



RAP PUBLICATION : 1996/6

Non-Wood Forest Products of Bhutan



**The Food and Agriculture Organization of the United Nations
Bangkok, Thailand**



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Foreword

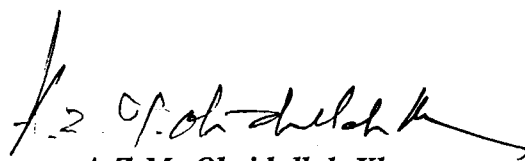
For centuries, the people of Bhutan have lived in harmony with nature in the far reaches of the eastern Himalayas. The Kingdom of Bhutan remains one of the most forested countries in the world, and harbours an astounding diversity of plants and animals. The country's environment has benefitted significantly from deep-rooted Buddhist ethics and a long history of conservation leadership.

The deep reverence the Bhutanese people have for their natural environment exists in spite of, or more likely because of, their extreme dependence on it. The forests of Bhutan, in particular, provide critical materials for the daily subsistence of most Bhutanese families. The Bhutanese make considerable use of wood for houses, shingles, tools, fences, and numerous other items, as well as for cooking and heating. But it is the extensive use of non-wood forest products by the Bhutanese that is especially striking.

Non-wood forest products touch nearly every aspect of the lives of a Bhutanese. The country's forests provide food, fodder, medicine, oils, resins, fibers, dyes, and raw materials for baskets, traditional paper, houses, brooms, mats and numerous other items.

Until recently, most non-wood forest products were used locally by Bhutanese people. Increasingly, however, these products are attracting the interest of outside buyers and consumers in far-away countries. This interest presents both opportunities and risks for Bhutan—opportunities include cash income for the rural poor, revenues for the government for developing the country, and increased investment in rural infrastructure and processing centers; risks include potential over-exploitation of natural resources, inequitable distribution of benefits, and shortages of raw materials that might otherwise be used for traditional and local needs.

This publication, prepared by the Forestry Services Division of the Bhutan Ministry of Agriculture, highlights the extensive use and potential of non-wood forest products in Bhutan. It should serve as a useful introduction for all foresters, biologists, and rural development workers interested in Bhutan's complex and bountiful non-wood forest resources and products.


A.Z.M. Obaidullah Khan
Assistant Director-General and
Regional Representative of FAO

Preface

Often there is a tendency to associate forests with trees and timber production only. Other products, such as bamboo, cane, oil, fibre, floss, food, fodder and medicinal plants, are sidelined as merely "Minor Forest Produce," or MFP. Some so-called MFP, however, is economically even more valuable than timber. Moreover, its social and cultural values also add to its importance.

Forestry development, through people's participation programs, is both an important objective and strategy of the Royal Government of Bhutan's Seventh Five-Year Plan. These programs are expected to improve rural people's understanding of the importance of forests and, at the same time, contribute to improving their daily life. Classical forestry models that look at trees alone may not provide the necessary incentives to trigger wide response from the people. Social forestry models must provide quick and attractive economic returns. MFP, particularly medicinal plants, has a tremendous potential as cash crops, and it can often be grown alongside numerous tree species.

In Bhutan's past development activities, unfortunately, MFP as the name suggests, has been accorded less attention than it deserves. Such knowledge as does exist is limited. This ignorance of MFP's value and potential prevents us from reaping the full economic benefits from our vast storehouse of genetic resources. We are not yet sure how to harvest produce from the forests on a sustainable basis. The technology for cultivating such resources has yet to be adequately explored. It is hoped that the change in nomenclature, from MFP to non-wood forest products, will not only give MFP a better image, but also lead to the development of these important resources. The first step in doing this was to review existing information and compile a comprehensive document as a reference base of all local knowledge. A committee was set up for just this purpose. The committee then submitted this report. I am happy to say that their work has surpassed expectations and I am extremely pleased with the results.

I congratulate the committee on producing its excellent document within such a short period. This report has greatly improved our knowledge and should act as a catalyst for further development.



S. Thinley
Joint Secretary
Forestry Services Division
The Royal Government of Bhutan

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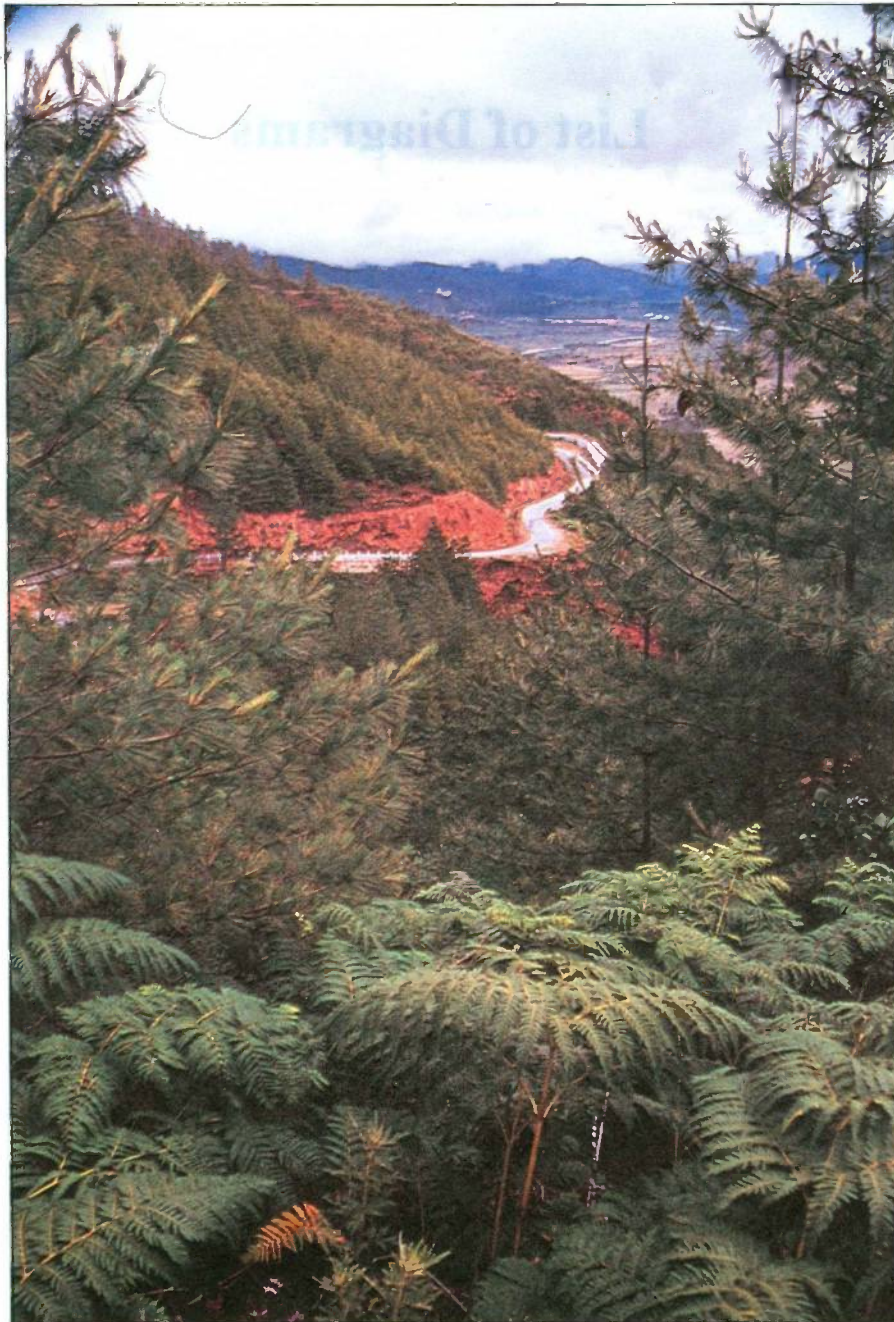
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Rugged terrain and lack of roads hinder the marketing and trade of non-wood forest products in most parts of Bhutan.

Overview of Non-Wood Forest Products in Bhutan

by K.J. Subba

Joint Director

Forest Resources Development Section, Thimphu

The Royal Government of Bhutan

The sudden rise of the Himalayas from the flat Indo-Gangetic plains into jagged and lofty mountain peaks endows Bhutan with a wide range of ecological zones. In the Himalayas, it is possible to move from tropical conditions to the alpine zone in a matter of hours. The flora and fauna are thus at once both diverse and unique to Bhutan's singular geography.

Most of the Himalayas, unfortunately, are in an advanced stage of decay. Some authors even describe the Himalayas as dying mountains. For the rural communities of these soaring mountains, the world's highest, over-population and over-use of land resources long ago crossed the line of sustainability. At the same time, biodiversity has inevitably become much poorer, the protective value of the forests has been lost and the region, particularly downstream areas, faces severe, natural calamities every year.

Fortunately, Bhutan, in the Eastern Himalayas, enjoys a somewhat more hopeful situation. Here people have learnt to live in harmony with nature in a symbiotic relationship that goes back untold centuries. The Buddhist philosophy of love and respect for nature has also greatly influenced the people's attitude towards their land and its environment. Thus 60 percent of Bhutan's forest cover is still in a pristine state. Flora and fauna, extinct or threatened elsewhere, continue to thrive in Bhutan.

FOREST POLICY

Bhutan's forest policy places conservation above all other considerations. Harvesting or commercial use of the forest is only permitted after conservation goals have been met and only if management policies ensure sustainable use.

FOREST STRATEGY

Bhutan has designated 23 percent of its national territory as protected areas, distributed over different ecozones. These are strictly controlled for the conservation of flora, fauna and biodiversity.

All remaining forests are designated production forests. Their management is also guided by conservation principles. Bhutan places strong emphasis on people's participation in forest management and on the development of forestry extension services.

FOREST LEGISLATION, RULES AND REGULATIONS

Rules and regulations are regularly updated to improve and better enforce forest conservation policies (the Royal Government of Bhutan's Master Plan for Forestry Development 1991, Annex Report No. 8). These rules, however, still allow the Bhutanese people to practice their traditional use of forest products. Here are a few examples:

Medicinal Plants

- The 1974 National Forest Policy categorises medicinal plants and herbs as resources yet to be fully exploited. Hence the Policy specifies that these resources be surveyed for efficient management and use.
- May 25, 1988—The Director of Forests approved a proposal to: 1) ban exports of medicinal plants, and 2) establish joint efforts by the Department of Forests (DOF) and the National Institute of Traditional Medicine (NITM) to both collect and cultivate medicinal plants.

Resin

- April 3, 1985—Revised rules on resin tapping from chir pine (*Pinus roxburghii*) were approved.

Natural Dyes

- January 4, 1980—The Royal Government of Bhutan waived royalties and sales taxes on the collection and sale of lac and waste products therefrom. This was to revive the dying art of lac cultivation and associated activities. No monopoly is now permitted.
- September 8, 1985—Exports of vegetable dyes were curtailed. These are now for domestic use only.

The abrupt rise of the Himalayas from the plains of India determines everything in Bhutan—topography, settlement, economy and climate.



Bamboo and Cane (Rattan)

- November 7, 1978—The Government decided that villagers in the Phontsholing area could henceforth collect bamboo and cane without paying taxes or royalties. This is to encourage the production of handicrafts for sale and domestic use.
- May 7, 1979—The Government gave Mongar and Zhemgang villagers permission to transport “bangchungs,” “palangs” (both traditional bamboo containers) and other products made of bamboo or cane anywhere, as long as they are for gifts, and not for sale.
- September 2, 1984—The Government, to encourage handicrafts production, allowed Dhrumjar (Mempa) Trongsa villagers to collect bamboo and cane for sale or domestic use without paying taxes or royalties.

Other Forest Products

No legislation, rules or regulations have yet been enacted for essential oils, mushrooms, and other forest products.

THE IMPORTANCE OF NON-WOOD FOREST PRODUCTS

More than 80 percent of the Bhutanese population depends on agriculture and animal husbandry for its livelihood. To remain sustainable, the country's farm system is highly dependent on forests. Non-wood forest products, used daily, are taken for granted. Important as they are, the full impact of these products on Bhutan's rural economy is yet to be either assessed or documented.

Grazing and Fodder Production

Animal husbandry is an important contributor to the country's rural economy. Almost every household maintains at least a few cattle for draft power, animal products and for manure. Many Bhutanese keep large herds as a status symbol or as insurance against hard times. The country's animal population is estimated at 300,000 cattle and buffaloes, 28,000 yaks, 40,000 sheep, 42,000 goats and 22,000 horses.

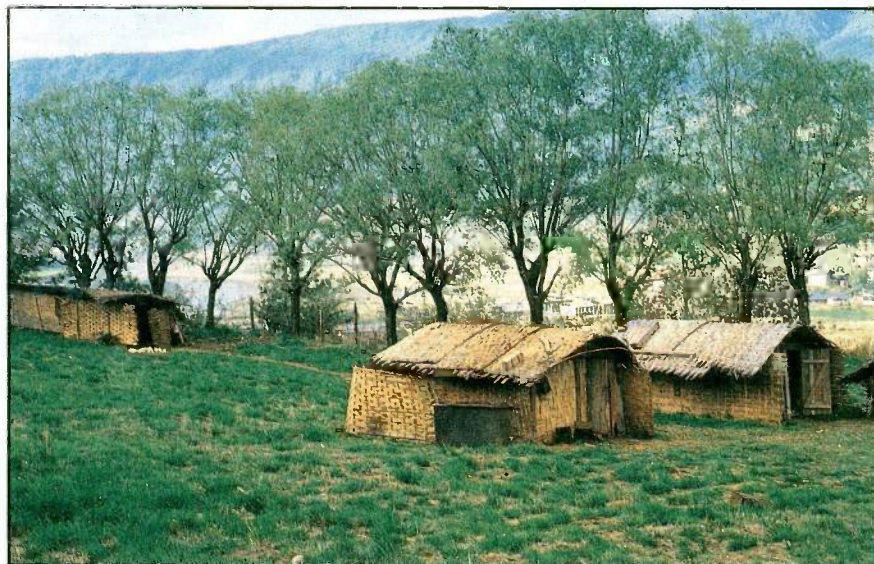
These animals' dependence on forests for fodder is not as yet fully appreciated. It is general Bhutanese practice to simply chase the animals into the forests to forage wherever they like and for whatever is available. In Bhutan, forests and grazing lands often overlap. During winter, when forest fodder becomes scarce in the country's colder areas, cattle are driven to forests in warmer climates. Tree fodder is collected, particularly for the milch cows so important for milk production during winter.

Bamboo

Bamboo is rightfully known as the "poor man's timber." Its use is so versatile that it merits a full study on its own. In Bhutan, bamboo has many uses. Due to the country's varied climate, many different kinds are available. Large bamboo, such as *Dendrocalamus hamiltonii*, is found in tropical areas, while the very small *Arundinaria maling* is found at high altitudes.

One of the most common uses for bamboo in Bhutan is for making bows and arrows. Archery is the national sport and an important cultural activity. Bows are made from *Dendrocalamus hamiltonii*, though only those that grow on particular microsites produce good bows. Arrows are made from high altitude bamboo. Making these arrows requires considerable skill. The arrows' feathers, for example, are obtained only from one type of wild pheasant, while the glue for attaching them is made only from fish skin.

Split bamboo is commonly woven into mats for house walls and roofs.



Producing fine bamboo baskets and other containers is a speciality of the people in the country's eastern districts. Such products, now becoming popular with tourists, are marketed throughout Bhutan. Poor people also use bamboo baskets for storage and as water containers. Many of the country's poor live in houses made entirely of bamboo. In southern and eastern Bhutan, the larger bamboos are all but indispensable to rural life, so much so that living without them cannot even be imagined. The smaller bamboos found in central and western Bhutan are used for weaving mats, as fencing, or as roofing for temporary shelters.

Traditional Medicine

Traditional medicine is still practiced throughout Bhutan, with its more than 300 species of medicinal plants. The National Institute of Traditional Medicine (NITM), for example, is a well-organised institute staffed with traditional and western trained doctors. The Institute regularly collects plants to produce medicine as per formulae cited in ancient medical scriptures. NITM combines traditional medicine with acupuncture to treat all types of diseases. The Institute is rapidly gaining in popularity, even though a nearby modern hospital provides free services.

While NITM's set-up is quite elaborate, simpler systems of traditional medicine—provided by individuals or groups—are practiced in rural areas. In the south, traditions are different. Knowledge of medicinal plants is passed down from father to son. Some practitioners combine spiritualism, and its accompanying elaborate rituals, with dispensing medicine.

As traditional medicine does not have the side effects associated with modern-day medicine, it is once again becoming popular. The country's modernisation almost wiped out this age-old practice and once-thriving business. It is known that in olden days at least two plants, ruta (*Saussurea lappa*) and manu (*Innula helenium*), were cultivated and marketed in the Bumthang Valley. Today many people do not even remember what these plants look like. A remnant of manu, however, has been found and is being cultivated by at least one family.

The 14 most prevalent diseases in Bhutan (Master Plan for Forestry Development 1991) in order of seriousness are:

- Respiratory tract infections
- Diarrhoea/dysentery
- Skin infections
- Worm infections
- Malaria
- Conjunctivitis
- Peptic ulcer syndrome

- Otitis media
- Tooth and gum diseases
- Urinary tract infections and nephritis
- Childhood diseases
- Sexually-transmitted diseases
- Diseases of the female genital tract
- Complications in pregnancy and childbirth puerperium

Natural Dyes

Natural dyes comprise another group of non-wood forest products associated with Bhutanese traditional arts and culture. Cloth weaving is an important economic activity in the central and eastern “dzongkhags,” or regions. At one time, the colouring of textiles was entirely done by using natural dyes. Many plants were cultivated for this, and some were even exported to Tibet. Natural dyes are gradually being replaced by chemicals or ready-made coloured thread. Improvements in the quality of natural dyes, however, may revive their production. A project at Khaling in eastern Bhutan is presently compiling an information base on natural dyes and conducting research to improve such dyes.

Pine Resin and Lemon Grass

Pine resin collection and lemon grass distillation are recently introduced activities in Bhutan. More than 270 tons of resin are collected each year by villagers in the country's eastern districts and sold to a factory. As the work is carried out close to their farms, farmers supplement their incomes by doing such collection when they are free from farm work. These activities pump more than Nu. 30 million (just under US\$ 1 million) into the country's rural economy.

Lemon grass distillation employs some 400 families in the eastern dzongkhags. To these families, this activity has become even more important than farming.

Forest Foods

Forests also play an important role in Bhutan's food security. Food from the forests becomes critical to rural areas in times of crisis, when transporting food to remote areas is difficult, or when people have no money to buy food. Because of Bhutan's varied and unpredictable climatic conditions, from time to time the country faces localised droughts and other conditions causing crop failures.

During hard times, people search for food in the forests to supplement their meagre supplies. Thus an important plant is yam (*Dioscorea* sp.). This plant has long tubers and requires a considerable amount of digging to obtain. Tuber hunting, though, is always a gamble. A vine may yield up to 10 kilogrammes of tubers, or nothing at all. Yet the plant's exotic taste and the hungry mouths waiting back home, make the hard digging worthwhile. When food shortages become extreme, the bulbs that grow on the vines are also eaten. This occurs only under the most desperate situations as the bulbs, which are stewed, are bitter and cannot be eaten too often. Bhutan has other less well-known tubers, but *Dioscorea* remains the most important substitute for food grains.

