying and finding solutions to issues of conservation and sustainable development.

Local people mostly depend on medicinal plants because these plants are good sources of materials needed in primary health care. Local people use these medicinal plants in different situations:

1. People use medicinal plants for the treatment of various ailments on the basis of indigenous knowledge passed to them generation after generation.
2. They use medicinal plants on the advice of elders, such as wise men, herbalists, and traditional practitioners.

Medicinal plants are used in different ways and situations; for example:

1. People use them singly in their own preparations for the treatment of various ailments on the basis of indigenous knowledge passed to them generation after generation.

2. They are used on the advice of elders, wise men, and religious teachers.

3. They are used with the advice of nonqualified but professional traditional medicine workers (*hakims*), who have also gained some experience through apprenticeship with some registered practitioners.

4. They are prescribed by qualified registered practitioners (traditional herbalists) of the Unani system of medicine for a wide range of diseases and ailments.

In the study areas, people collect plants based on traditional knowledge rather than scientific knowledge. Most of them have insufficient knowledge about the proper time of collection, which is essential not only for the maximization of active ingredients, but also from the viewpoint of the sustainability of resources. After col-lection, the plants are dried in sunlight and in shade. Mostly flowers and leaves are dried in shade, while bark, fruits, roots, and seeds are dried in sunlight for 4–8 days. Old men and women do the drying by spreading the plants on a cloth or plastic sheets on the ground. Some plants are also used in fresh condition. Generally, the plant material is not stored. Today's younger generation in the area is forgetting the indigenous knowledge of plants; with increasing labour costs and people's search for better job opportunities, the plant collection is rapidly declining.

Among the plant parts, leaves, aerial parts, fruits, bark, flowers, rhizomes, roots, tubers, rinds, seeds, and bulbs are commonly used. All medications are classified into two types:

1. Single-plant-based
2. Based on more than one plant species, medium and administrated along with milk, ghee, oil, egg, sulphur, and butter. The method of preparation falls into different categories, including plant parts used in crushed form, in powders, in pastes, fresh, in decoctions, in juices, in extracts, as latex, in infusions, and as resin.

Use of Plants as Food

Among the basic requirements of humans, food is the most important one. The population of any part of the world is dependent on the food production capacity of that region. *Triticum aestivum* (wheat) and *Zea mays* (corn), which are the most important crops of Pakistan, are also cultivated in the Lesser Himalayas area. The local inhabitants use the fruits of various plant species, including *Berberis lycium*, *Carissa opaca*, *Debregeasia saeneb*, *Diospyros lotus*, *Ficus* spp., *Myrsine africana*, *Pistacia chinensis*, *Punica granatum*, *Rhus chinensis*, *Rubus ellipticus*, *Segeratia brandrethiana*, *Solanum* spp., *Vitis lanata*, *Zanthoxylum armatum*, and *Zizyphus* spp. in both fresh and dried forms. Most of these fruits are also sold in the local market. Presently these species are under pressure due to population stress and deforestation. Among vegetables, *Alysum desertorum*, *Amaranthus viridis*, *Bauhinia varie-gata*, *Brassica campestris*, *B. rapa*, *Chenopodium album*, *Cichorium intybus*, *Ficus* spp., *Lamimum amplexicaula*, *Lathyrus aphaca*, *Medicago polymorpha*, *Nasturtium officinale*, *Plantago lanceolata*, *Raphanus sativus*, *Rumex chalpensis*, *R. hastatus*, *Solanum* spp., *Taraxacum officinale*, and *Torilis leptophyla* are commonly utilized species. *Allium cepa*, *A. sativum*, *Coriandrum sativum*, *Capsicum annuum*, *Mentha* spp., *Oxalis corniculata*, and *Pimpinella diversifolia* are used as condiments and spices. The season for collection varies. *Allium cepa*, *A. sativum*, *Brassica campes-tris*, *B. rapa*, *Chenopodium album*, *Cichorium intybus*, *Ficus variegate*, *Nasturtium officinale*, *Raphanus sativus*, and *Taraxacum officinale*, are collected in early spring, while *Amaranthus viridis*, *Capsicum annuum*, *Medicago polymorpha*, *Mentha* spp., *Oxalis corniculta*, *Pimpinella diversifolia*, *Plantago lanceolata.*, and *Rumex* spp. are collected in early winter. *Allium cepa*, *A. sativum*, *Amaranthus viridis*, *Brassica campestris*, *Coriandrum sativum*, *Ficus variegata*, *Mentha longifolia*, *Oxalis cor-niculata*, *Pimpinella diversifolia*, *Plantago major*, *Rumex* spp., *Solanum* spp., and *Taraxacum officinale* are also for medicinal purposes, used, for example, to treat asthma, body swelling, body weakness, cholera, cold fever, cough, diarrhea, dysen-tery, earache,