Another commodity that sends poorer farmers into the forests during difficult times is seeds, from which cooking oil is extracted. Many wild seeds can be used to produce oil. The seeds of the *Symplocos* tree, for example, are commonly used for this purpose, even in good years. The seed of *Gynocardia* sp., a subtropical tree, is used less frequently because of its highly-poisonous covering.

Sal (*Shorea robusta*) seeds are collected and marketed in India because Bhutan still lacks the requisite extraction technology at the rural level. *Neolitsea* is cultivated throughout Bhutan, particularly in the country's eastern districts. *Aesandra butyracea*, a multipurpose tree, is also an important source of oil.

A variety of forest fruits and nuts are regularly consumed in Bhutan, but contribute little to food security. Some fruit is plucked and eaten by rural folks passing through forests; some may be taken home. Fruits and nuts, such as the walnut, *Cornus*, *Zizyphus*, and *Morus*, are occasionally marketed. Some wild fruits are rich in vitamins. *Phyllanthus emblica*, for example, is recognised as a rich source of vitamin C.

Villagers also use many plants as vegetables. Fern shoots, bamboo shoots, mushrooms, cane shoots and even orchid flowers are marketed in their respective seasons. These are much sought after delicacies throughout Bhutan. Mushrooms, particularly *Cantharellus cibarius*,



Traditional paper made from *Daphne* spp. and *Edgeworthia gardneri* has become a popular export product.

are canned and sold for as much as Nu. 50 (about US\$ 1.50) per kilogramme. These are found in oak-pine forests in the country's temperate zones. Some are exported. The oak mushroom is widely cultivated on oak billets.

Villagers in western Bhutan commonly collect and sell beetle leaf and beetle nut on a year-round basis. Leaves are collected from tropical and sub-tropical forests, then transported from western Bhutan to northern districts where wild leaves are preferred over cultivated varieties.

Bhutan's forests also produce a number of spices, used locally and exported. *Piper* sp. is one of the country's most important spices. Though not used locally, this spice earns people in tropical areas a good income during season. *Cinnamomum* sp. bark and leaves are also collected and exported. *Zanthoxylum* sp. seeds are marketed locally and are extensively used throughout the country.

PROBLEMS AND CONSTRAINTS IN DEVELOPING NON-WOOD FOREST PRODUCTS

Bhutan's potential for developing its non-wood forest products (NWFP) is quite considerable. But this promising sector is burdened, at least for the present, by several serious constraints. Too little is known, for instance, about the country's existing resources, management strategies, best harvesting practices and marketing opportunities. Professionals in the NWFP sector are far too few and they have limited knowledge of practical management and prospects for further and future development. Institutional support is extremely weak.

There is an acute lack of inventory data and even many of the best informed Bhutanese professionals admit they are all but completely in the dark as to the country's real NWFP resources. But finding out just what these resources are and, equally important, *where* they are requires money, and money is precisely the resource in shortest supply in the country. Bhutan is, after all, one of the poorest countries on earth. Per capita income is a lowly US\$ 150 a year and government financial resources are never adequate to cover Bhutan's almost endless development needs.

The shortage of quality training institutes in the country is another major constraint to Bhutanese development. Legal codes and laws governing most phases of forestry development are as yet inadequate and where they do exist they are all too often ignored. Comprehensive enforcement of modern forestry legislation, even were it to exist, would require more forestry officers than Bhutan could afford to put into the field.

Geography itself is a massive physical barrier to the country's rapid development. Bhutan lies in the heart of the beautiful but stupendously rugged Eastern Himalayas, and is, in fact, one of the most mountainous countries on the planet. To build a good all-weather road in Bhutan is a colossal and extremely expensive achievement. The present road network, for instance, though by far the best the country has ever known, makes the transport of goods a

slow, costly, and at times dangerous, endeavour. Roads, uniformly narrow due to the Himalayan peaks through which they pass, are few and far between.

During the long rainy season and the winters of ice and snow, Bhutan's roads often become altogether impassable, beset as they are by landslides and washouts. All this adds up to far more than just human inconvenience. It is a major obstacle to development of any kind.

These problems and developmental constraints seriously affect every aspect of the country's social and economic advancement, including its budding non-wood forest products industry.

GENERAL RECOMMENDATIONS FOR LONG-TERM ACTIVITIES IN DEVELOPING NON-WOOD FOREST PRODUCTS

- Establish national priorities based on all known non-wood forest products and prioritise them according to an agreed set of criteria.
- Aim for a more complete inventory of the prioritised commodities, giving species, locations, and quantities. This would involve taxonomists, botanists, forest rangers, and foresters, among others.
- Train personnel in plant identification, proper collection methods, appropriate processing techniques, efficient manufacturing procedures, quality control, and the generation of new designs.
- Establish and maintain gene banks for conservation, tissue culture, and seed storage, and start a collection of voucher herbarium specimens; set up extension and information centres for teaching the art of vegetable dyeing.
- Set up post-harvest handling facilities as close to commodity sources as possible for drying, sifting, deep freezing, controlled atmosphere, etc.
- Initiate annual scholarships and grants for B.Sc., M.Sc., and Ph.D. degrees in related disciplines or short-term, non-degree training programmes for acquiring new technologies.
- Create an agency, or agencies, to serve as the national clearing house for all matters pertaining to non-wood forest products, including marketing. This should include a mechanism to oversee annual reviews of accomplishments, preferably conducted by unbiased third-party personnel.

ORGANISATIONS INVOLVED IN THE DEVELOPMENT OF NON-WOOD FOREST PRODUCTS

Forest Research Section, Research Extension and Irrigation Division of the Ministry of Agriculture

- herbarium collection, plant identification
- vegetative propagation of important non-wood products

Forestry Services Division

- collection of information on non-wood product use
- survey of non-wood forest products

Research Extension and Irrigation Division of the Ministry of Agriculture

- essential oils
- vegetable oils
- mushroom production

Ministry of Trade and Industries

- survey of specific non-wood products with industrial potential
- marketing and production

National Institute of Traditional Medicine

- collection of medicinal plants and production of medicines
- research on cultivation and propagation of important medicinal plants

The Handloom Weaving Centre, Khaling

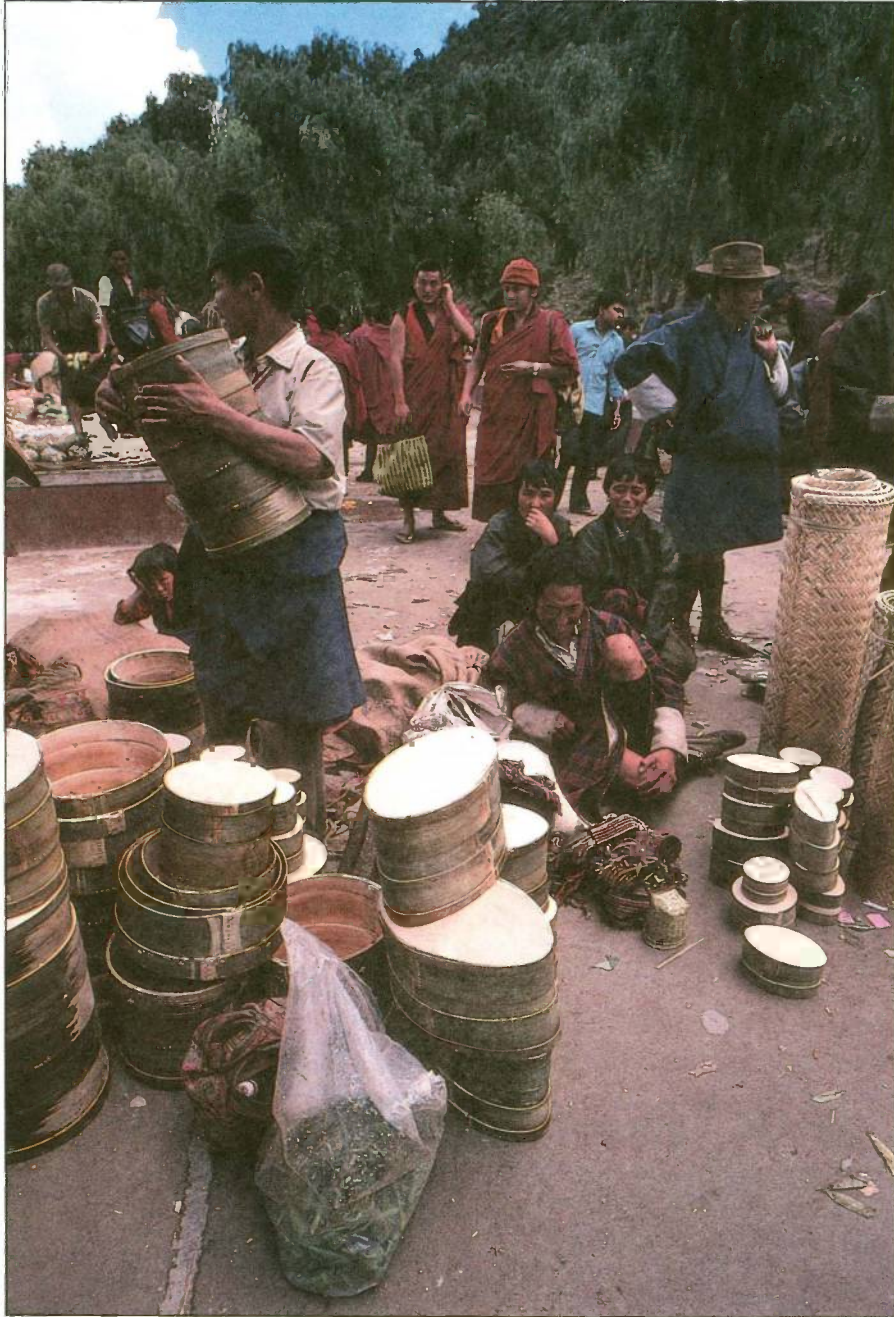
- documentation on traditional natural dyes
- production of textiles based on natural dyes

Cottage Industries (Yatha Weaving Centres)

- production of textiles based on natural dyes

National Women's Association of Bhutan

- interested in local paper production and other non-wood products



Farmers' markets selling non-wood forest products are common throughout Bhutan.

Bamboo, Cane, Wild Banana, Fibre, Floss and Brooms

by Dorji Rinchen

Divisional Forest Officer, Samdrup Jongkha

The Royal Government of Bhutan

BAMBOO

Bamboo grows naturally in Bhutan because of the country's largely undisturbed forests and the limited agriculture practiced in areas where bamboo proliferates (Table 1). The Kingdom probably has the greatest variety of bamboo species of all the Himalayan countries. Bhutan's great range of altitudes and climates account for this diversity. Bhutanese bamboo is principally of Himalayan and Chinese-Japanese origins, with some Southeast Asian and South Indian contributions. Bhutan has 15 genera and 31 species of bamboo. Possibly as many as 50 more species exist, but have yet to be identified.

Table 1 Information on Bamboo in Bhutan

Botanical name	Local name	Distribution	Parts used
<i>Arundinaria</i> spp.	Maling bans	Chimithangka and Thimphu Selephu/Paro Diafam/Samdrup Jongkha Bhangtar/Samdrup Jongkha Nganglam/Samdrup Jongkha Deothang/Samdrup Jongkha Pemagatshel	Stems Leaves
<i>Arundinaria maling</i>	Hima	Begana/Thimphu Helela/Thimphu Lamperi/Thimphu	Stems
<i>Bambusa</i> spp.	Bhalu bans	Sarpang Samdrup Jongkha Santse	Stems
<i>Dendrocalamus</i> spp.	Mal bans/Choya bans	Sarpang Zhemgang Samdrup Jongkha Pemagatshel	Stems
<i>Dendrocalamus stricta</i>	Bejuli bans	Sarpang	Stems

Distribution

Knowledge of the distribution of Bhutan's bamboo species is limited. Major species found in sub-tropical areas include *Bambusa nutans*, *Dendrocalamus hamiltonii*, *D. sikkimensis*, *D. patelleries*, *D. strictus*, *Drepanostachyum hookerianum*, and *D. intermedium*. Higher elevation species include *Arundinaria racemosa*, *A. maling* and *A. polystachya*. Other species are *Dendrocalamus hookeri* and *Arundinaria griffithii* (Griern dwarf rhododendron trees).

Current and Potential Uses

Bamboo has long been used by the Bhutanese people. A few of its major uses, identified with the genera most commonly used for each product, are listed below:

Bambusa species

- split and woven mats
- used whole for construction and scaffolding

Dendrocalamus species

- roofs and walls of houses
- domestic and agricultural implements, such as water containers, baskets, trays, mats, etc.
- leaves provide valuable fodder for livestock
- shoots are edible and can be preserved

Drepanostachyum species

- finely woven domestic and agricultural equipment, such as baskets, trays, mats, sieves, etc.
- livestock shelters and temporary dwellings
- parts of traditional houses
- edible shoots

***Thamnocalamus* species**

- roofing, mats and fencing

***Arundinaria* species**

- high-quality woven handicraft products, such as food and drink containers, hats, arrows, quivers, etc.
- winter and dry season livestock fodder
- durable mats for building construction
- fencing material
- edible shoots
- shelter and food for endemic fauna in reserve areas

Bhutan's overall development policy is to make limited use of many natural resources, concentrating on the renewable ones. This policy recognises the importance of rural activities, such as agriculture, forestry, and handicrafts production, in the country's long-term development strategy. Bamboo is involved in all of these. The demand for bamboo is, therefore, bound to increase over time, particularly for use as fodder and other multipurpose uses. There is ample scope for greater bamboo production, especially in the country's higher areas where communities are widely dispersed and agriculture is less profitable.

The manufacture of handicrafts using locally-available materials, such as bamboo, and employing simple techniques and equipment is now emphasised in Bhutan. The country is fortunate in having highly-skilled craftsmen, a strong cultural heritage, and a good supply of renewable resources. There is a need, however, for improving the design of handicrafts and hence their market appeal. This could raise the income of the rural people while allowing them to maintain their culture and way of life.

Increasing the use of bamboo resources in the making of Bhutanese handicrafts has the advantage of building upon existing traditions without threatening the country's cultural heritage or way of life. The people of Zhemgang, for example, are permitted to collect bamboo free of taxes for making "bangchungs" and "palangs" (traditional containers) etc., for their own use or as gifts. Only unwise human interference has retarded bamboo proliferation in Bhutan.

Using simple methods, bamboo harvested from forests is often transported long distances.



CANE

Cane is the stem of the climbing palm of the genus *Calamus* and other related genera. Bhutanese cane belongs to the *Palmae* family and is commonly found in the country's tropical and subtropical areas. *Palmae* is represented by 170 genera and more than 2,500 species worldwide. There are 13 genera of *Palmae* found in Bhutan.

Distribution

As with bamboo, knowledge of the distribution of Bhutan's cane is limited. Species so far reported in tropical areas are *Calamus acanthospathatus* and *Calamus tenuis*, found in Zhemgang, Trongsa, Punakha, Chukha, Haa, Mongar, Trashigang, Samdrup Jongkha, Pemagatshel, Samtse and Sarpang Districts.

Calamus acanthospathatus is locally known as “de” (Shar chop-kha) and “phogrebeth” (Nepali). *Calamus tenuis* is known as “menj” (Shar chop-kha). A third cane species, locally known as “phasi,” has been reported but its presence is not yet confirmed.

Current Uses and Potential

Calamus acanthospathatus is a common climber, which grows extensively in Bhutan. It yields strong cane and is used as a substitute for rope and as cable for suspension bridges. It is also used for wickerwork, baskets, and containers. Thicker cane is used for making furniture frames, walking sticks and umbrella handles. The shoots of this plant are edible.

Calamus tenuis is used for making household items, such as mats, screens, furniture and chair seats.

The long distances from where cane grows to roads and the limited availability of this resource, restrict the potential for expansion of its use and exploitation.

WILD BANANA

Distribution

Wild banana (*Musa* spp.) grows in Bhutan's sub-tropical and temperate regions at up to 1,800 metres (Table 2). There are three varieties. Although it has never been successfully managed, wild banana grows prolifically on "tseri" (shifting cultivation) land abandoned after cultivation, openings in forests, and on most terraces. Regeneration is quick and growth is profuse in these particular areas.

Current Uses and Potential

Banana leaves are used in house construction, roofing, and for making temporary sheds. The leaves and stems are also used as fodder for elephants and other animals. The flowers and fruits are, of course, edible. The fibres from banana leaves make good paper, but they are not commonly used for this purpose in Bhutan.

The inner soft core of the banana stem is edible. The Bhutanese use the water extracted from this stem to cure stomach ailments and as an antidote to *Aconitum* poisoning. This type of poisoning, from the *Aconitum* spp., is rare, but can happen during the preparation of medicine. The leaves and stems are also used for preserving fish, meat, butter, "pani" (beetle leaves), and other foodstuffs. Banana stems are also used as conduits and to make rafts.

The country's growing production and demand for paper will undoubtedly increase the demand for this renewable banana resource, thus increasing rural Bhutanese income. The traditional uses of banana leaves and stems—part of the country's cultural heritage—will, however, continue.

Botanical name	Local name	Distribution	Parts used
<i>Musa</i> spp.	Bakpa Lampa Kera (N)	Zhemgang Diafam Bhangtar Nganglam Deothang Pemagatshel Norbugang Decheling Sarpang Noonpani (Sarpang) Leopani " Gaytsha "	Leaves, stems

Note: (N) = Nepali

FIBRE, FLOSS AND BROOMS

Fibre

Bhutan's main sources of fibre are from various stems and leaves, though fibre may also be extracted from roots, fruits and seeds. Bhutanese fibre species include odal (*Sterculia villosa*) for making rope, *Girardiana* spp. for producing ropes and gunny bags, *Musa* spp. for paper making, and *Areca catechu*. Table 3 gives information on fibre in Bhutan. Other fibre-producing species are *Cannabis* sp. (bark), *Urtica* sp. ("jazu" in Sharchop-kha), *Girardiana palmata* ("zangjazu" in Sharchop-kha), *Boehmeria* sp. ("pu yangzewa" in Sharchop-kha), *Agave* sp., *Daphne* sp., *Edgeworthia* sp., *Kydia calycina* and *Grewia* sp.

Floss

Floss is obtained from tree pods, and collected from kapas (*Gossypium* spp.) and semul (*Bombax ceiba*). The capsules of these trees yield floss which is soft, yet strong. *Gossypium* and *Bombax ceiba* grow in the sub-tropical areas of southern Bhutan (Table 4). Rural Bhutanese collect floss to make pillows and mattresses. Another floss species reported is *Ceiba pentandra*.

Table 3 Information on Fibre in Bhutan

Botanical name	Local name	Distribution
<i>Sterculia villosa</i>	Odal (N) Phrangshing (Sh)	Sarpang Samdrup Jongkha Diafan Bhangtar Nganglam Manas Zhemgang
<i>Girardiana</i> spp.	Sishnu (N)	Sarpang Sandrup Jongkha Bhangtar Diafan Nganglam

Note: (N) = Nepali
(Sh) = Sharchop-kha

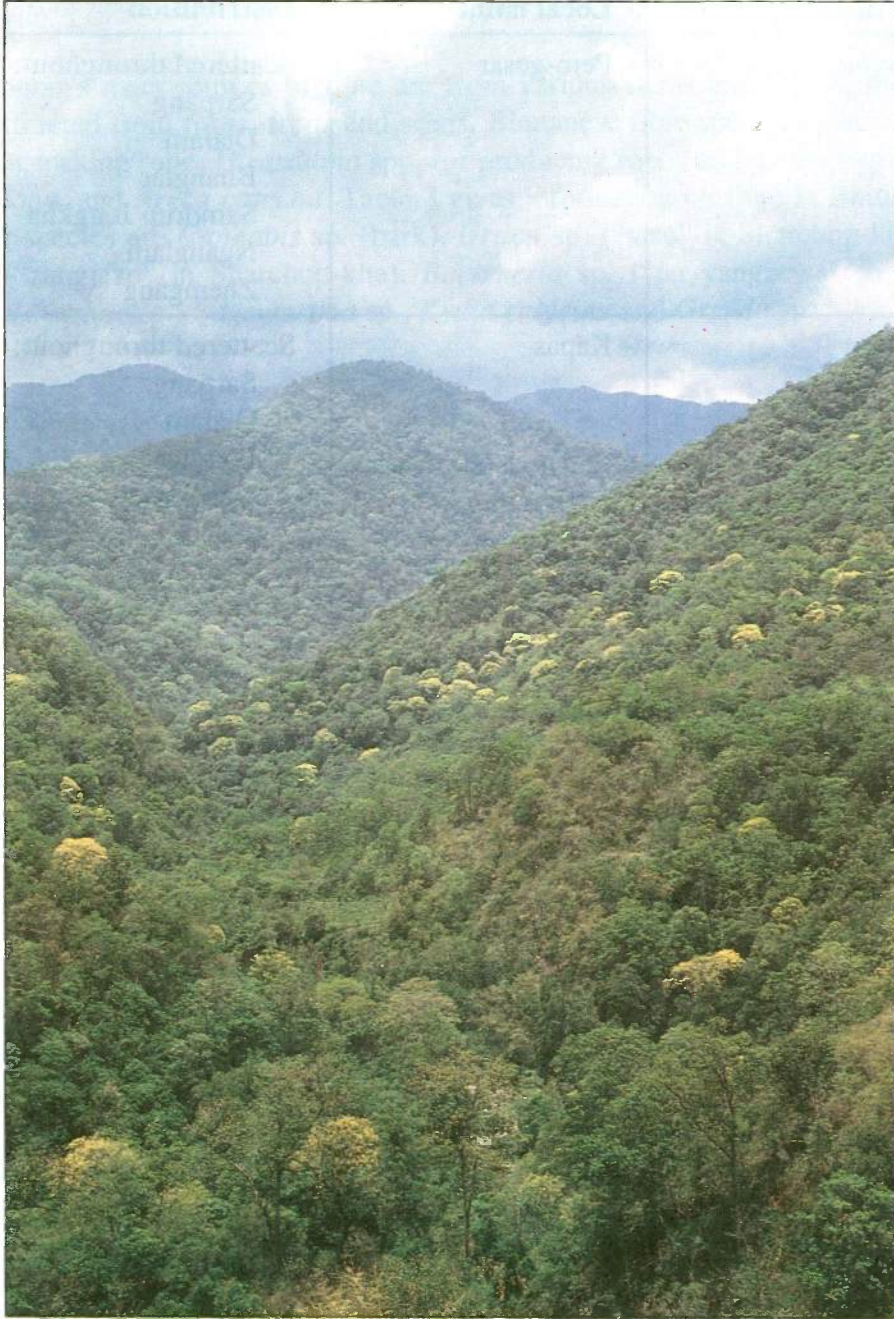
Table 4 Information on Floss in Bhutan		
Botanical name	Local name	Distribution
<i>Bombax ceiba</i>	Pem-gesar	Scattered throughout: Sarpang Diafam Bhangtar Samdrup Jongkha Nganglam Zhemgang
<i>Gossypium</i>	Kapas	Scattered throughout: Sarpang Diafam Bangtar Ngaylam Manas

Brooms

The most common species used to make brooms is *Thysanolaena maxima*, known locally as “kucho,” “amkso,” or “tsakusha.” This species is found in Bhutan's sub-tropical areas (Table 5). Other materials used for brooms are lemon grass, pal (“cari” or “sysam” in Sharchop-kha), *Phoebe*, *Sida*, bamboo leaves and split bamboo culms, and coconut leaves.

Table 5 Information on Brooms in Bhutan		
Botanical name	Local name	Distribution
<i>Thysanolaena maxima</i>	Kucho (N) Tshakusha (Dz)	Scattered throughout: Sarpang Nganglam Norbugang Kulikatla Diafam Bhangtar Samdrup Jongkha Manas Zhemgang

Note: (N) = Nepali
(Dz) = Dzongkha



Bhutan's hills and forests house a wide variety of medicinal plants—so many, in fact, that the total is not yet known.

Medicinal Plants

by Raling Nawang

Project Manager

Integrated Forest Management Project, Bumthang

The Royal Government of Bhutan

A wide range of plant diversity covers Bhutan's two main mountain ranges, the Lho-Menjong and the Druk-Yul. From these rugged mountains come over 300 plant species traditionally used in preparing indigenous (Ayurvedic) medicine. Table 6 shows some of these plant species.

Medicinal plants collected from Bhutan's temperate and lower zones are known under the traditional broad classification as "THRO-MEN," while plants from the country's alpine zone are known as "NGO-MEN."

In the case of "THRO-MEN" plants, specific parts of the plants (e.g., the roots, bark, wood, leaves, flowers or fruit) are generally collected, while for "NGO-MEN," the whole plant is gathered for its medicinal properties.

TRADE IN MEDICINAL PLANTS IN THE PAST

In Bhutan's past, medicinal plants, such as manjito (*Rubia cordifolia*), chereta (*Swertia cherita*), pipla (*Piper nigrum* and *Piper longum*), sarpagandah or nakbhel (*Rauvolfia serpentina*) and putishing/kutki (*Picorrhiza kurroa*), among others, were sold to India. The sales method used was the leasing of large tracts of land through tenders or auctions. The highest bidder was given full access to and jurisdiction over seasonal collection in the area allotted. Such produce was classified as minor forest produce (MFP) and could be exported to India upon issuance of a "Certificate of Origin" by the Divisional Forest Officers concerned.

The Royal Government of Bhutan realised that in the long run, however, such non-scientific harvesting of plant species would bring more harm than the revenue generated. Hence the ban on exporting MFP—which included medicinal plants—imposed in the early 1980s, remains valid to date.

SCOPE FOR INTERNATIONAL MARKETING

A number of medicinal plant species growing naturally in Bhutan have international market value. Among these are agar wood (*Aquilaria agallocha*), *Rauwolfia serpentina*, tshe (*Ephedra gerardina*), Himalyan yew (*Taxus baccata*), chutsa (*Rheum nobile*), chumtsa (*Rheum accuminita*), kutki/putishing (*Picorrhiza kurroa*), pangpoi (*Nardostachys jatamansi*), tsenduk rig (*Aconitum* spp.), and yartsa-gunbu (*Cordyceps sinensis*). All are in high demand for pharmaceuticals.

Owing to the great volume of competitive synthetic products currently marketed, the trade in medicinal plants and their derivatives has declined in many industrialised countries (*Study on the Market for Selected Medicinal Plants and Their Derivatives*, Geneva, 1982.) Trade in botanicals, however, has risen following their relatively recent increased use by the food and cosmetics industries. A renewed interest in traditional medicine in Asia, and the introduction of health foods in Europe and North America, has between them provided new outlets for many botanical products.

Over 400 botanicals are used commercially in Western Europe, with Hamburg as the centre for the trade. Of the Western nations, the United States is the major importer of medicinal plants. Japan is the major importer among Asian countries.

SCOPE FOR CULTIVATING MEDICINAL PLANTS

The National Institute of Traditional Medicine (NITM) has a programme for research on, and propagation of, medicinal plants. During the reign of Bhutan's second king, His Majesty Jigme Wangchuck (1926-52), the people of the Bumthang Valley cultivated two medicinal plant species—manu (*Innula helenium*) and ruta (*Saussurea lappa*). Both these plants were used for producing “sowa-rigpa” medicine and incense. Unfortunately, the present generation in Bumthang knows little of these two plants.

The manu plant, however, is in demand from NITM in Thimphu. The plant has survived years of neglect and is now cultivated in Ura by one family for supply to the Indigenous Hospital in Thimphu. The fate of the second plant, ruta, is not known. A survey is needed to determine if it still exists in the valley.

During Bhutan's Fourth Five-Year Plan (1972-77), the planting of agar wood in lower Kheng villages, such as Panbang, Shilingtot, Mamung, and Pantang, was encouraged by the late Dasho Keiji Nishioka on his family's private land. The agar wood plants have now grown to over 10 metres in height and 12 to 15 centimetres in diameter (measured during the author's visit in January, 1993). Some villagers are growing 20 to 30 or more trees, and say the trees are not difficult to propagate. Only those plants infected by a particular fungus, through a yet unknown mechanism, however, produce the highly-valued agar wood. No report has been received so far as to whether some of the planted trees have produced this most valuable type of agar wood.

Ipacac (*Cephalus ipacacaunha*) and *Dioscorea deltoides* are cultivated on large plantations in India just across the Bhutanese border. Proceeds from these plantations reportedly amount to over 10 million rupees, or some US\$ 319,000, per annum. Similar plantations are quite possible within Bhutan.

NATURE: THE BEST TEACHER

Most plants readily propagate naturally. For example, pipla (*Piper* spp.) is very common in Bhutan's southern belt and *Rheum accuminita* and *Aconitum* sp. frequently occur in the sub-alpine and alpine belts of the country's northern region. The abundance of these plants is entirely due to a well-balanced ecosystem within which these plants flourish.

Nature is the best teacher. In the absence of technical know-how for the propagation of many important medicinal plants, studies must be undertaken and data gathered on the how these plants can be cultivated and made economically beneficial. The environmental conditions—geology, soil, plant association, climate, etc.—must also be studied and used as a guide and reference for their large-scale propagation.

MEDICINAL PLANTS, PRESENT COLLECTION TRENDS AND CURRENT PROBLEMS

Upon request by NITM to collect medicinal plants, the Forestry Services Division (FSD) issues permits on a case-by-case basis. The location for collection and quantity to be collected are specified in the permits. But often the collection of the permitted quantity is not possible as the required species is not available in adequate volume.

NITM shows samples of the medicinal plants to local labourers, who are then requested to collect and bring in the required quantity of each species. The collectors are paid on a daily basis, or sometimes contracted under lump-sum agreements. The required permits are given to the collectors, who are paid only upon receipt of the produce. Payment is generally made for each kilogramme collected. For quality control, “dungtshoes,” or indigenous technicians, supervise the collection whenever possible. It is virtually impossible, however, for Bhutan's scant core of technicians to reach every collection area for screening. In most cases, meeting the collection target for the year is more important to collectors than is scientific harvesting on a sustainable basis. Lacking technical directives and proper guidelines, this is to be expected. This is the probable reason why some species have decreased by almost 50 percent over the past 20-25 years in localities where they once grew abundantly (personal communication with locals and NITM, 1994).

But this should not lead one to conclude that all harvesting is necessarily destructive. Quite the contrary, many plant species benefit when mature plants are removed and space is created for new plants to grow.

Generally, alpine plants flower in August, which coincides with the NITM team's collection schedule for herbal plants. At this time, even the fruits from the earlier-flowering plants are not yet ripe or mature enough for their seeds to be shed. For many herbs, the whole plants are collected, including both flowers and fruit. This method of collection reduces the chances for regeneration and hence threatens the very existence of some species. If such methods continue, some species may become extinct.

GENERAL RECOMMENDATIONS

- Collect detailed information on the extent and frequency of occurrence of species. Priorities should be set for each species.
- Develop efficient and cost-effective methods for propagating rare and important medicinal plants, as well as for such species as agar wood, important on the international market.
- Legalise and promote cultivation of commercial medicinal plants on private farms under a social forestry scheme. In the initial stages, the Government should establish an export market and “buy-back” system to encourage private entrepreneurs to undertake mass cultivation. Thus the Indigenous Hospital's requirements would be met, while the surplus could be exported. Establishing plantations for medicinal plants would also reduce wasteful harvesting from the natural forest.
- The Forest Research Division should co-operate with NITM's Research and Propagation Programme, including in the exchange of information and technical know-how. At the same time, FSD should develop a mechanism to monitor NITM's methods, the quantities it collects, and the species harvested annually. At present, FSD is completely uninformed on these matters.

CONCLUSION

If present trends in ad-hoc harvesting/collection continue, the scope for the economical harvesting of all medicinal plants from the wild, on a sustainable basis, will become practically nil. The only option remaining is to introduce large-scale cultivation through artificial propagation. Natural resources are presently being depleted in the natural forests due to annual and non-scientific collection of the various species on an ad hoc basis. New settlements and the expansion of land under cultivation also threatens the survival of natural forests. Unless artificial propagation is adopted, it is only a matter of time before some of these plants become extinct.

Table 6 Medicinal Plants in Bhutan

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Meconopsis simplicifolia</i>	Papaveraceae	Upel	-	Herb	Rare; scattered locations in Soi, Barshong and Lingshi; 4,300 m.	Whole plant	-
<i>Aconitum orochryseum</i>	Ranunculaceae	Bongkar	Bong-nga (Sh)	Herb	Rare; scattered locations in Shoduk and Lingshi; 3,500-4,500 m.	Tubes	-
<i>Onosma hookeri</i>	Boraginaceae	Drimok	Muktsi (Sh)	Herb	Rare; scattered locations in Bumthang and Thimphu; 2,600-3,500 m.	Root	Used for religious purposes
<i>Pedicularis oederi</i>	Scrophulariaceae	Lukru-serpo	-	Herb	Rare; scattered locations in Lingshi and Soi; 3,600-4,500 m.	Onosma plant	-
<i>Pedicularis longiflora siphonantha</i>	Scrophulariaceae	Lukru-mukpo	-	Herb	Rare; scattered locations in Bumthang and Lingshi; 3,500-4,500 m.	Whole plant	-
<i>Saxifraga mucronulata</i>	Saxifragaceae	Dritasazin	-	Herb	Rare; scattered locations in Bumthang and Paro; 4,500 m.	Whole plant	-
<i>Salvia</i> sp.	Labiatae	Jeeptsi	-	Herb	In pockets in Thimphu and Bumthang; 2,500-3,600 m.	Flower	-
<i>Polygonatum verticillatum</i>	Polygonaceae	Rangey	-	Herb	In pockets in Paro and Thimphu; 2,400-4,000 m.	Root	Can be cultivated
<i>Nardostachys jatamansi</i>	Velarianaceae	Pangpoi	Pangpay (Dz/Sh)	Herb	Rare; scattered locations in Haa, Paro, Thimphu and Bumthang; 4,000-4,500 m.	Root	Used as incense
<i>Delphenium brunonianum</i>	Ranunculaceae	Jagoidpae	-	Herb	Extremely rare; found in Nelela and Chheewla; 4,500-5,300 m.	Whole plant	Used as incense

(continued on page 26)

Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Senecio chrysanthemoides</i>	Compositae	Gudee	-	Herb	Rare; found in Bumthang and Thimphu; 2,500-3,500 m.	Whole plant	-
<i>Gentiana urnula</i>	Gentianaceae	Ganga-Chhung	-	Herb	Extremely rare; found in Yaalela and Nelela Chhewla; 4,500-5,000 m.	Whole plant	-
<i>Juniperus recurva</i>	Cupressaceae	Shuk-tsher	Shup (Dz), Shukpashing (Sh)	Tree	In pockets in Pelela, Laya and Chelela; 3,400-4,500 m.	Leaves	Used as incense
<i>Picorrhiza kurroa</i>	Scrophulariaceae	Honglen and Ngo-Honglen	Puti-shing (Dz), Kutki (N)	Herb	Rare; found in Dagala, Memla and Nelela; 4,500 m.	Root	Marketed to India
<i>Aconitum patulam</i>	Ranunculaceae	Menchhen and Bongnak	Manchhen (Sh), Tsenduk (Dz)	Herb	In pockets in Bumthang, Merak, Laya, Soi, Paro and Haa; 2,700-4,000 m.	Root	-
<i>Gyannadenia crassinervis</i>	Orchidaceae	Wanglak and Wangpoilakpa	Wanglak (B)	Orchis/ Herb	Rare; found in Bumthang, Soi and Lingshi; 3,400-4,000 m.	Root	-
<i>Helene elliptica</i>	Gentianaceae	Chaktik	-	Herb	In pockets in Thimphu, Haa and Bumthang; 2,300-3,800 m.	Whole plant	-
<i>Codonopsis foetens</i>	Campanulaceae	Luded-Dorji	Gaytangru (Sh)	Climber/ creeper	Rare; scattered locations in Chebesa and Lingshi; 4,300 m.	Whole plant	-
<i>Pulicaria</i> sp.	Compositae	Mingchen-nakpo	-	Herb	Rare; in pockets in Lingshi; 4,000 m.	Flowers	-
<i>Taraxacum tibeticum</i>	Compositae	Khenkar	Khenpa-karpo (Dz/Sh/B)	Herb	Rare; scattered locations in Bumthang, Paro and Haa; 4,000 m.	Whole plant	Used as incense
<i>Podophyllum emodi</i>	Podophyllaceae	Yolmosey	Goegabetapi (Sh)	Herb	Scattered locations in Gunitsawa and Thimphu; 2,500-3,500 m.	Root	-

(continued on page 27)

Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Fritillaria nanum</i>	Liliaceae	Aambhi and Ambhikha	Lily (C)	Herb	Rare; scattered locations in Selela and Barshong; 3,800-4,300 m.	Bulb	-
<i>Bistortia coriacium</i>	Polygonaceae	Pangram	-	Herb	Abundant in Bumthang, Haa and Barshong; 3,100-4,500 m..	Root	-
<i>Angillica cyclocarpa</i>	Umbelliferae	Tunak-tsawa, Tunak	-	Herb	In pockets in Dolamjencho and Barshong; 3,000-3,600 m.	Root	-
<i>Acer ricephalus</i>	Compositae	Lukmig	-	Herb	Scattered locations in Bumthang and Laya; 4,600 m.	Flower	-
<i>Fritillaria delavaye</i>	Liliaceae	Karpochhikhup	Tsika (Dz)	Herb	Extremely rare; found in Chhewla and Yaalela; 4,500-5,200 m.	Bulb	-
<i>Pedicularis amas</i>	Scrophulariaceae	Langna	-	Herb	Scattered locations in Zambuhang and Soi; 3,800 m.	Whole plant	-
<i>Ranunculus nuichillus</i>	Ranunculaceae	Chesha	-	Herb	In pockets in Soi and Zambuhang; 3,800 m.	Achsuc/fruit	-
<i>Taraxacum officinale</i>	Compositae	Khurmang	-	Herb	Abundant in Thimphu and Phajoding; 2,500 m.	Whole plant	-
<i>Angelica sinensis</i>	Umbelliferae	Tangkuen	-	Herb	In pockets in Laya, Soi and Dhur	Root	-
<i>Astragalus yunnanensis</i>	Linguminosae	Sedkar	-	Herb	Abundant in Thimphu and Barshong; 2,400-3,500 m.	Whole plant	-
<i>Gentiana grandiflora</i>	Gentianaceae	Ngodewa	-	Herb	Scattered locations in Soi, Laya and Dhur; 3,500-4,500 m.	Whole plant	-
<i>Arenaria denissima</i>	Caryophyllaceae	Atong	-	Herb	Rare; found in Laya and Lingshi; 3,600-5,500 m.	Whole plant	-
<i>Anisedus luridus</i>	Solanaceae	Thangthrom	-	Herb	Scattered locations in Selela and Phading; 3,500-4,000 m.	Fruit	-
<i>Androsace hookeriana</i>	Primulaceae	-	Gatik-mukpo	Herb	Scattered locations in Shoduk and Soi; 3,500-4,500 m.	Whole plant	-

(continued on page 28)

Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Galium aparine</i>	Rubiaceae	Zangtsi-karpo	Zangtsi-rokpu (Sh)	Creepers	Scattered locations in Trashigang, Bumthang, Thimphu and Paro; 800-3,000 m.	Whole plant	-
<i>Rubia cordifolia</i>	Rubiaceae	Tseod	Tsey (Dz), Laniru (Sh), Majito (N)	Creepers	Abundant in Pemagatshel, Wamrong and Trashigang; 1,000-2,000 m.	Root	Used as dye
<i>Herecleum candicans</i>	Umbelliferae	Tukar	-	Herb	Scattered locations in Bumthang and Lingshi; 3,500-4,000 m.	Root	-
<i>Publicaria insignis</i>	Compositae	Mingchen-serpo	-	Herb	Rare; found in Barshong and Gunitsawa; 2,600-3,800 m.	Whole plant/flower	-
<i>Delphinium cashmerianum</i>	Ranunculaceae	Jakang	-	Herb	Scattered locations in Paro, Thimphu and Dhur; 2,300-3,500 m.	Whole plant	-
<i>Erysisimum bhutanica</i>	Cruciferae	Gongthokpa	-	Herb	Rare; found in Thimphu, Paro and Lingshi; 3,600-4,100 m.	Whole plant	-
<i>Silene setisperma</i>	Caryophylleae	Luksuk	-	Herb	Rare; found in Gunitsawa and Barshong; 3,500 m.	Whole plant	-
<i>Piper longum</i>	Piperaceae	Pipling	Pipli (N)	Climber	Abundant in South Jongkha, Sarpang and Samtse; 150-500 m.	Fruit	Marketed to India
<i>Oroxylum indica</i>	Bignoniaceae	Tsampaka	Tsampaka (Dz), Namkalingshing (Sh)	Tree	In pockets in Trashigang, Samtse and Panbang; 200-1,500 m.	Flower/seed	Religious, rare
<i>Pinus roxburghii</i>	Pmaceae	Shelta	Resin from pine (C), Thetong (Dz), Reynangshing (Sh)	Tree	Abundant in Trashigang, Mongar, Wangdue and Punakha; 500-1,500 m.	Resin	-

(continued on page 29)

Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Taxus baccata</i>	Taxaceae	-	Keyrangshing (Sh)	Tree	Rare; scattered locations in Haa, Paro, Thimphu and Bumthang; 2,100-3,300 m.	Bark/leaves	-
<i>Lanceae tibetica</i>	Scrophulariaceae	Paayak	-	Herb	Rare; found in Chebesa and Gangyul; 3,800-4,200 m.	Whole plant	-
<i>Silajit</i> sp.	-	<i>Dakzhun</i>	-	Rock	Extremely rare; found in Haa and Thimphu; 1,800-2,500 m.	Rock exude	-
<i>Zingiber officinale</i>	Zingiberaceae	Menga	Saga (Dz/Sh), Aaduwa (N)	Herb	In pockets in Samtse, Sarpang, Phuntsholing and Khen; 150-1,500 m.	Rhizome	Cultivable
<i>Hedychium spicatum</i>	Zingiberaceae	Gacha	Borangsaga (Sh)	Herb	In pockets in Wangdue, Punakha, South Jongkha and Trashigang; 200-1,500 m.	Rhizome	-
<i>Amomum subutatum</i>	Zingiberaceae	Kakola	Ailanchi (N)	Herb	Abundant in Geylephug, Shemgang and Samtse; 200-1,500 m.	Fruit	Easily cultivated
<i>Xanthoxylum alatum</i>	Rutaceae	Yaarma	Thi-ngey (Dz), Gee (Sh), Timber (N)	Medium-sized tree	In pockets in Thimphu and Trashigang; 1,500-2,100 m.	Fruit	Easily cultivated
<i>Areca catechu</i>	Palmae	Goyu	Doma (Dz), Gugay (Sh)	Palm tree	In pockets in South Jongkha and Samtse; 150-300 m.	Fruit/seed	Easily cultivated
<i>Phyllanthus emblica</i>	Euphorbiaceae	Churu	Chhorgengsoi (Sh)	Tree	In pockets in Wangdue, Punakha and Trashigang; 800-1,500 m.	Fruit	-
<i>Kaempferia galanga</i>	Zingiberaceae	Gacha	Borangsaga (Sh)	Herb	Scattered locations in Punakha, Wangdue and Trashigang; 800-1,500 m.	Rhizome	-

(continued on page 30)

Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Asparagus racemosus</i>	Liliaceae	Ngeyshing	Ngalakom (Sh), Ngakhacho (Dz)	Herb	In pockets in Punakha, Wangdue and Trashigang; 800-1,500 m.	Root	Easily cultivated
<i>Rhus chinensis</i>	Anacardiaceae	Datik	Chokashing (Dz), Roptangshing (Sh), Bhakimlo (N)	Small tree	Found in large quantities	Fruit	-
<i>Erythrina stricta</i>	Papilionaceae	Khalmashosha	Chhasey (Dz), Faleydo (N), Kharshing (Sh)	Tree	In pockets in Trongsa, Punakha, Trashigang and Chimakothi; 500-1,500 m.	Seed	-
<i>Adhatoda vasica</i>	Acanthaceae	Thro-Bashaka	Bashakha (Dz), Khateermu (Sh), Bashak	Shrub	In large quantities in Punakha, Wangdue, South Jongkha, Panbang and Manas; 200-1,000 m.	Flower	-
<i>Herocleum wallachii</i>	Umbelliferae	Tumakarpo	-	Herb	Scattered locations in Lingshi, Laya, Bumthang; 2,500-4,000 m.	Root	-
<i>Herocleum dissectum</i>	Umbelliferae	Tunak	-	Herb	Scattered locations in Lingshi, Laya, Bumthang and Barshong; 25-1,000 m.	Root	-
<i>Cremanthodium humile</i>	Compositae	Mingchenserpo	-	Herb	Rare; found in Barshong, Dolamkencho and Gunitsawa; 2,500-3,500 m.	Flower/whole plant	-
<i>Pedicularis longiflora</i>	Scrophulariaceae	Motoklangna	-	Herb	Rare; found in Lingshi; 4,000 m.	Flower whole plant	-
<i>Euphorbia sikkimensis</i>	Euphorbiaceae	Tharnu	-	Herb	Abundant in Soi and Lingshi; 3,800-4,500 m.	Tubes	-
<i>Euphorbia griffithii</i>	Euphorbiaceae	Durjeet	-	Herb	Scattered locations in Thimphu, Paro and Bumthang; 2,200-3,800 m.	Root	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Gentiana veitchiorum</i>	Gentianaceae	Pangen-metok	Gangi-Pangenmotok (Dz)	Herb	Scattered locations in Bumthang, Laya and Soi; 3,800-4,500 m.	Flower/whole plant	-
<i>Rhododendron anthopogon</i>	Ericaceae	Dalimetok, Balu	Balu (Dz/B/Sh)	Shrub	In pockets in Phajoding, Bumthang and Merak; 3,800-4,500 m.	Flower	Used as incense
<i>Rhododendron setosum</i>	Ericaceae	Sulu	Sulo (Dz/Sh/B/T)	Shrub	In pockets in Haa, Paro, Thimphu, Laya, Lingshi and Merak/Sakten; 3,600-4,500 m.	Flower	Used as incense
<i>Juncus grisbachii/hippris</i>	Juncaceae	Dambukara	Juncus (C)	Herb	Scattered locations in Thimphu and Paro; 500-3,500 m.	Whole plant	-
<i>Cotoneaster microphylla</i>	Rosaceae	Japhotsitsi	Cotoneaster (C)	Shrub	Abundant in Thimphu, Paro, Haa and Bumthang; 2,200-4,000 m.	Fruit	-
<i>Cirsium</i> sp.	Compositae	Jarokngungma	-	Herb	Rare; found in Jhomolhari and Lingshi; 4,000 m.	Flower/whole plant	-
<i>Malcolmia</i> sp.	Cruciferae	Jeewolaphu	-	Herb	Found in Thimphu and Bumthang; 2,200-3,500 m.	Whole plant	-
<i>Sorosieris hookerianum</i>	Compositae	Solgongpa	-	Herb	Rare; found in Soi and Dungshola; 4,000-4,500 m.	Whole plant	-
<i>Cuscuta sinensis</i>	Convolvulaceae	Serkuet	Bayding/dukpoo-ru (Sh)	Creepers	Scattered locations in Wamrong, Gedu and Chhatshilakha; 500-2,000 m.	Whole plant	-
<i>Artemisia severaiana</i>	Compositae	Tsa-aatong	-	Herb	Abundant	Whole plant	Used as antiseptic
<i>Chrysanthemum tateianense</i>	Compositae	Aajak	-	Herb	-	Flower/whole plant	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Pedicularis deorissima</i>	Scrophulariaceae	Lukru-marpo	-	Herb	In pockets in Bumthang and Laya; 4,000 m.	Whole plant	
<i>Datura metel/stramonium</i>	Solanaceae	Thangthrom-karpo	Dungmomnang (Sh), Devil's plant (C)	Herb	In pockets in Wamrong, Trashigang, South Jongkha and Thimphu; 200-2,400 m.	Fruit	Grows on fallow land
<i>Scopolia lucida</i>	Solanaceae	Thangthrom-nakpo	-	-	In pockets	Fruit	-
<i>Hyecoum leptocarpum/exectum</i>	Cruciferae	Parpata	-	Herb	Rare; found in Trashigang, Khaling, Bumthang and Thimphu; 300-2,800 m.	Whole plant	Grows in fields
<i>Ixeris gracilis</i>	Compositae	Tsathri-chook	-	Herb	Rare; found in Barshong and Bumthang; 2,500-3,500 m.	Whole plant	-
<i>Hippophae rhamnoides</i>	Rhamanceae	Tarboo	Seabuck-thorn (C)	Small tree	Abundant in Paro, Dechhencholing and Bumthang; 2,500-3,300 m.	Fruit	-
<i>Cassia tora</i>	Caesalpinaceae	Thekadorji	-	Herb	Found in South Jongkha, Sarpang, Samtse and Punakha; 200-111,500 m.	-	-
<i>Acorus gramineus</i>	Aroideae	Shudak-karpo	Silijam (Dz), Bortsl (Sh)	Herb	In pockets in Trashigang and Thimphu; 500-3,000 m.	Rhizome	-
<i>Cassia fistula</i>	Caesalpineae	Donga	Dongkoshing (Sh)	Tree	Scattered locations in South Jongkha, Sarpang, Punakha and Trashigang; 200-1,500 m.	Fruit/seed	-
<i>Brassica sp.</i>	Cruciferae	Yoongkar	Yoongkar (Dz)	Herb	Rare; found in Samrang; 200-1,500 m.	Pod/seed	Cultivable
<i>Terminalia chebula</i>	Combretaceae	Aaru	Aaru (Dz/Sh)	Tree	In pockets in Samtse, Sarpang, South Jongkha and Shamgang; 200-1,000 m.	Fruit	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Terminalia belerica</i>	Combretaceae	Baru, Barura	Baru (Dz/Sh/T/B)	Tree	In pockets in Samtse, Sarpang, Wangdue, South Jongkha and Kheng; 200-1,500 m.	Fruit	-
<i>Morus laveaegata</i>	Urticaceae	Sengdengshing	Sengdengshing (Sh), Tshendey (Dz), Kimbu (N)	Tree	In pockets in South Jongkha, Sarpang, Samtse, Shemgang and Punakha; 200-1,500 m.	Extracts from heartwood	Cultivable
<i>Enteda gigantea</i>	Leguminosae	Twiner	Kolokpu-sae (Sh)	Twiner	Rare; found in Deothang, South Jongkha, Kheng, Shemgang and Manas; 200-1,200 m.	Seed	-
<i>Symplocos craraegoides</i>	Styraceae	Zhungkhen	Pangtsi (Dz)	Small tree	In pockets in Punakha and Thimphu; 1,300-2,500 m.	Leaves	-
<i>Aristolochia griffithii</i>	Aristolochiaceae	Baleyka	Pitcher plant (C)	Twiner	Scattered locations in Haa and Chendebjee; 1,800-2,500 m.	Flower	-
<i>Embelia ribes</i>	Myrsinae	Getangka	-	Small tree	Rare; 2,500-2,900 m.	Seed	-
<i>Bombax ceiba</i>	Malvaceae	Pemageyser	Pemgeyser (Sh)	Tree	Abundant in South Jongkha, Sarpang, Samtse, Manas and Trashigang; 200-1,500 m.	Flower	-
<i>Erythrina arborescens</i>	Papilionae	Khelmazhosha	Chhasey (Dz), Phaledo (N), Kharshing (Sh)	Medium-sized tree	Abundant in Chimakothi, Punakha, Trashigang and Wamrong; 500-1,500 m.	Seed	-
<i>Cucurbita pepo</i>	Cucurbitaceae	Kabet	-	Climber	Abundant, 100-800 m.	Fruit	-
<i>Aquilaria agallocha</i>	Thymelaeaceae	Aagurushing	Aagurushing (Dz, Sh, T)	Medium-sized tree	Extremely rare; found in Samrang, Manas, Panbang, Samdrup Jongkha and Kheng; 150-1,500 m.	Heartwood	-
<i>Tinospora cordifolia</i>	Minispermaceae	Seydey	-	Shrub	Abundant, 200-1,000 m.	Fruit/seed	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Canarium sikkimensis</i>	Burseraceae	Peykar	Poskar shing (Sh)	Tree	Rare; found in Deothang, Pankhar, Kheng and Zhemgang; 500-1,500 m.	Exude or resin	Used as incense
<i>Punica granatum</i>	Rosaceae	Sadey	Sindu (Dz), Thalim (Sh), Dalim (N)	Small tree	Abundant in Trashigang, Depthang, Wangdue, Punakha and Trongsa; 500-1,500 m.	Fruit/seed	Domesticated
<i>Innula helenium</i>	Domesticated	Manu		Herb	Rare; found in Bumthang (cultivated); 3,000-3,500 m.	Root	-
<i>Saussurea lappa</i>	Compositae	Ruta	-	Herb	Extremely rare; 3,000-4,000 m.	Root	-
<i>Capsella bursa</i>	Cruciferae	Sokapa	-	Herb	In pockets in Thimphu, Bumthang and Wamrong; 800-3,000 m.	Whole plant	Grows as weed
<i>Berginia ciliata</i>	Saxifragaceae	Dakcham	-	Herb	Rare	Root	-
<i>Chrysosplenium coronosum</i>	Saxifragaceae	Yaakima	-	Herb	Rare; found in Soi and Lingshi; 3,600-5,200 m.	Whole plant	-
<i>Dryopteris fragrans</i>	-	Rayral	Baynang-gogalapu (Sh)	Fern	In pockets in Wamrong and Trashigang; 500-2,200 m.	Stem	-
<i>Uncaria rhynchophylla</i>	Rubiaceae	Chhusindermo	-	Fern	Rare; found in Tangu and Barshong; 2,000-3,500 m.	Whole plant	-
<i>Myricaria rosea</i>	Myrshinaceae	Wombu	-	Herb	Abundant in Paro and Gunitsawa; 3,000-4,400 m.	Whole plant	-
<i>Aegle marmelos</i>	Rutaceae	Belwa	-	Medium-sized tree	Rare; found in Gaylegphu and Samtse; 150-400 m.	Fruit	Cultivable
<i>Butea monosperma</i>	Leguminosae	Marutsey	Flamingo tree (C)	Medium-sized tree	In pockets in Manas, Gaylegphug and Samtse; 150-500 m.	Fruit	-
<i>Mucuna pruriens</i>	Cesalpinae	Khelzhosha	-	Strong twiner	Rare; 150-400 m.	Seed	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Iris nepalensis</i>	Iridaceae	Dema	-	Herb	Abundant in Lingshi and Laya; 3,500-4,000 m.	Fruit	-
<i>Calotropis gigantea</i>	Asclipidaceae	Shri-khenda	-	Shrub	Rare; found in Gomtu; 100-500 m.	Latex	-
<i>Jatropha curcas</i>	Euphorbiaceae	Denrok-manpa	Ngera-kharshing (Sh)	Small tree	Abundant in South Jongkha, Sarpang, Samtse, Deothang and Punakha; 200-1,500 m.	Seed	Hedge plant
<i>Abies densa</i>	Coniferae	-	Dungshi (Dz)	Tree	Abundant in Haa, Changkaphu and Ura; 3,500 m.	Leaf	-
<i>Rheum nobile</i>	Polygonaceae	Chutsa, Chukardongpo	Chuka (Dz)	Herb	Scattered locations in Dagala, Nelela, Jomolhari and Dhur top; 4,500-5,200 m.	Root	-
<i>Rheum acuminata</i>	Polygonaceae	Chumtsa	-	Herb	Abundant in Dagala, Phajoding and Dhurtshachhu; 3,000-4,000 m.	Root	International market
<i>Clematis montana</i>	Ranunculaceae	Emong	Lanitokaru (Sh)	Climber	Scattered locations in Wamrong and Trashigang; 1,500 m.	Seed/flower	-
<i>Anemone rivularis</i>	Ranunculaceae	Sukpa	-	Herb	Scattered locations in Zambuthang and Lingshi; 3,800 m.	Fruit/achene	-
<i>Rosa sericea</i>	Rosaceae	Sewaimetok	-	Shrub	Abundant in Haa and Thimphu; 2,400 m.	Flower	-
<i>Rosa macrophylla</i>	Rosaceae	Sewaudebu	Wild rose (C)	Twining shrub	In pockets in Bumthang and Ura; 3,300 m.	Fruit	-
<i>Sikkimia laurela</i>	Lauraceae	-	-	Shrub	Scattered locations; 3,000 m.	Leaf extracts	-
<i>Astilbe rivularis</i>	Asteroideae	-	Tongsergugay (Sh), Buroakhoti (N)	Herb	Abundant in Gedu and Khaling; 1,500 m.	Root	-
<i>Mandragora officinarum</i>	Solanaceae	-	-	Herb	Rare; found in Chelela and Selela; 3,600-4,000 m.	Root	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Cordyceps sinensis</i>	-	Yaartsa-gunbu	Yaartsa-gunbu (Dz)	Mushroom (C)	Extremely rare; found in Laya and Lingshi; 3,500-4,500 m.	Whole plant	-
<i>Quercus griffithii</i>	Fagaceae	Moenchhara	Sisi (Dz), Benangshing (Sh)	Tree	In pockets in Raling, Trashigang, Trongsa and Thimphu; 800-2,000 m.	Seed/acorn	Cultivable
<i>Corydalis crisper</i>	Fumariaceae	Khamlu-bashaka	-	Herb	Rare; found in Lingshi; 3,500 m.	Whole plant	-
<i>Geranium lambertii</i>	Geraniaceae	Ligadur	Geranium (C)	Herb	In pockets in Barshong and Dhur; 2,500-3,500 m.	Root	-
<i>Cymbopogon flexuosus</i>	Gramineae	-	Solubang (Sh), Lemon grass (C)	Grass	Abundant in Trashigang and Mongar; 1,500 m.	Leaf extract	-
<i>Dichroa fibrifuja</i>	Hydrangeaceae	-	Borang-yangshabu (Sh)	Shrub	Abundant in Wamrong and Mechhuna; 1,500-2,000 m.	Root	-
<i>Eriophyton wallachii</i>	Labiataeae	Pangtshen puru	-	Herb	Rare; found in Nelela, Yaalayla and Chhewla; 4,000-5,000 m.	Whole plant	-
<i>Phlomis rotata</i>	Labiataeae	Taapak	-	Herb	Rare; found in Soi, Lingshi and Laya; 3,300-3,800 m.	Whole plant	-
<i>Salvia campanulata</i>	Labiataeae	Jeeptsi-karpo	-	Herb	In pockets in Haa, Thimphu and Bumthang; 2,200-3,000 m.	Flower	-
<i>Cinnamomum tamala</i>	Lauraceae	Shingtsha	Tejpat (N)	Medium-sized tree	Rare; found in South Jongkha and Shemgang; 200-1,800 m.	Bark	Used as spice
<i>Cinnamomum zeylanicum</i>	Lauraceae	Shingtsha	Shingtsha (Sh), Dalchini (N)	Small tree	Rare; found in Deothang, Kheng and Panbang; 200-1,500 m.	-	-
<i>Acacia catechu</i>	Leguminosae	-	Jaseng (Dz), Khair (N)	Small tree	In pockets in Samtse, Sarpang and South Jongkha; 150-500 m.	Heartwood extract	-
<i>Oxitropis japonica</i>	Leguminosae	Sedngo	-	Herb	In pockets in Thimphu and Haa; 2,200-3,500 m.	Whole plant	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Allium</i> spp.	Liliaceae	Lagok-rig	Lagok (Dz/Sh)	Herb	Found in Laya and Lingshi; 3,500-4,500 m.	Whole plant	-
<i>Malva verticillata</i>	Malvaceae	Niga and Halemetok	Halemetok (Dz)	Herb	Found in Thimphu (cultivated); 2,300 m.	Flower	-
<i>Ricinus communis</i>	Euphorbiaceae	Denrok-chhok	Chamlingshing (Sh)	Small tree	Abundant in Trashigang, Wamrong, Deothang and Sarpang; 150-1,500 m.	Seed	Cultivable
<i>Swertia chirata</i>	Gentianaceae	Balting	-	Herb	In pockets in Wamrong, Deothang and Sarpang; 200-1,500 m.	Whole plant	-
<i>Phytolacca acinosa</i>	Phytolaccaceae	Pawo-serpo	Zalmathangru (Sh)	Climber	In pockets in Wamrong and Deothang; 200-1,500 m.	Bulb/root	-
<i>Curcuma zedoaria</i>	-	Pagoed	Zalmathangru-tsalu (Sh)	Climber	Found in Wamrong; 200-1,500 m.	Bulb/root	-
<i>Dendrobium curcuminatum</i>	Orchidaceae	Pusheltsey-chhog	Orchid (C)	Orchid	Scattered locations in Narphung and Deothang; 200-2,000 m.	Stem	-
<i>Caelogyne oculata</i>	Orchidaceae	Pusheltsey-meonpa	Churchurba (Sh), Orchid (C)	Orchid	Scattered locations in Wamrong, Deothang and Thinleygang; 700-2,000 m.	Bulb/stem	-
<i>Mucuna entada phaseoloides</i>	Leguminosae	Lagorzhosha	-	-	Rare; 1,000 m.	Seed	-
<i>Semicarpus anacardium</i>	Anacardiaceae	Gojeela	-	-	Rare; 1,000 m.	Seed	-
<i>Holarrhena antidysenterica</i>	Apocynaceae	Dukmongung-chhog	-	Small tree	In pockets in Manas and Panbang; 150-400 m.	Fruit	-
<i>Rauwolfia serpentina</i>	Apocynaceae	-	Surpagandah (Sanskrit)	Herb	In pockets in Samtse and Sarpang; 150-400 m.	Root extracts	Cultivable
<i>Vincetoxicum album</i>	Asclepiadaceae	Dukmongung/Ngodukmongung	-	Herb	In pockets in Gunitsawa and Dechhancholing; 2,000-2,500 m.	Fruit	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Arisaema</i> sp.	Araceae	Dowo	Dowo (Dz), Rungenengsae (Sh)	Herb	Scattered locations in Wamrong, Teybesa and Thimphu; 1,200-2,400 m.	Bulb	-
<i>Panax pseudo-ginseng</i>	Araliaceae	Dingi-raza	Ginseng (C)	Herb	Rare; found in Trashigang, Bumthang, Haa, Paro and Thimphu; 2,000-3,200 m.	Tuber/ root	-
<i>Eugenia cumini</i>	Myrtaceae	Maak	Bjee (Sz), Dangbelingsae (Sh)	Shrub/ small tree	Abundant in Paro, Thimphu and Bumthang; 2,000-3,300 m.	Fruit	-
<i>Eugenia jambolana</i>	Myrtaceae	Seydey	Ngasi (Dz)	Tree	Scattered locations in Manas and Punakha; 150-1,500 m.	Fruit	-
<i>Lapiserus wallachii</i>	-	Dakpay	-	Fern	Rare	Whole plant	-
<i>Lapiserus thunbergianus</i>	-	Tsunmo-rayral	-	Fern	Rare	Whole plant	-
<i>Berberis aristata</i>	Berberidaceae	Kershun	Kerpatsang (Dz)	Shrub	Abundant in Bumthang, Haa, Paro and Thimphu; 2,000-3,500 m.	Bark/ root	-
<i>Erigeron multiradiatus</i>	Compositae	Gelwaichen/Gel waimingchen	-	Herb	Rare; found in Soi, Lingshi and Bumthang; 3,100-4,000 m.	Flower	-
<i>Saussurea gossypiphora</i>	Compositae	Sukdra	-	Herb	Rare; found in Chhewla and Nelela; 4,500-5,200 m.	Whole plant	-
<i>Tanacetum atkinsonii</i>	Compositae	Genthabata	-	Herb	Rare; found in Chhewla and Yaalela; 4,000-5,000 m.	Whole plant	-
<i>Dioscorea bulbifera</i>	Dioscoreaceae	-	Yam (N), Tshema- kewa (Dz), Borang-Joktang/ Fantang (Sh)	Creeper	Rare; found in South Jongkha, Sarpang, Samtse, Wamrong, Pemagatshel and Kheng; 150-1,500 m.	Tuber	Cultivable
<i>Drosera peltata</i>	Droseraceae	Tang-ngu	Drosera/insect plant (C)	Herb	In pockets in Thimphu; 2,400 m.	Whole plant	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Pterocephalus hookeri</i>	Dipsacaceae	Luktsidowo	-	Herb	Scattered locations in Soi, Laya, Ura and Dhur; 2,800-3,400 m.	Flower/whole plant	-
<i>Dipsacus atratus</i>	Dipsacaceae	Pangtsidowo	-	Herb	Scattered locations in Bumthang, Soi and Laya; 2,500-3,500 m.	Whole plant	-
<i>Diospyrys lotus</i>	Ebenaceae	Gundum-Nakpo	Gundum (Dz), Amdebu (Sh)	Small tree	Scattered locations in Punakha Raling; 500-1,700 m.	Fruit	Domesticated
<i>Ephedra herardiana</i>	Ephydraceae	Tshe, Tshedum	Tshe (Dz)	Herb	Rare; found in Dagala, Lingtshi and Soi; 4,500-5,200 m.	Whole plant	-
<i>Mallotus phillipenensis</i>	Euphorbiaceae	-	Sindhuri (Hindu)	Small tree	Scattered locations in Manas and Panbang; 150-1,500 m.	Bark	-
<i>Euphorbia sieboldiana</i>	Euphorbiaceae	Tren-bu	-	Herb	Rare; found in Soi, Naro and Lingshe; 3,500-4,500 m.	Tuber, root	-
<i>Aconitum naviculare</i>	Ranunculaceae	Bong-nga-Karpo	-	Herb	Rare; found in Shoduke and Lingshe; 3,500-4,500 m.	Tuber	-
<i>Leontopodium</i> sp.	Compositae	Tawai-Thok-gu	-	Herb	In pockets in Gangchhen tak and Nelaela; 3,500-4,800 m.	Whole plant	-
<i>Hyoscyamus</i> sp.	Solanaceae	Langthang-tse	-	Herb	Extremely rare; found in Haa-la-chu-la; 3,500-4,000 m.	Fruit/whole plant	-
<i>Elettaria cardamomum</i>	Zingiberaceae	Sukmel	-	Herb	Rare, 200-500 m.	-	Cultivable
<i>Meconopsis horridula</i>	Papaveraceae	Tsher-ngoan	Blue poppy (Eng)	Herb	Rare; found in Soi, Naro and Lingshe; 4,000-4,500 m.	Whole plant	-
<i>Piper nigra</i>	Piperaceae	Phowari	Pipla	Creeping shrub	Scattered; abundant in southern belt; 200-500 m.	Fruit	-
<i>Polygonum</i> sp.	Polygonaceae	Nga-la	Kochokmu, Barshong	Shrub	Scattered locations in Shoduk and Barshong; 3,000-4,500 m.	Root	-