vision weakness, gas trouble, gleets, indigestion, internal pain, inter-nal worms, intestinal and liver inflammation, leucorrhoea, loose stools, menstrual disorders, mouth and gum problems, skin infections, and stomach disorders, to kill germs, and to stop bleeding. The above-mentioned species are not specifically cul-tivated for diseases. Some species such as *Allium sativum*, *A. cepa*, *Coriandrum sativum*, *Mentha* spp., *Pimpinella diversifolia*, and *Zanthoxylum armatum* are dried in shade for 7–8 days and then stored. These species would be beneficial for the local people if they were cultivated on a large scale, as they provide food and treat-ment for diseases and could become a good source of income.

Fuelwood Species

Wood is the oldest fuel known to man. Since time immemorial it has been meeting energy needs for domestic activities such as cooking and heating. Until the middle of the nineteenth century, wood was the sole or principal source of domestic and industrial energy worldwide. However, the use of wood as fuel has been steadily by cheaper, more efficient and more convenient sources of energy such as fossil fuels and electricity in developed countries. In developing countries, the pro-cess of replacing fuelwood is still in its initial stages, and wood continues to be the dominant fuel for domestic cooking and heating. According to FAO estimates, about 80% of wood removed all over the world is used as fuel in developing countries, and a large majority of rural people and urban poor depend upon it for providing domes-tic energy. Pakistan has a very small forest resource, as forests cover only about 4.8% of its total land area; only about half of these forests are productive, where timber and fuelwood can be harvested on a sustained basis. Although the foresters' community was advocating for the development and extension of forestry in the country from the time Pakistan gained independence in 1947 to meet the growing needs of fuel wood and timber, nothing substantial was done in this regard until the late 1970s. Initial planning for the establishment of energy plantations on farming lands through farm/social forestry programs was done in the early 1980s. A number of projects were launched by the federal and provincial forest departments in the mid-1980s to pro-mote tree growth on private lands to meet the public's needs for fuel wood. In the Lesser Himalayas, *Acacia modesta*, *A. catechu*, *Aesculus indica*, *Bauhinia variegata*, *Berberis lycium*, *Broussonetia papyrifera*, *Carissa opaca*, *Celtis caueasica*, *Cotinus coggyria*, *Dalbergia sissoo*, *Debergeasia saeneb*, *Diospyros lotus*, *Dodonaea viscosa*, *Ficus variegata*, *F. auriculata*, *Grewia optiva*, *Juglans regia*, *Justicia adh-atoda*, *Mallotus phillipensis*, *Melia azedarach*, *Morus* spp., *Myrsine africana*, *Olea ferruginea*, *Pinus roxburghii*, *Pistacia chinensis*, *Populus alba*, *Prunus* spp., *Punica granatum*, *Pyrus* spp., *Quercus leuctrichophora*, *Q. incana*, *Salix tetrasperma*, *Segertia brandrethina*, *Woodfordia fruticosa*, and *Zizyphus jujuba*, are used as fuelwood. Some herbs, such as *Cannabis sativa* and *Zea mays*, are also used for ignition when dry.

Fuel wood is collected by men, children, and, very rarely, women. About 90% of the people depend on plant species for fuel wood, and 5% of residents use kerosene oil and gas cylinders. Residents depend on forest as well as cultivated trees for their fuel wood supply. Today people from the plain areas move to the upper mountains to collect wood, whereas 25–30 years ago, fuel wood was available at their doorstep. This shows the increased deforestation that has occurred in the area during the last 30 years. The main factors responsible for the deforestation include increasing population, fire, and excessive cutting of trees for construction. About 5% of local families make their