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Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Primula sikkimensis</i>	Primulaceae	Shang-shang-drilba	Primula (Eng)	Herb	Scattered locations in Phajoding and Soi/Naro; 3,000-4,000 m.	Whole plant	-
<i>Lycoperdon pyriformis</i>		Phawa-go-go	Puff-ball (Eng)	Fungus	Rare; found in Shingkar and Bumthang; 2,000-3,500 m.	Whole item	-
<i>Plantago tibetica</i>	Plantaginaceae	Thar-ram	Tsa-shokum-sh	Herb	Abundant throughout Bhutan; 300-3,500 m.	Whole plant	-
<i>Curcuma longa</i>	Zingiberaceae	Yungwa	Juung (Sh), Haldi (N), Yongka (Dz)	Herb	Cultivated in lower zone; 200-2,500 m.	Rhizome	Cultivable
<i>Comarium carvi</i>	Umbelliferae	Go-Ngod	-	Herb	Rare, 200-3,000 m.	Fruit	-
<i>Megacodon scylophoru</i>	Gentianaceae	Key-chay-karpo	Gintian (Eng)	Herb	Rare; found in Gunitsawa, Soi, Naro and Bumthang; 3,000-3,500 m.	Floral part	-
<i>Corydalis dubia</i>	Fumariaceae	Tongzil, Tongri-Zilpa	-	Herb	Rare; found in Soi and Lingshe; 3,500-4,500 m.	Whole plant	-
<i>Thalspi arvense</i>	Cruciferae	Dega	Jay-kha (Dz), Tirmu-Bumthang	Herb	Cultivated in Fromrong, Bumthang and Thimphu; 2,400-3,500 m.	Whole plant	-
<i>Aster neo-elegans</i>	Compositae	Yugushing	-	Herb	Abundant in Haa, Thimphu and Bumthang; 2,500-3,500 m.	Whole plant	-
<i>Thaliostrum foliolosum</i>	Ranunculaceae	Ngang-tse-tray	-	Herb	Scattered locations in Dolamkencho and Thimphu.; 2,200-3,500 m.	Root	-
<i>Tinospora cordifoli</i>	Minispermaceae	Seydey	-	Shrub	Rare, 200-1,000 m.	Fruit/seed	-
<i>Cucurbita pepo</i>	Cucurbitaceae	Kabet	-	Climber	In pockets, 100-800 m.	Fruit	-
<i>Canarium sikkimensis</i>	Burseraceae	Paykar	Poskarshing (Sh)	Tree	Rare; found in Deothang, Pangkhar, Kheng and Shemgang; 500-1,500 m.	Exude/ resin	Used as incense

(continued on page 41)

Table 6 Medicinal Plants (continued)

Botanical name	Family name	Medicinal name	Local name	Form	Distribution	Parts used	Remarks
<i>Aquilaria agalloocha</i>	Thymelaeaceae	Aagarushing	Agurshing (Dz/Sh/T)	Medium-sized tree	Extremely rare; found in Samrang, Manas, Panbang, South Jongkha and Kheng; 150-1,500 m.	Heartwood	-
<i>Punica granatum</i>	Rosaceae	Sadey	Sindu (Dz), Thalim (Sh), Dalim (N)	Small tree	Abundant in Trashigang, Deothang, Wangdue, Punakha and Trongsa.; 500-1,500 m.	Fruit/seed	Domesticated
<i>Innula helenium</i>	Compositae	Manu	-	Herb	Rare; found in Bumthang (cultivated); 3,000-3,500 m.	Root	Domesticated

Note: Dz = Dzongkha
 Sh = Sharchop-kha
 T = Tongsap (Mangdep)
 B = Bumthap
 N = Nepali
 C = Common
 Eng = English



A traditional paper production factory in Thimphu. The bark is soaked in water for cleaning and separating into smaller pieces.

Traditional Paper, Essential Oils, Rosin and Turpentine

by *K.D. Chamling*

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The Royal Government of Bhutan

TRADITIONAL PAPER

Background

Bhutan uses the bark of two tree species in the manufacture of traditional paper (“deh-sho”): dhenap (*Daphne*) and dhekap (*Edgeworthia*).

Resources

Bhutan has five species of *Daphne* and one of *Edgeworthia* (Table 7). All six are found throughout the country, but their distribution and frequency varies—a constraint in providing a continuous supply of raw materials to local cottage industries (Table 8). The *ad hoc* collection of this raw material would not only deplete existing stocks, but threaten its sustainable management as well. Detailed surveys have yet to be carried out.

Processing

The method used to produce paper from bark is quite simple and does not involve the use of chemicals. The plants are stripped and dried and then taken to production centres. In the traditional system, a few strips of the fibre are soaked in a pond and then beaten with a mallet on a flat stone. The fine pulp is placed on a bamboo screen and allowed to spread evenly by suspending it in water. The screen is then dried in the sun. Today the process has become more mechanised, using imported equipment and screens. Besides the greater quantity produced, the paper's quality has also improved. Table 9 gives the annual raw material requirements of Bhutan's paper-making units. The country has a number of family-operated paper-making units. The only semi-mechanised unit is the Jungshi Hand-made Paper Factory, in Thimphu.

Table 7 Raw Material Sources for Traditional Paper			
Botanical name	Local name	Distribution	Forest type and altitude
<i>Edgeworthia gardneri</i>	De shing (Dz) Shogo shing balingmeen (Sh) Kagate, Argale (N)	Kamji, Chukha, Punakha, Putlibhir, Chasilakha and Trongsa (Tashiling and Shemgang)	Wet, sub-tropical forest; 1,670-2,400 m.
<i>Daphne involucrata</i>	Seti barwal, Chhota, Argale, Bimbiri (N)	Chukha, Marichong and Tala	Mixed broad-leaved forest; 1,200-2,000 m.
<i>D. bholua</i>	De shing (Dz) Shogo shing (Sh) Shugu shing (Sh) Kagate, Argayle (N)	Chukha, Punakha, Deothang, Haa, Thimphu and Trongsa Districts	Evergreen oak, blue pine, spruce, hemlock and fir forests; 1,980-3,400 m.
<i>D. sureil</i>	Kagate, Argayle, Bhale and Kagate (N)	Chukha, Punakha Deothang, Trongsa and Trashigang Districts	Warm, broad-leaved and evergreen oak forests; 1,220-2,130 m.
<i>D. retusa</i>		Thimphu and Bumthang; Upper Mo-chu and Upper Bumthang-chu.	Rocky hillsides and wet ravines; 3,700-4,200 m.
<i>D. ludlowii</i>		Bumthang Phepe (Peipe) la	Mixed rhododendron, hemlock, and spruce forests; 3,350-3,580 m. Endemic to Bhutan.

Source: *Flora of Bhutan*, Vol. 2, Part 1.

Note: (Dz) = Dzongkha
(Sh) = Shar chop-kha
(N) = Nepali

Table 8 Availability of Raw Material for Traditional Paper-making in Bhutan		
Location	Area (acres)	Quantity (kg.)
Korila	80	1,600
Gasawang-Khengkhag	30	600
Yalang		
Trashiyangtse		
Khamdang	2,500	50,000
Phongmey		
Bikhar		
Wamrong	250	5,000
Dremtsi	50	1,000
Dhag-sa-Manang	498	9,960
Total	3,408 *	68,160

Source: Forestry Services Division video No. DF/Ga-3-6/94/3954 dated 25 February, 1994.

- * This figure was obtained from information gathered from raw material surveys. These surveys are conducted when an entrepreneur proposes to establish a paper-making unit in a particular area. The actual availability of *Daphne* in Bhutan is much more than shown here. Since the demand is growing, the Forestry Services Division is planning to carry out a more comprehensive survey of the resource throughout the country. Guidelines are being prepared for carrying out this assessment, and for the silvicultural management of *Daphne*.

Table 9 Paper-making Units and Raw Material Requirements in Bhutan				
Factory/unit	Location	Annual raw material requirement at full capacity (kg)	Agent	Remarks
National Women's Association of Bhutan (NWAB)	Kurizampa (Mongar)	24,000	NWAB	
Jungshi Hand-made Paper Factory	Thimphu	32,000	Norbu Tenzin	
Paper Factory	Chorten Kora (Trashiyangtse)	Not yet fixed	Tshewang Norbu	
"	Raptay (Trashiyangtse)	10,000	Thinley Wangchu	
"	Chazam	2,000	Tow Tshering	
M/S Dewang Hand-made Paper Unit	Kabjisa (Thimphu)	94,000		
Paper Factory	Shingkar Lauri	Not yet fixed	Jamtsho	
"	Thramgom and Khaling	16,000	Sherub Tenzin	
"	Radhi	24,000	Tawpo	
"	Bomdheyling	-	Thinley Dorji	Under process
"	Thimphu	-	Nakchung Tshering	"

Note: As the above table clearly indicates, the demand for *Daphne* species for producing local paper is very high. Thus, more entrepreneurs are applying for licenses to establish local paper factories. The volume of raw materials required for an individual unit varies, depending on its size and the number of workers available. Some entrepreneurs prefer to operate a small unit for a few years to produce only a few hundred sheets of local paper for a specific purpose. Others intend to operate large enterprises on a continuing basis. The method of paper processing, therefore, varies from one paper unit to another. Only a few units are presently operating, while others are being established. Quantifying actual demand and production on an annual basis is, therefore, difficult.

Products from the Jungshi Hand-made Paper Factory in Thimphu are now exported to many countries.



Uses

Paper quality depends on the species used. *Daphne* gives strong, dark paper, while paper from *Edgeworthia* is whiter and more fragile. Since all paper produced is durable and attractive, it is used for gift wrapping, greetings cards, prayer books and important deeds.

Marketing

Hand-made paper sells well on both the domestic and foreign markets. Demand from Sweden and the United Kingdom amounts to about 30,000 sheets a year. Japan, Austria and the U.S. have also purchased a few thousand sheets as samples (personal communication with the manager of Jungshi Hand-made Paper Factory in Thimphu).

Production

Figures for Bhutan's total paper production are not presently available. The only reliable figure is for Jungshi Hand-made Paper Factory, which produces about 1,500 sheets per day.

ESSENTIAL OILS

Background

Essential oils, also known as 'volatile oils,' are odoriferous substances widely distributed throughout the plant kingdom. They occur in some 60 plant families and almost any part of a plant may yield oil.

Extraction

Depending on the quantity and stability of the compound, essential oils are mainly extracted by three methods:

- distillation by hot water or steam
- pressed by hand or using machinery
- extraction using such volatile solvents as hot oils, fats (maceration), or cold neutral fats (enfleurage)

Uses

Because of their odour and high volatility, essential oils have a variety of uses, for example, soaps and cosmetics, pharmaceuticals, confectionery, aerated water, scented tobacco and incense, among others.

Grass Oil

Lemon Grass Oil

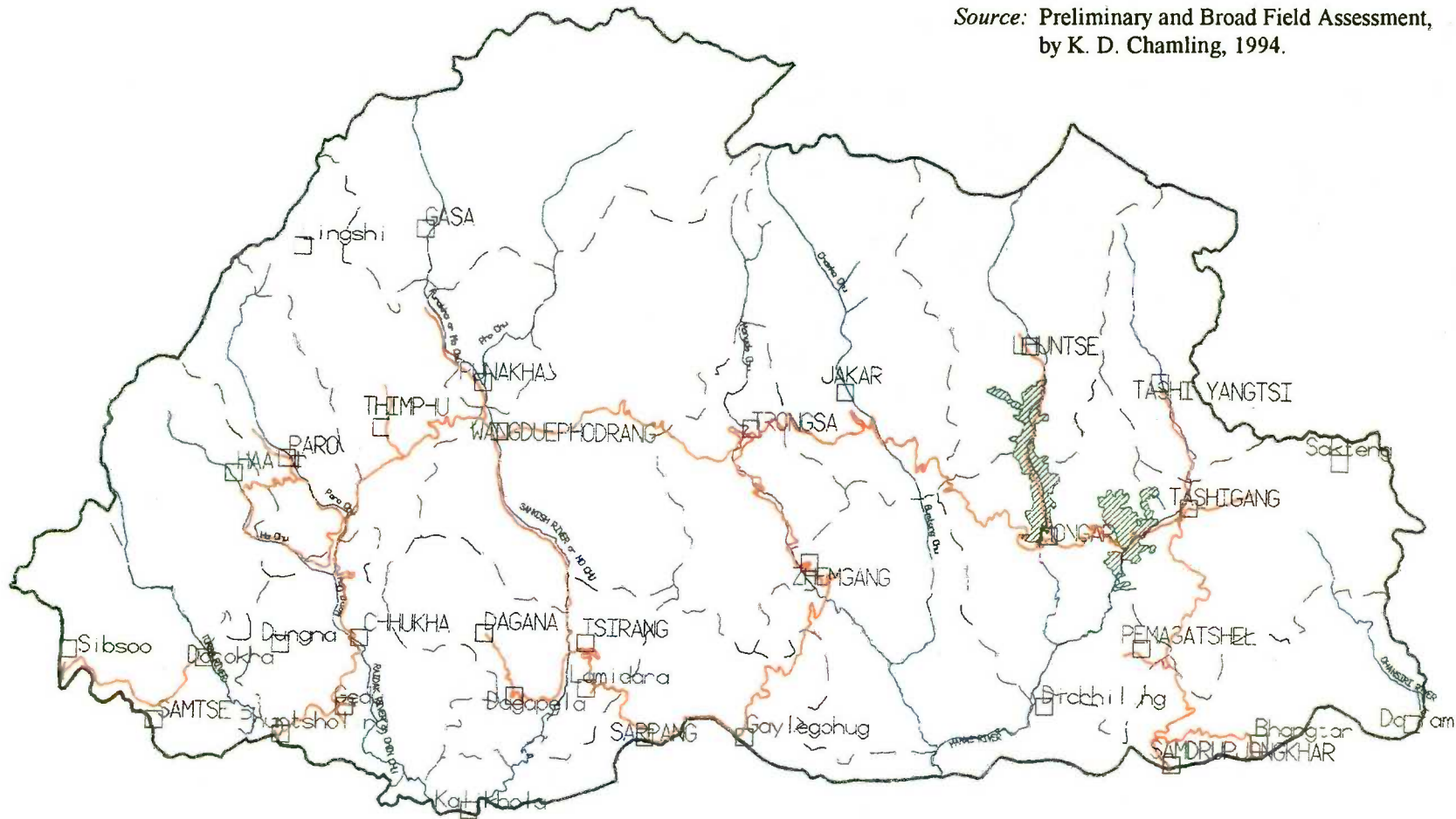
Source: Lemon grass (*Cymbopogon flexuosus*) is found over large areas in Mongar and Trashigang Districts (Diagram 1). It is common in chir pine forests, especially on sandy or gravelly, sloping areas. Lemon grass contains citral—its major constituent. Lemon grass oil quality is judged by its citral content and its solubility in alcohol.

Properties and uses: The oil is of a reddish-yellow to reddish-brown colour, with a strong, lemon odour. It is used in the perfume, soap and cosmetics industries. Lemon grass forms the starting material in the manufacture of synthetic Vitamin A. It is also used in pharmaceutical preparations, such as pain balm, disinfectants, and mosquito-repellent creams.

Diagram 1 Lemon Grass Area in Bhutan

Area = 34,589 hectares (346 sq. km.)

Source: Preliminary and Broad Field Assessment, by K. D. Chamling, 1994.



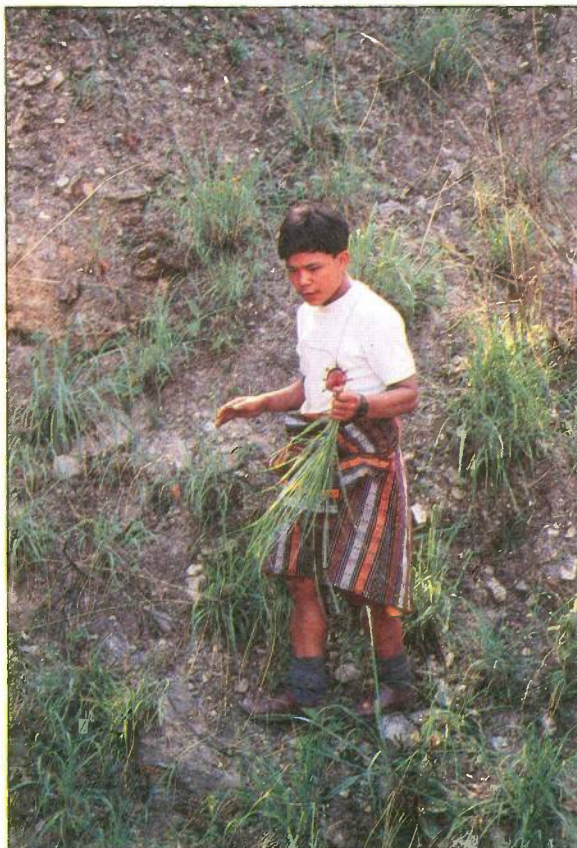
 Lemon Grass

Produced in the GIS/Computer Unit, Resources Development Section, Forestry Services Division, Ministry of Agriculture, Thimphu, June 1995.

Scale 1:1,550,000

Production and trade: Bhutan's production and trade of lemon grass oil was introduced and initially carried out by the Aromatic and Phytochemicals Section of Tashi Commercial Corporation in 1983 and 1984. The oil was processed by steam distillation, using a low-cost, cottage-type distillery made from second-hand petrol drums. Tashi Commercial Corporation now has a large distilling unit at Kurizampa and has sold large numbers of smaller units to the farmers from whom the company now buys the oils. The company also buys lemon grass collected from the wild and delivered to road sides.

The FAO-supported "Production of Essential Oils by Small Holders in Remote Areas" project helped establish two essential oil distilleries at Pakhadrang (Mongar District) and Lungtenzampa (Trashigang District) in 1990, with a total capacity of 2.5 tons of lemon grass per eight-hour working day. The project also helped in establishing germplasm and multiplication nurseries at Gyelpoizhing (Mongar District) and Chhali (Mongar District), using plant materials from India and Europe. Trials on mentha, citronella, vetiver, palmarosa grass and *Basilicum* are presently being conducted.



Lemon grass, which grows extensively in Mongar and Trashigang districts, provides the raw material for a growing essential oils industry in eastern Bhutan.

Scope: To obtain higher quality essential oil, wild lemon grass must be replaced by improved varieties. Palmarosa grass, the most promising alternative, should be planted in areas presently under lemon grass. Palmarosa oil sells for almost double the price of lemon grass oil on the international market.

A few field experiments have been carried out on the native lemon grass growing wild in Bhutan's eastern region. Experiments on different harvest dates, commencing the end of July and spaced at monthly intervals, were conducted to estimate the effects on the biomass and the subsequent oil yields.

The findings showed that the September harvest of native lemon grass yielded the highest biomass (3.22 tons per hectare) and oil yield (9.83 kilogrammes per hectare), with 0.31 percent oil recovery. These experiments, however, have to be repeated to confirm these findings.

A further experiment on the effects of burning on the biomass production and oil yield of native lemon grass (*C. flexuosus*) was carried out on a 40-square-metre plot in Doyang, at an elevation of about 990 metres. The following results were obtained:

Treatment	Biomass yield (tons/ha)	Oil yield (kg/ha)	Citral (%)	Plant height (cm)	Tiller/hill	Hills/ha
With burning	1.625	7.0	85	48	45	59,500
Without burning	3.250	5.25	84	55	55	56,750

Source: "The Effect of Harvest Date on Biomass Production and Oil Yield of Native Lemon Grass (*C. flexuosus*)," by D. Dhungel (Renewable Natural Resources Workshop, 1993).

Palmarosa Oil

Source: Palmarosa oil is obtained from rosha grass (*Cymbopogon martini var. motia*). It is a tall, perennial, sweet-scented grass, which grows from about 1.5 to 4 metres in height. It can also be cultivated.

Distillation: The process is similar to that used for lemon grass.

Properties and uses: Palmarosa oil is a pale-yellow liquid with a characteristic geranium odour. Oil quality is based on the total geraniol content. Palmarosa oil is used as a base for perfumes and cosmetics, for flavouring tobacco, and in mosquito repellent ointments.

Leaf Oils

Winter Green Oil

Source: Commercial winter green oil is derived by water-distillation of the leaves of *Gaultheria procumbens*. Prior to distillation, the leaves are exposed to the enzymatic action of warm water. During this process, the aromatic chemical, methyl salicylate, is formed. Fresh leaves are practically odourless, containing no methyl salicylate whatever. Winter green oil, which was once popular and well-known in the perfumery industry, is becoming obsolete due to its substitution by synthetic methyl salicylate. The main producer of the oil is the United States.

Properties and uses: Winter green oil is a pale yellow or pinkish liquid of intensely sweet-aromatic odour and flavour. The oil is still used in pharmaceutical preparations as a flavour corrector. In candy, chewing-gum, tooth-paste, and other products, the oil has been completely replaced by synthetic methyl salicylate, which is much less expensive. The use of methyl salicylate in root-beer (an American carbonated, non-alcoholic beverage) has made its flavour extremely popular. Bhutan has nine species of *Gaultheria* as shown in Table 10.

Table 10 Distribution of *Gaultheria* Species

Botanical name	Local name	Distribution	Remarks
<i>Gaultheria fragrantissima</i>	Chanze kam (Dz) Machino (N)	S: Gelephu, and Doethang C: Thimphu, Punakha, Trongsa, Mongar and Trashigang 1,700-2,500 m.	
<i>G. discolor</i>		Orka la (Bhutan/Arunachal Pradesh border) 1,830-2,130 m.	Similar to <i>G. fragrantissima</i> : branches sparsely setose, lobes white beneath; fruit is edible
<i>G. griffithiana</i>		S: Chhukha C: Punakha, Trongsa, Mongar and Trashigang N: Upper Mo-chu 2,000-3,050 m.	
<i>G. semi-infera</i>	Shogshingma-shing (Sh)	C: Thimphu, Punakha, Trongsa and Trashigang N: Upper Mo-chu and Gasa 2,100-3,000 m.	
<i>G. hookeri</i> var. <i>angustifolia</i>		S: Gelephu (above Shan Khara) C: Mongar (Pangkar) and Trashigang (Chorten-kora) 2,100-3,000 m.	
<i>G. pyroloides</i>		C: Trongsa (Rinchen-chu and Phobjikha), Trashigang (Preng la) and Saktin (Orka la) N: Upper Kulong-chu (Me-la) 3,650-4,570 m.	
<i>G. trichophylla</i>	Laya: Zum	C: Thimphu, Trongsa, Mongar and Trashigang N: Upper Mo-chu, Upper Phochu, Upper Bumthang-chu and Upper Kulong-chu 1,800-3,500 m.	
<i>G. nummularioides</i>	Tronsa: Khwe shokpa	S: Chhuka and Gelephu C: Thimphu, Trongsa and Trashigang 2,900-4,270 m.	
<i>G. sinensis</i>		C: Mongar (east side of Rudo la) N: Upper Kulong-chu 2,900-3,650 m.	Similar to <i>G.</i> <i>trichophylla</i> : Mossy rocks and waterfalls.

Note: S = South, C = Centre, N = North
(Dz) = Dzongkha, (N) = Nepali, (Sh) = Sharchop-kha

Source: *The Flora of Bhutan*, Vol. 2, Part 1.

Wood Oils

Agar Oil

Source: Agar oil is distilled from the resinous portions of the wood of *Aquilaria agallocha*. This resinous wood is traded under the names “agar,” “aloe wood” or “eagle wood.” The tree occurs in patches in Bhutan's southern hills, in Assam in India, and in parts of West Bengal. Very little is known regarding why irregular portions of dark wood, highly charged with oleo-resin, appear in some trees but not in others, especially in and around old wounds and hollows. It is known that resinous infiltration occurs because of fungal attack, but the specific fungus responsible for the formation of agar wood has not yet been identified. Attempts to impregnate trees by driving pegs from trees already containing agar wood into trees not yet infected have not been successful.

Only mature trees, 50 to 60-years-old and infected with fungus, are exploited. The average resin yield is 3-4 kilogrammes per tree. Agar wood is classified as either real agar or “dhum” agar. The former is hard and brown, while the latter is soft and varies in colour from light yellow to almost white. True agar is largely used as such, while agar oil is almost entirely distilled from dhum agar, which has no value as wood.

Distillation: The distillation process for agar oil consists of soaking agar wood in water for 60-70 hours. The wood is then disintegrated into powder in a chopper. The powdered wood, suspended in water to which 5 percent by weight of common salt has been added, is placed in a retort and heated over a furnace. The retort has a swan neck with a device for replenishing the water, without removing the lid, during distillation. A Florentine flask made of glass or copper constitutes the receiver for the distillate. Distillation takes 30-32 hours. Because distillation takes place at atmospheric pressure, the process of total exhaustion of the wood is lengthy. The oil boils at high temperatures and the distillation waters are cohobated (i.e., returned to the still and re-distilled) to produce a reasonable yield. The oil yield ranges from 0.75-2.5 percent of the wood.

Properties and uses: True agar is heavier than water and has a peculiar yet agreeable odour, comparable to sandalwood. It is highly prized and in great demand in Arab countries for burning as incense. “Agar-bathis,” or incense sticks, are prepared from the exhausted and distilled agar wood. Agar oil is used for diluting perfume oil from sandalwood oil or vegetable oils. It is a valuable perfume-retainer and prized by perfumeries for blending in their high-grade perfumes.

The Bhutanese experience: Agar wood is still found in Bhutan's forests, though now considerably less abundant than it once was. Despite the Forest Department's vigilance, many trees have fallen to the poacher's axe. Agar is not presently being exploited commercially. Because of its high market value, however, a few trial plantations were established in Panbang and Samdrup Jongkha in the 1980s. These trial plantations have been successful in terms of growth, but efforts to inoculate the trees with infected branches have not been encouraging.

Oil from Other Sources

Pine-needle Oil

Source: Pine-needle oil is obtained not only from pine-needles (*Pinus* spp.), but also from the needles or leaves of various spruces and firs. Distillation of needles from young twigs and stems seems to yield higher levels of oil.

Uses: The oil is used for treating rheumatism and related complaints. In the perfumery industry, it is used in the manufacture of bath crystals and soaps. It is also used in hospital disinfectants and room sprays, deodorants, general disinfectants and similar products. Once the oil is recovered, the exhausted needles are used for a variety of purposes. "Pine wool," for example, is manufactured from the needles. This type of wool can be woven into fabrics, knitting yarns, quilts, etc.

Cedar Oil

Source: Cedar oil is manufactured by distilling shavings and sawdust from *Juniperus macropoda* (Indian Juniper, Himalayan Pencil Cedar). Following oil extraction, the shavings can be converted into linoleum. The potential for extracting cedar oil from *J. recurva*, which grows in Bhutan, should be explored.

Champ Oil

Source: Champ oil is extracted from the flowers of *Michelia champaca*, a large, handsome tree. The oil is obtained from the fragrant, deep yellow flowers by maceration or extraction.

Uses: The oil is one of the most famous perfumes of India and other Asian countries. It rivals ylang-ylang in its fragrant odour and is much used in the local perfume industry.

Calamus Oil (calamus perfume)

Source: Calamus oil is obtained from the rhizomes of the plant *Acorus calamus* through steam distillation. It contains the glucosidic bitter principle, "acorin." The plant is found in marshes up to 2,400 metres in altitude.

Uses: The oil is largely used in perfumery and also in spice blends and in the flavouring of alcoholic beverages.

Ginger Oil

Source: Ginger oil is obtained from the rhizomes of *Zingiber officinale*.

Uses: The oil is used in pharmaceutical preparations, and by the cosmetics and perfumery industries. A private project to produce ginger oil has been established in Samtse.