living selling wood. The wood is collected from far-flung areas (4–5 km from the source of consumption) of the Reserved and Guzara areas in dry (dead) and wet (living) forms. The instruments used for cutting wood are saws (*aree*), axes (*kulahri*), and diggers (*kuddal*). Donkeys and camels are used to trans-port the wood. Some men even carry the fuel wood themselves. They gather the wood and tie the load with the help of elastic branches of *Mallotus phillipensis*, *Cotinus coggygria*, *Myrsine africana*, *Morus nigra*, and *Dodonaea viscosa.* The method is called *sub*. The wood is used by the houses and small hotels in the area. Fuelwood is also stored; this storage is done in the rainy season (July–September). Some species, including *Dodonaea viscosa*, *Mallotus philippensis*, *Myrsine africana*, *Olea ferruginea*, *Pinus roxburghii*, *Punica granatum*, and *Quercus leuc-trichophora* are under high pressure due to increased human population. It has been observed that more wood products are found at places that have been declared (shrines, graveyards, and rakhs). Locals pay great homage particularly to the shrines. These intentions of the people can be suggested to use for the protection of reserved areas if the areas near the shrines may be dedicated to the name of the respective saint or shrines by preaching through local religious people. As local inhabitants give more respects to such place and don't exploit vegetation so it is suggested that we can protect vegetation of a place, if we dedicate that place to the name of respective saint or shrines.

Fodder Species

Forest grazing, a conventional resource follows a centuries old use of the forestland in Pakistan. Almost all types and legal categories of forests are burdened with unspecified grazing rights and privileges. The grazing pressure has been increasing with the increase in human and livestock populations. Consequently, uncontrolled heavy grazing is causing great damage to soil and vegetation due to compaction and trampling. This creates gaps in the forests and retrogression in certain localities. Summer grazing by both local and nomadic livestock is very common in the moist temperate forest ranges in the northern mountainous tract. These forests are mostly located between 200 and 300 m above sea level, where, due to favourable moisture and temperature conditions, luxurious ground vegetation, and perennial and annual grasses, heavy uncontrolled grazing causes considerable damage to both the forest and range vegetation.

Fodder is the basic demand of cattle. Cattle's fodder requirement is fulfilled in the area because it is rich in fodder species. Local people use trees, shrubs, and herbs as fodder for their livestock. Primarily the members of the family Poaceae are used as fodder in both fresh and dry forms throughout the year. However, *Brassica campestris* (Sarsoon), *Berberis lycium* (Sumbal), *Celtis caucasica* (Batkair), *Ficus* spp. (Phagwara), *Grewia optiva* (Dhaman), *Melia azedarach* (Drek), *Morus* spp., and *Punica granatum* (Drauna) are used as fodder in their respective seasons. Grazing is the usual practice for cows, goats, and buffalo. These domestic animals fulfill the dairy requirements of the local people as well as improve the local micro economy. Agricultural areas and "Rakhan" consist of those areas of Guzara forests that have abundant grasses, are harvested in September for the winter, and are regulated as the property of households not cut before September and protected from grazing. Rakhan areas form patches of Guzara forests that are the only source of fodder in winter. Grasses are the most important fodder of the area and are found abundantly. Major grass species that

are grazed by the animals and stored for winter are *Alopecurus myosuroides*, *Aristida cynantha*, *Avena sativa*, *Cynodon dactylon*, *Dichanthium annulatum*, *Heteropogon contortus*, *Phlaris minor*, and *Sorghum halepense.* Grasses are stored from August to October after the monsoon rainy season. The stored grasses are used from November to January. From mid-January, when the stored fodder diminishes, the leaves of trees and shrubs, mainly *Grewia optiva* (Dhaman), *Celtis australis* (Batkair), *Quercus* spp., *Broussonetia papyrifera* (Gangli toot), *Ficus variegate* (Phagwari), *Myrsine africana* (Khukan), *Segeretia brandrethiana* (Ghangir), and *Olea ferruginea* (Kahu), are used, which play a vital role in maintaining the fodder supply during the off-season (November to February).

Local people also use trees and shrubs as fodder for their livestock, including *Carissa opaca*, *Berberis lyceum*, *Broussonetia papyrifera*, *Diospyros lotus*, *Ficus variegata*, *Quercus leuctrichophora*, *Acacia* spp., *Morus* spp., *Melia azedarach*, *Olea ferruginea*, *Zizyphus jujuba*, *Myrsine africana*, *Pyrus* spp., *Prunus* spp., *Grewia optiva*, *Segeretia brandrethiana*, and *Celtis australis*. They cut branches with leaves with the help of sickles. The basic unit of collection is called a *phant* or *dali*. Thirty to 40 *phants* or *dalis* are tied together with the help of elastic branches of *Morus* spp., *Dodonaea viscosa*, *Myrsine africana*, *Grewia optiva*, *Vitex negundo*, *Olea ferruginea*, and *Cotinus coggyria* called *sub*. Then they use *sub* to tie the entire *phants* or *dalis* together to make a *gada*. The weight of this *gada* is about 25–35 kg. Among households interviewed, it was found that most of them could meet their winter fodder requirement. But those who could not meet it buy grass, maize, and wheat stalks from local villages. Livestock, especially buffalo, cows, and goats, totally depend upon the stored fodder and fodder species found during winter.