Keora Oil

Source: Keora oil is derived from the flowers of *Pandanus tectorius* (*P. odoratissimus* Roxb.), a small evergreen shrub, or small tree, with a many-branched stem, supported by a number of stiff aerial roots. The flowers are usually large—a single flower can weigh up to 150 grammes—and powerfully fragrant. The flowers appear in July and the plant continues flowering till mid-December. Flowers are particularly abundant from August to September.

Uses: The oil is used in the preparation of cosmetics and perfumes.

Remarks

Bhutan has many potential sources for essential oils which have yet to be exploited. The main obstacles are lack of technical know-how and the paucity of information on the extent of the resources. The Ministry of Agriculture is now exploring the possibilities of tapping these various sources. They represent great potential as exports and future sources of foreign exchange earnings.

ROSIN AND TURPENTINE

Background

Resins are obtained from mature chir pine (*Pinus roxburghii*) greater than 40 centimetres in diameter, using the “French cup and lip” method. Diagram 2 shows the distribution of chir pine forest in Bhutan. Trees above 70 centimetres in diameter are given two blazes per year. In Bhutan, tapping of chir pine is primarily carried out by Tashi Rosin & Turpentine, a branch undertaking of Tashi Commercial Corporation, under a 50-year lease running from 1972 to 2022.

Distribution and Resource Availability

An area of 420 square kilometres has been leased to Tashi Rosin & Turpentine Company. However, the company is only allowed to tap in the areas shown in Table 11.

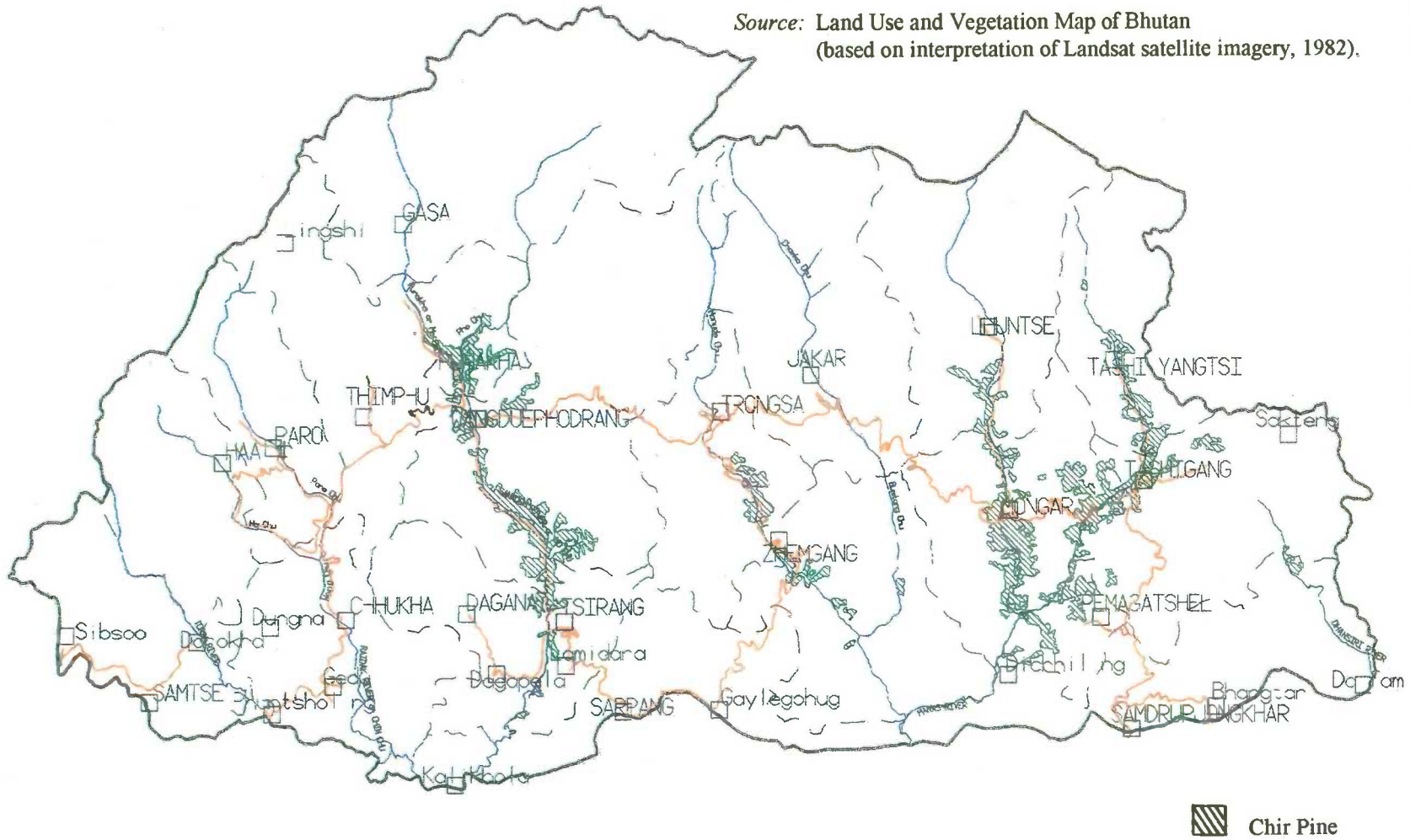
Production

Bhutan's yearly resin production peaked at 1,760 tons in 1985. The tapping methods used, however, were not sustainable and were damaging to the country's delicate environment. Resin tapping rules have now been revised and, with better control over tapping methods, the yield has declined to a sustainable level of just 272 tons per year.

Diagram 2 Chir Pine Forest in Bhutan

Area = 120,063 hectares (1,200 sq. km.)

Source: Land Use and Vegetation Map of Bhutan (based on interpretation of Landsat satellite imagery, 1982).



Produced in the GIS/Computer Unit, Resources Development Section, Forestry Services Division, Ministry of Agriculture, Thimphu, June 1995.

Scale 1:1,550,000

Table 11 Area Available to the Tashi Rosin & Turpentine Company for Resin Tapping	
District	Location
Trashigang	Khengthongmani, Oozurong and Rollong
Mongar	Rollong, Sheree-chu, Thangrong and Kurizampa
Lhuntse	Autsho
Trongsa	Lamthel
Pemagatshel	Shaliyang, Satang , Firi, Chongmashing, Dagor and Bainang
Tsirang	Pataley gewog (Keroni—between Wakhley tar and Buri-chu)
Zhemgang	Tingtibi

Source: Review on Resin Tapping Operations in the Chir Pine Forest of Bhutan, by M.R. Moktan, 1994.

Note: Bhutan's chir pine forests cover an area of approximately 810 square kilometres. Only about half of this area is tapped as the terrain is difficult for commercial extraction and the distribution of mature trees is widely scattered. The major obstacle Tashi faces at present is an insufficient number of labourers on a dependable basis. Rural Bhutanese are too occupied with their own fields during crop seasons, and tend to view resin tapping as a supplementary source of income normally pursued only during the agricultural off-season.

Processing

Resin collected from the various field depots is transported to the Rosin and Turpentine Factory in Samdrup Jongkha for processing into rosin and turpentine. The processing plant's production capacity is 300 tons of resin per annum (Master Plan for Forestry Development, Annex Report No. 8).

Production output:

Rosin	78 percent
Turpentine oil	14 percent
Waste	8 percent

All products are sold to India, with the price for rosin ranging from Nu. 20.00 (63 US cents) to 24.00 per kilogramme (76 US cents) and the price for turpentine oil at Nu. 11.00 per litre (35 US cents).

Uses

Rosin is used in the paper, paints and varnish, soap and ink industries. Turpentine is used in the production of camphor and paints, and in the pharmaceutical industry (Table 12).

Table 12 Resin Products	
Rosin	%
Paper	39.06
Paints, varnish and synthetic resins	24.99
Soap	18.00
Benzoin and Agar-bathis	7.60
Shoes	0.59
Waterproofing	1.21
Sealing wax	1.45
Phenyl	2.72
Ink, varnish	0.85
Linoleum	0.85
Cables and bangles	1.12
Jute, wax, bleaching soaps	1.13
Miscellaneous industries	0.43
Turpentine	
Camphor and terpene chemicals (mineral turpentine does not yield these products)	85.00
Boot polish, paints, varnish, and the pharmaceutical industry	15.00

Source: Manual on Resin Tapping for Chir Pine Areas Under Tapping in Bhutan.

The Economic Aspects of Resin Tapping in Bhutan

Under normal circumstances, one chir pine tree with one resin channel should yield 1.5 kilogrammes of resin per annum, if the work is carried out efficiently and the weather is favourable. But with Bhutan's shortage of trained labourers, difficult working conditions, and mountainous terrain, the yield is not more than 1 kilogramme per channel. As only trees above 70 centimetres in diameter have two channels, the large majority of Bhutan's chir pine trees have only one channel.

Given the above assumptions, the present economics of resin tapping in Bhutan are estimated as follows:

Estimated Economics of Resin Tapping

Yield of resin per tree (raw basis).....	1 kilogramme
Labour costs for tapping; provision of tools and empty tins; and establishment of depots, including contractor's commission	Nu. 7.00 per kilogramme (22.26 US cents)
Transport costs from forest by road to head depot depends on distances, e.g., from Dagor to Kherigonpa.....	Nu. 1.50 per kilogramme (just over 4.7 US cents)
Transport costs from road head to factory also depends on distances, e.g., Kherigonpa to Samdrup Jongkha	Nu. 0.80 per kilogramme (2 US cents)
<hr/>	
Total production costs (i.e., up to delivery at the factory site) equals from	Nu. 9.30 per kilogramme (29.5 US cents)
to a maximum of	Nu. 10.00 per kilogramme (31.8 US cents).
Market value of resin (average).....	Nu. 15.00/kilogramme (US\$ 47.7 cents)
Net profit to lessee.....	Nu. 5.00 per kilogramme (15.9 U.S. cents)

Source: Review on the Resin Tapping Operations in Chir Pine Forests of Bhutan, by M. R. Moktan, 1994.

Remarks

Based on the above assumptions, resin production generates gross revenue of about Nu. 4.1 million per year (272,000 kilogrammes x 15 Nu. per kilogramme), or about US\$ 130,143.



When the rhododendron blossoms in spring, Bhutan's hillsides and forests blaze with colour.

Vegetable Oil and Ornamental Plants

by B.B. Chhetri
Divisional Forest Officer
Social Forestry and Extension Section, Thimphu
The Royal Government of Bhutan

VEGETABLE OIL

Bhutan has many trees and shrubs which are potential sources of oil in both the country's sub-tropical and sub-temperate zones. There are a few common species traditionally used by villagers in different parts of the country, but no systematic study has yet been carried out to survey Bhutan's potential for producing vegetable oil. The socio-economic and ecological attributes, and marketing needs associated with such production, have also not been studied.

Bhutan consumes a high level of vegetable oils. The country's requirements are largely met by imports from India and other countries. Coconut oil, soyabean oil, and mustard oil with the trade name "Dalda," for example, are all from India, while palm oil comes from Malaysia. Some 80 percent of Bhutanese rural communities cannot afford to buy even their basic requirements in vegetable oils because of their high cost, ranging from Nu. 40 (US\$ 1.27) to Nu. 70 (US\$ 2.22) per litre. This problem could be overcome by small-scale industries producing vegetable oil from locally-available species. Surpluses, could easily be marketed in neighbouring countries. The quantity and quality of production are the two main factors governing successful marketing.

The major problem presently is the lack of a proper study on the potential for vegetable oil production in the country. A full-fledged systematic study on vegetable oils would, unfortunately, entail large financial and human resource investments. It is therefore recommended that a proposal be submitted for initiating a pilot project, with the Government providing technological support and financial assistance to interested and innovative farmers.

Following is a list of known vegetable-oil-yielding forest species in Bhutan:

- gante, bandré, dhorkho-shing (*Gynocardia odorata*)
- yikka-shing, chiuri (*Aesandra butyracea*)
- panche-shing, gunilo-kharaney (*Symplocos paniculata*)
- sal, sakhuna (*Shorea robusta*)

Curcuma parviflora Wall. is one of Bhutan's numerous ornamental plant species.



Here is a brief description of each species:

***Gynocardia odorata* R. Brown**

- Local name:** Gante or Bandre (Nepali); Dorkho-shing (Sharchop-kha).
- Family:** Flacourtiaceae.
- Distribution:** Samtse, Lower Chhukha, Sarpang and Samdrup Jongkha Districts.
- Altitude:** 300-1,000 metres.
- Climatic zone:** Tropical and subtropical.
- Morphology:** Gante is a tree with thickly-spreading branches that grows from 10 to 20 metres high. Its leaves are dark green, coriaceous, and oblong—poisonous to cattle. Gante's flowers are yellow or yellowish green, appearing in April until late May. The tree can be easily recognised by its hard, round, dark-grey, rough-textured fruit, growing on its stems and main branches.
- Silviculture:** *Gynocardia odorata* species is light-demanding and needs little care. It grows mostly on sloping land at Bhutan's higher elevations or on stream banks and gullies where there are no other tall trees. Plantations can be established by direct sowing or by planting seedlings. Seedlings are grown in raised nursery beds or in polythene bags.

- Extraction method:** Oil is extracted from the seeds. The seeds are beaten into a pulp, heated, then compressed in tightly-woven bamboo baskets. Raw oil is boiled until it no longer foams. After cooling, the oil becomes white and semi-solid.
- Other uses:** The tree's fruit pulp is poisonous and is often used to kill fish. The seed is covered with a thick, edible pulp. The fruit is also used in Ayurvedic medicine. Oil from the Nepali gante is sold under the trade name "Chulmugra," common in India's Ayurvedic medicine market.
-

***Aesandra butyracea* Roxb.**

- Local name:** Yika-shing (Dzongkha), Yi-shing (Kurtoep), Chiuri (Nepali), Pin-shing (Sharchop-kha).
- Family:** Sapotaceae.
- Distribution:** Mongar, Lhuntse, Trashigang, Shemgang and Tsirang. Sparsely distributed in Punakha and Wangdue.
- Altitude:** 500-1,500 metres.
- Climatic zone:** Sub-tropical, sub-temperate.
- Morphology:** Yika-shing is a medium-sized tree that generally grows with a crooked stem. The leaves form large clusters and its bark is light gray. It has milky sap and its wood is pinkish-white in colour.
- Flowering time:** December-January.
- Silviculture:** *Aesandra butyracea* is a light-demanding species, with some tolerance to frost. It normally grows on sloping land with deep soil, and can easily be grown in nurseries. The number of seeds per kilogramme averages 450 to 600. The seed is viable for only a short period, so it has to be sown immediately after collection. Planting bare-root seedlings gives poor results, but seedlings grown in polythene pots perform well.
- Extraction method:** Vegetable butter is extracted from the seeds. The seeds are heated and mashed into a pulp. The pulp is heated in a pan and then compressed in tightly-woven bamboo baskets. After cooling, the oil becomes white and semi-solid. It is locally-known as "pinsi" in Sharchop-kha and "yiga makhu" in Dzongkha.

Other uses: In solid form, the oil is burned in lamps and used for making “Torma” (images made during religious ceremonies). After extracting the butter, the remaining cake is toxic and is used as fish poison.

Symplocos paniculata

Local name: Pangtshe-shing (Dzongkha); Zim-shing (Sharchop-kha); Gunilo (Nepali).

Family: Symplocaceae.

Distribution: Punakha.

Altitude: 1,500-3,000 metres.

Climatic zone: Sub-tropical and temperate.

Morphology: Pangtshe-shing is a medium-sized tree, which grows from 5 to 10 metres in height. A deciduous species, its bark is ash-grey with vertical fissures. Old bark scales off naturally. Some villagers scratch off the dead bark, believing that this helps produce better fruit. The tree flowers in April and May. Its flowers are white. Its fruit is ready for harvesting by June or July.

Silviculture: *Symplocos paniculata* is a light-demanding species that mainly grows in valleys and on slopes with moist soil. Its seeds have low viability. The fruit is sown, without removing the pericarp, in nurseries immediately after collection.

Extraction method: Vegetable butter is extracted from the seeds. The seeds are heated and mashed to a pulp. The pulp is heated in a pan then compressed in a tightly-woven bamboo basket. After cooling, the oil becomes white and semi-solid.

Other uses: The oil is also burned in lamps. The leaves are used for making dye.

Shorea robusta

Local name: Sal, Sakhuna.

Family: Dipterocarpaceae.

Distribution:	Grows naturally in Kalikhola Sarpang and is planted in other southern districts.
Altitude:	200-1,300 metres.
Climatic zone:	Tropical and dry-sub-tropical.
Morphology:	Sal is a large tree, with ovate-oblong leaves. Its bark has deep, vertical fissures. The tree flowers from March to April. Harvesting of fruit is from June to August. The fruit is winged and usually has only one seed.
Silviculture:	<i>Shorea robusta</i> species needs well-drained soil. Sowing seeds directly into the plantation site immediately after collection yields the best results as the seeds cannot be stored for more than a week.
Extraction method:	Not known.
Other uses:	Excellent timber; essential and edible oils.

ORNAMENTAL PLANTS

Domesticated ornamental plants are widely-known to Bhutan's rural folk and are, therefore, unnecessary to describe in detail in this document. Wild varieties of ornamental plants are also abundant in Bhutan. Identification and classification of such plants, with respect to their aesthetic, economical and environmental value, however, is yet to be carried out and almost no information on them exists.

The Japan-Himalayan Company is the pioneer in the ornamental plant business in Bhutan. Established in 1990, it is a joint business venture with Japanese counterparts. The nursery occupies more than 1.25 hectares, or about three acres, located after the Dzong going to Taba. It employs five workers, two trained in Japan. Four plastic-covered propagating chambers are used to produce rooted cuttings of the following plants: *Agapitus*, *Begonia*, *Corpus*, *Capitata*, *Cupressus*, *Edgeworthia*, *Hedera*, *Gaultheria*, *Peonia*, *Piteris* and *Viburnum*. These are exported to Japan for landscaping highways. So far, 5,000 cuttings have been exported to Japan, sold at 60 to 100 yen each (US\$ 0.73 to 1.21 per cutting), depending on the size and extent of the root system development. The rooted cuttings are washed in the nearby river to remove all sand. The cuttings are then packed in moss and sent by air freight from Paro to Bangkok, and from there to Japan. A package of 100 plants weighs up to 2 kilogrammes.



The forests of Bhutan contain numerous species of rhododendron which are increasingly in demand as ornamental plants.

The Japan-Himalayan Company is now conducting experiments to determine which species are most easily propagated by various simple methods, with or without growth regulators. At present, the company gets 50 percent rooting success with *Cornus*, using a Japanese rooting hormone. It also claims that *Cupressus* multiplies faster using cuttings rather than germinating seeds.