Grazing animals provide a very good natural material for the soil that ensures the regeneration of fodder species next year. However, locals may be told to avoid periodic grazing of specific areas, to give that area enough time for recovery. This can be achieved through rotational grazing; based on community self-management, it encour-ages keeping livestock of improved breeds and helps in the formation of livestock associations. *Olea ferruginea*, *Myrsine africana*, *Accacia* spp., *Quercus leuctrichophora*, *Morus* spp., *Pyrus* spp., and *Grewia optiva* emerge as the most sustainable.
These species play a vital role in maintaining the fodder supply during the off-season of November to February. The wood, branches, bark, and fruit of these species are used as food, fuel, agricultural tools, rope, and thatching, among other uses.

Agricultural Implements

A proper tool handle is one of the basic requirements for the safety and high productivity of forest workers. Several forest tools have wooden and metallic parts. Substantial amount of work has been done throughout the world to design tool handles, which fulfill the agronomical and physical requirements of the job. In the case of wooden handles, the choice of the species depends upon its strength and other desirable characteristics. Beside strength and elasticity, other properties such as smoothness and the type of splintering that takes place during the failure of a handle are also important. Inhabitants of the area use different plants species in making agricultural implements, ploughs, tools handles, sticks, sickle, dagger, hoe, axe and

knife handles. They are made from locally available hard and soft wood. *Quercus leuctrichophora*, *Dalbergia sissoo*, *Morus* spp. *Diospyrus lotus*, *Acacia* spp. *Juglans regia*, *Melia azedarach* and *Olea ferruginea* are among the commonly utilized species. The most preferred wood is that of *Quercus leuctrichophora, Olea ferruginea, Morus alba, M. nigra, Melia azedarach, Psiticia integrrima, Salix tetrasperma, Populus alba, Diospyros lotus, Dalbergia sissoo* and *Acacia* spp.

Fencing and Hedges

Spiny and bushy species are used for fencing and hedges. These species are cultivated on the margins of fields and form a permanent fencing or branches of these plants are fixed in mud on the margin and form temporary fencing. *Carissa opaca*, *Berberis lycium*, *Acacia* spp., *Punica granatum*, *Zizyphus* spp., *Rubus* spp., and *Zanthoxylum armatum* are among the commonly utilized species for fencing and hedges.

Construction Material

In overall botanical importance to human existence, only food plants rank above wood and wood products. In early human history wood had been of greater importance than the food plants, as a fuel and for weapons and tools. There are over 4500 products that come wholly or in part from the wood of forest trees. Wood is used for housing, furniture, fuel, paper, charcoal and distillation by products, and synthetic materials such as rayon, cellophane and acetate plastics. One of the most obvious uses for trees is the production of building and furniture. Many millions of board feet of certain softwoods are used each year for home construction. Because of the grains, colors and durability of hardwoods, they are most often used in furniture making. Now a day is introduced in house construction like concrete roofs, iron doors and windows but plants still play very important in the construction of homes. The most preferred species used for the said purpose are *Acacia* spp, *Pinus rox-burghii, Myrsine africana, Dodonaea viscosa, Dalbergia sissoo, Olea ferruginea, Morus alba, M. nigra, Celtis caucasica, Psiticia integrrima, Segeretia brandrethina and Quercus* spp. Leaves, branches and poles of these species are used, as most of the local houses have mud roofs. *Pinus* spp., *Morus spp. Quercus spp., Melia aza-darach* and *Olea ferruginea* wood is also sold in the local markets as timber.

Miscellaneous Uses

Cotinus coggyria, Myrsine africana, Juglans regia, Pinus roxburghii, Acacia spp., *Triticum aestivum, Grewia optiva, Celtis australis, Dodonaea viscosa, Phoenix sylvestris, Grewia optiva, Salix tetrasperma* and *Berberis lyceum* are used miscellaneously. Women and children make ropes, bags, baskets, mats, ornamental goods and handicrafts from these plants which are used in daily life. The use of non-timber forest products like wild fruit and flowers for food, handicraft making, mats, dry decoration pieces from leaves, and rope making from bark should be encouraged and properly managed by the local social organizations for better use of resources for benefit of the local people and protection of ethnobotanical culture.

Grafting

Grafting is already being done quite successfully by local people in late winter (February–March) on *Morus* spp., *Ficus* spp., *Pyrus* spp., and *Prunus* spp. to get

higher fruit production to improve their micro economy. There is also the possibility of grafting *Olea europea* (olive) on the native *Olea ferruginea* (wild olive) to make it a more profitable and sustainable species for the local people. In this regard, suc-cessful experimental trials were carried out at National Agriculture Research Centre (NARC) in Islamabad. But the results have yet to be applied in the Lesser Himalaya areas. Grafting different strains of *Olea europea* from different countries should be done to make it successful.

Beekeeping

Beekeeping is currently becoming a most beneficial industry. The flora of the Lesser Himalayas has great potential for honey beekeeping. A number of wild species are normally visited by the bees, including *Acacia modesta*, *Bauhinia variegata*, *Brassica campestris*, *Carissa opaca*, *Dalbergia sissoo*, *Justicia adh-atoda*, *Punica granatum*, *Pyrus* spp., *Prunus* spp., *Zea mays*, Beekeeping has been identified as a small-scale, nonland-based, off-farm activity that can facilitate the use of land resources without degrading them. Encouraging this industry in the area will stress to the local community the importance of keeping the flora alive as

disturbs beekeeping. Older people and women of the area can undertake this activ-ity as a domestic industry. The association of wild animals with the is a natural phenomenon; for example, according to the older generation, there was a thriving population of barking deer when the vegetation of *Dodonaea viscosa*, *Myrsine africana*, *Mallatous Phillipensis*, and *Olea ferruginea* was dense, but due to habi-tat degradation, the barking deer population has also diminished. Several other animal species have become extinct, but they should be reintroduced to the area after rehabilitation.

Marketing of Medicinal Plants

The marketing of crude herbal drugs needs special attention due to their wide-spread use by traditional practitioners of the Greco-Arab system of medicine. Approximately 5,000 poor families residing in the remote hilly areas are engaged in the collection of medicinal plants during the summer months in the northern regions. Medicinal plants are transported to other markets by the seasonal traders, from where these commodities ultimately find their way to other parts of the country for consumption and export. Medicinal plants are used not only by local practitioners as household remedy but also provide raw material for the pharmaceutical industries of the country. The business is in the hands of a few large trading houses in the areas that neither are organized nor work along scientific lines for the collection, drying, cleaning, washing, storage, and standardization of medicinal plants. The medicinal plants from the study areas are collected by local inhabit-ants, drug dealers, village grocers, and local practitioners through traditional knowledge and having no scientific background and approach. They collect every possible available part of the plant. Most of the collectors are also ignorant of, or have insufficient knowledge about, the proper time of collection. Medicinal plants are either dried for further use or sold directly to the local grocers in fresh form, where the grocer does the drying him- or herself. Women generally do drying at home by spreading the plants on the floor, plastic sheets, cloth pieces, mats, and so forth, both in sunlight and in shade. The drying takes about 4.5 days. The

quality of the drying process is generally very poor, as dust and foreign materials get mixed in with the plants. The fresh plant materials on the market are dried by being spread in sunlight for 4–6 days and then graded (pure, mixed), packed, and stored in bags ranging in volume from a few kilograms to mounds (1 mound = 40 Kg), depending upon the mass and availability of the drug. There is no storage process at the collector's level, because they try to sell them as soon as possible. Village grocers have to store small quantities for a short while until they are able to sell them to wholesalers of the local markets in Rawalpindi, Abbottabad, Murree, and Haripur. Like drying, the storage is not done in hygienic conditions, and the crude drug often gets infected with insects and fungi. This results in the deterioration.

Climatic Factors

Among climatic factors, the important ones are snowfall, wind, drought, and frost. Snowfall in the area is not heavy and does not damage vegetation. The areas are also not subjected to violent windstorms, but occasional damage from high winds may occur to solitary pine trees, which were left naked at the base for torchwood or severely damaged by fire. Ordinary frosts are not severe in winter, but *Dodonaea viscosa*, which is frost tender, does suffer to some extent from frost.

Wild Animals and Insects

The damage to vegetation caused by wild animals and insects, like beetles, porcupines, and wild pig, is not of significance in the area.

Agriculture

The people of the Lesser Halayas are generally agriculturists. Due to the limited and small, uneconomical land holdings, they usually seek employment locally as well as in Ismabad, Abbottabad, Murree, Rawalpindi, Haripur, and Wah. In recent years, the growing trend has been to seek employment in the Gulf States. Since the people of the area are agriculturists, in order to obtain more food grains for their increasing family size, they put more land under cultivation. Local people classify agricultural land into two basic units: (1) *kalsi* (contains 8 *marlas* (1 marla = 272 sq.ft.)) and (2) *Doga* (contains more than 8 *marlas*). For the cultivation of crops the plow-ing of land for the first time is called "*khili patna*". People plow the land again the same day if the land is a small area; larger areas are plowed the next day. Then they plow the land a third time before spreading the seeds on the land. They call this plowing *rai karna*, which means "sowing seeds." If the land is one *kanal* (1 kanal = 20 marlas (5440 sq. ft)), then plow the land from one side to the other is called *ang*. Three kilograms of maize seeds and 6–8 kg of wheat seeds are used for one *ang*. About 8–10 kg of maize and 10–15 kg of wheat seeds are used on one *kanal*. The plowing of land in hilly areas is mostly done with oxen in pairs. People who do not have oxen hire them for a day or more according to their needs. The cost of hiring oxen per day is 600–700 rupees (Rs). In the plain areas where the land is flatter, land is plowed with a tractor leased at 700 Rs/h. There is a lack of good, cultivable land. The people who live in the hilly areas usually have much land, but the productivity of this land is very low.

Recommendations

It is evident from the present investigation that the Himalayas a rich area particularly with reference to medicinal plants. Its vegetation is valuable due to its natural resources. The natural resources must be looked after and managed. In order to conserve these resources, the local people must become actively involved in the evaluation, planning, implementation, and monitoring processes, as they are the best judges of the area.

The following recommendations are being proposed to conserve the plant species and to reap the greatest benefits from the available resources:

- The literacy rate must be increased; this will change people's minds about current practices.
- Local organizations may involve local people as leaders of activities towards environmental conservation awareness. Local school teachers and religious leaders must be considered for such positions.
- In the present situation, the authorities should give attention to the sustainable use of resources.
- The locals should be educated about the importance of medicinal plants to their socioeconomic conditions and their sustainable utilization.
- Small domestic industries such as beekeeping, gardening, handicrafts, and so on must be encouraged in the area through social organizations within the local communities.

Modern approaches of Ethnobotany

The application of scientific knowledge relating to bio-resources for human welfare demands data on socio-economic aspects, impact on environment or conservation of biodiversity. Ethics demands preservation of the knowledge base, capacity building among the indigenous people and fair sharing of benefits accruing from commercial use of the indigenous knowledge. Modern scientific approach to the study of ethnobotany demands precision in information, statistical support to data and quantitative or semiquantitative analysis of field observations.

Precision

Several papers dealing with ethnobotany in some parts of the world mention the traditional uses of the plant very briefly, using words or phrases such as 'edible', 'used as drink', 'is medicinal', 'used in fertility', 'for house building', etc. Such phrases indicate a very broad and vague use of the plant. For medicinal species, elaborate data are

needed on symptoms of disease, plant part used, single drug or mixture, preparation,dosage, frequency, etc. Data are needed on informants' age, experience, approximate number of patients treated, how procured, i.e., from forest, market, etc.

Statistical support

Benefits of statistical or quantitative methods are summarized below:

1. Data are more accurate because from the very start of the field work, statistical methods are employed on age, sex, occupation, etc, of resource persons.
2. Numerical data make analysis easy and precise.
3. False or cooked up data are easily detected and data become more reliable.
4. The above three factors lead to better conclusions, models, forecasts, projections or extrapolations, resulting in more intensive ethnobotanical activity.
5. The above benefits lead to newer approaches, e.g., if a particular forest type is threatened by any ethnobotanical uses, Ranking the importance of bio-cultural resources becomes possible. The proposals of conserving certain areas have been strengthened by quantitative data.
6. Quantitative evidence of importance of species or dependence of people on certain species can help even in pleading IPR cases.