The company's current problems are all related to rooting. These problems, however, should not be difficult to solve. Suggested priority activities are the following:

- 1) Construct a mist system over a well-drained propagating bed to provide continuous high relative humidity to cuttings. Heating may be needed during winter.
- 2) Experiment with various concentrations of growth regulators and soaking or dipping time in relation to the percentage of rooting/shooting.
- 3) Experiment with cuttings of different maturities, for example, terminal, sub-terminal or basal in conjunction with point 2) above to establish the combinations which will give the highest percentage and number of roots and shoots.
- 4) Look into other markets; study the quarantine rules for plant entry into other countries.
- 5) Send key personnel abroad for training to keep abreast of the most recent trends in the ornamental plant industry.

This information is based on the experiences of the Japan-Himalayan Company (Master Plan for Forestry Development, 1990). There is a need to appraise and document information from other sources, including villagers, city corporations, other government organisations, etc.

Overall, more comprehensive studies on occurrence, flowering time, durability of flowers, availability, propagation techniques, and marketing prospects for wild varieties of ornamental plants are needed.

Following is a list and a table of ornamental plants in Bhutan:

ORNAMENTAL PLANTS IN BHUTAN

Magnolia campbellii Hook. f. and Thompson

Local name:	Ghoge champ (Nepali).
Family:	Magnoliaceae.
Distribution:	Haa, Thimphu (Lamperi-Menchuna), Punakha, Wangdue, Trongsa and other districts with similar conditions.
Altitude:	900-2,500 metres.
Flowering time:	March-May.
Climatic zone:	Sub-temperate to temperate.
Morphology:	Middle-sized, deciduous tree, 12 to 15 metres in height. Flowers are terminal, erect and yellowish white.
Silviculture:	Light-demanding species, found in wet, evergreen forests. Seeds are collected from August to September.

Michelia excelsa Wall.

Local name:	Rani champ.
Family:	Magnoliaceae.
Distribution:	Chhukha, Trongsa, Tsirang, Trashigang, Mongar and Punakha Districts.
Altitude:	1,800-2,500 metres.
Climatic zone:	Temperate, evergreen forests.
Silviculture:	Evergreen species, associates with oak species.

***Edgeworthia gardneri* Wallich**

- Local name:** Deshing (Dzongkha), Kagate.
Family: Thymelaeaceae (shrub).
Distribution: Chukha District (Punakha to Kamzi).
Altitude: 150-1,600 metres.
Flowering time: June-August.
Climatic zone: Sub-temperate/temperate.
-

***Daphne bholua* Buch**

- Local name:** Deshing (Dzongkha), Kagate.
Family: Thymelaeaceae.
Distribution: Chukha, Deothang Haa, Thimphu, Punakha and Trongsa Districts.
Altitude: 1,800-3,100 metres.
Flowering time: October-April.
-

***Luculia gratissima* Wallich**

- Family:** Rubiaceae.
Distribution: Wangdue and Mongar Districts.
Altitude: 1,200-2,000 metres.
Flowering time: September-October.
-

***Hippophae rhamnoides* L**

- Local name:** Tare (Dzongkha).
Family: Elaeagnaceae.
Altitude: 2,000-3,000 metres.
Flowering time: April-May.
-

***Viburnum grandiflorum* Wallich**

- Family:** Caprifoliaceae.
Distribution: Pele-la and Thrumshing-la.
Altitude: 2,700-3,600 metres.
Flowering time: April-May.
-

Viburnum nervosum

Distribution: Changkaphu, Hele-la, Chhamina and Tharana.

Altitude: 2,700-3,300 metres.

Flowering time: April-May.

***Aconitum spicatum* Bruhl**

Local name: Bgo-grod-spos (medicinal).

Family: Ranunculaceae.

Distribution: Thimphu, Trongsa, Gasa, Bumthang and Paro.

Altitude: 3,000-4,000 metres.

Flowering time: August-September.

Cypripedium himalaicum

Common name: Lady's slipper.

Family: Orchidaceae.

Distribution: Lingtshi, Barsong and Chebesa.

Altitude: 3,000-4,000 metres.

Flowering time: June.

***Cymbidium hookeranum* Rechh**

Local name: Ola-chhoto (Dzongkha).

Family: Orchidaceae.

Distribution: Gedu, Punakha, Tsirang, etc.

Flowering time: February-May.

Dactylorhiza hatagirea

Local name: Panch umole, Wanglok.

Family: Orchidaceae.

Distribution: Lingtshi, Phajodhing and Chele-la.

Altitude: 3,700 metres.

Meconopsis grandis

Local name: Upel nginpo.
Family: Papaveraceae.
Altitude: 3,650-4,200 metres.
Flowering time: June-August.

***Allium wallichii* Kunth**

Local name: Zimbu.
Family: Liliaceae.
Distribution: Paro, Haa, Thimphu and Bumthang Districts.
Altitude: 3,000-4,200 metres.
Flowering time: August-September.

Lilium nepalense

Local name: Lily.
Family: Liliaceae.
Altitude: 1,800 metres.
Flowering time: July-August.

***Lagerstroemia hirsuta* Lamark**

Family: Lythraceae.
Altitude: 300-600 metres.
Flowering time: May-June.

***Lagerstroemia parviflora* Roxb.**

Local name: Sidha (Nepali).
Family: Lythraceae.
Altitude: 180-700 metres.
Flowering time: April-July.
Silviculture: Direct sowing in planting site immediately after collection of seeds.

Table 13 Other Ornamental Plants in Bhutan				
Botanical name	Family name	Altitude	Flowering time	Habitat
<i>Justicia adhatoda</i> Nees	Acanthaceae	500-1,600 m.	February-April	Wasteground, roadside
<i>Barleria cristata</i> , Linn.	Acanthaceae	500-,2000 m.	June-September	In light forest
<i>Amaranthus caudatus</i> Linn.	Amaranthaceae	2,000-2,800 m.	June-October	Cultivated
<i>Baumontia grandiflora</i> Wall.	Apocynaceae	150-1,400 m.	April	Foothills of sub-tropical forest (limestone areas)
<i>Brassiopsis glomerulata</i> Regel	Araliaceae	1,180-2,000 m.	March-April	Under shrubs in oak forests
<i>Gamblea ciliata</i> Clarke	Araliaceae	2,800-3,500 m.	June-July	Understory in Abies/Rhododendron forests
<i>Aristolochia griffithii</i> Hook. f.	Aristolochiaceae	1,800-2,900 m.	April-May	Climber on shrubs
<i>Impatiens strenantha</i>	Balsaminaceae	1,800-2,600 m.	July-September	Forest shrubberies
<i>Impatiens sulcata</i>	Balsaminaceae	1,800-4,000 m.	July-September	Shrubberies/cultivated areas
<i>Bombax ceiba</i> Linn.	Bombacaceae	200-1,400 m.	February-March	Dry, sub-tropical, and tropical zones; well-drained, bouldery areas, open forest
<i>Mahonia nepalensis</i> DC.	Berberidaceae	1,500-2,400 m.	October-April	Near small streams, under shrubs
<i>Begonia griffithiana</i> Hook.	Begoniaceae	up to 1,800 m.	June-July	Damp, rocky slopes in ravines
<i>Opuntia vulgaris</i> Muller	Cactaceae	1,000-1,800 m.	Throughout summer	Naturalised in cultivated areas/wasteland
<i>Cardamine macrophylla</i> Willd.	Cruciferae	2,100-3,600 m.	May-August	Forest; marshy areas
<i>Codonopsis affinis</i> Hook.	Campanulaceae	1,800-3,000 m.	June-September	Shrubberies

(continued on page 75)

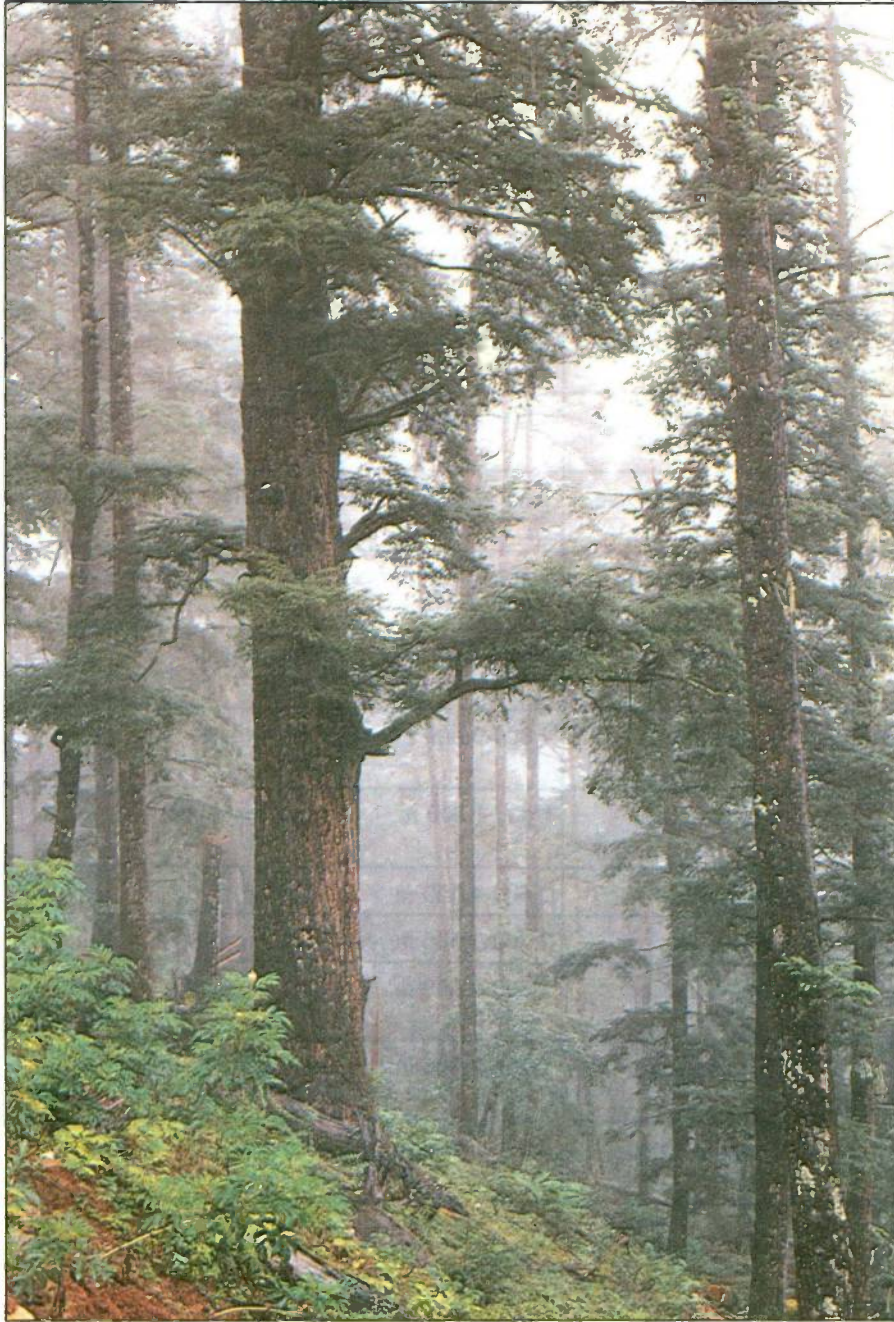
Table 13 Other Ornamental Plants (continued)				
Botanical name	Family name	Altitude	Flowering time	Habitat
<i>Codonopsis ovata</i> Benth.	Campanulaceae	240 m.	July-August	Alpine pasture
<i>Lonicera agustifolia</i> Wallich	Caprifoliaceae	2,000-2,900 m.	May-June	Shrubberies
<i>Lonicera hispida</i>	Caprifoliaceae	2,000-3,300 m.	May-July	Shrubberies
<i>Gypsophila cerastioides</i> D. Don	Caryophyllaceae	2,800-4,100 m.	June-August	Open slopes, rocks, and roadsides
<i>Ageratum conyzoides</i> Linn.	Compositae	1,000-3,000 m.	Almost all year around	Cultivated areas
<i>Hypericum choisianum</i> Wallich	Hypericaceae	2,400-3,000 m.	May-August	On cliffs, rock
<i>Deutzia bhutanensis</i>	Hydrangeaceae	2,400-2,800 m.	April-June	Shrubberies
<i>Ainsliaea aptera</i> DC.	Compositae	1,400-3,000 m.	March-June	Shrubberies
<i>Artemisia roxburghiana</i> Basser	Compositae	200-4,000 m.	March-September	Cultivated areas/wasteland
<i>Ipomea carnea</i> Jacq.	Convolvulaceae	100-2,400 m.	April-August	Wasteland
<i>Ipomea purpurea</i> Linn.	Convolvulaceae	100-2,400 m.	April-October	Wasteland
<i>Porana grandiflora</i> Wallich	Convolvulaceae	1,500-2,400 m.	July-October	Wasteland
<i>Dipsacus inermis</i> Wallich	Dipsacaceae	1,800-3,500 m.	June-September	Cultivated/bushy land
<i>Morina longifolia</i> Wallich	Dipsacaceae	3,000-4,000 m.	June-September	Alpine scrub
<i>Agapetes serpens</i> Wight	Ericaceae	1,500-2,800 m.	February-June	Damp, rocky slopes
<i>Cassiope fastigiata</i> Wallich	Ericaceae	1,500-2,800 m.	February-June	Evergreen scrub, rocky wet areas
<i>Enkianthus deflexus</i> Griffith	Ericaceae	2,500-3,300 m.	May-June	Mixed conifer forests
<i>Elaeagnus parvifolia</i> Wallich	Elaeagnaceae	2,600-3,000 m.	April-June	Cultivated land, wasteland
<i>Euphorbia sikkimensis</i> Boiss	Euphorbiaceae	2,400-2,900 m.	April-May	Open forest

(continued on page 76)

Table 13 Other Ornamental Plants (continued)

Botanical name	Family name	Altitude	Flowering time	Habitat
<i>Euphorbia wallichii</i> Hook. f.	Euphorbiaceae	2,400-3,000 m.	April-May	Wasteland, scrub forests
<i>Geranium procurrens</i> Yeo	Geraniaceae	2,400-3,600 m.	May-September	Open slopes
<i>Geranium nepalense</i> Sweet	Geraniaceae	1,400-3,000 m.	February-July	Roadside in warm and cool broad-leaved forests and blue pine forests
<i>Geranium lambertii</i> Sweet	Geraniaceae	2,300-4,000 m.	July-September	Open areas in blue pine forests
<i>Gentiana oranta</i> G. Don	Gentianeae	3,000-4,500 m.	August-October	Alpine meadows
<i>Gentiana depressa</i> D. Don	Gentianeae	3,000-4,500 m.	August-October	Alpine meadows
<i>Hypericum hookerianum</i> Wight	Hypericaceae	2,600-3,000 m.	June-September	On cliffs, rock
<i>Philadelphus tomentosus</i> Wallich	Hydrangeaceae	2,000-2,800 m.	May-June	Mixed conifer forests
<i>Hypoxis aurea</i>	Hypoxidaceae	2,500-3,000 m.	April-July	Dry, open ground
<i>Iris clarkei</i> Baker	Iridaceae	3,000-3,500 m.	June-July	Damp, open hillsides
<i>Iris cf. tectorum maxim</i>	Iridaceae	2,500-3,000 m.	April-May	Marshy areas
-	Labiatae	3,500-4,500 m.	June-August	Alpine pasture
<i>Colquhounia coccinea</i> Wallich	Labiatae	2,000-3,000 m.	August-September	Shrubberies
<i>Oxytropis lapponica</i> Gay	Leguminosae	3,800-4,600 m.	July-August	Sandy loam
<i>Porochetus communis</i> D. Don	Leguminosae	1,500-3,900 m.	March-September	Moist places and beside streams
<i>Allium macranthum</i> Baker	Liliaceae	3,000-4,000 m.	August-September	On top of ridges
<i>Allium sikkimense</i>	Liliaceae	3,000-4,500 m.	July-October	Wet slopes
<i>Woodfordia fruticosa</i> Linn.	Lythraceae	600-1,500 m.	March-May	Scrub on dry slopes
<i>Michelia doltsopa</i> DC.	Magnoliaceae	1,800-2,700 m.	March-April	Broad-leaved forests in temperate zones

(continued on page 77)



Bhutan has many different types of forests. All of them provide a diversity of non-wood products.

Basic Information on Bhutan's Himalayan Yew (*Taxus baccata*)

by *Passang Wangchen Norbu*
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Forest Resources Development Section, Thimphu
The Royal Government of Bhutan

Local name: Yew (English), Keyrang-shing (Sharchop-kha), Dhengrey salla (Lhotsham kha)

Botanical name: *Taxus baccata* L.

BACKGROUND

Officers and foresters from other parts of the Himalayas report that the Himalayan yew's foliage contains a chemical known as taxol, discovered only in recent years and now considered to be one of the most important drugs in the fight against cancer. Provided scientific principles are followed, foliage production can be maintained on a sustainable basis. Currently, however, there is little knowledge on the proper management of Bhutan's Himalayan yew. Given this shortage of knowledge, large-scale foliage collection at this juncture would do more harm than good and could even threaten the resource. Thus a conservative approach must be taken.

Morphology

The Himalayan yew is an evergreen tree, generally middle-sized, though sometimes quite large, with a large, spreading crown. Most yew trees tend to be forked, fluted, and with depressions at branch-stem junctions. This is not regarded as a defect (Evans, 1984). Its bark is reddish-grey, thin and smooth, and peels off in longitudinal shreds. Its leaves are 1.5-2.75 by 0.2-0.25 centimetres, usually curved, acuminate margins, slightly inrolled, dark-green and shining above, brownish-yellow and somewhat pale beneath, single nerved and narrowing into a short petiole.

Distribution

According to the *Flora of Bhutan*, *Taxus baccata* L. is the only representative of the Taxaceae family in Bhutan. On average, it is a tree of 5 to 12 metres in height. Taller trees grow to 12 metres or more. The tree occurs in scattered localities from Haa District in the west to Mongar District in the east. Reportedly, it also grows in the Kharungla area of Khaling and in the Zukpula-Menthongla belt in Wamrong, under Trashing District (author's personal communication 1992 and 1994).

The Bhutanese yew's habitat is characterised by moist, mixed coniferous forests or cool, broad-leaved forests, from 1,800 to 2,700 metres in altitude. Yew is also listed as one of the characteristic species of the "spruce forest" (2,700 to 3,100 metres) vegetation zone. Yew in Bhutan is best treated as a subspecies of zuccarini pilger (*Taxus baccata* var. *wallichiana*).

The extent of the area and forest types where yew occurs are furnished in Table 14.

Approximately 40 to 50 percent of the Himalayan yew's stems fall into the small diameter class of 10 to 20 centimetres. The yew growing stock for northwestern Bhutan is estimated at 1,459.7 cubic metres, equivalent to 1.1 percent of the total forest volume. The mean annual volume increment is estimated at 0.96 percent.

Table 14 Extent and Area of Forest Types Where Yew Occurs

Forest type	Area (ha)	Vol./ha. (m ³)	Stem/ha. (m ³)	Total Vol. (m ³)	Total Stems
Fir and spruce	128,021	0.93	3.15	119,060	403,266
Mixed conifers	137,199	1.46	7.06	200,310	968,625
Conifers mixed with broadleaf	149,679	1.03	5.56	154,169	832,215
Upland hardwood	207,889	0.70	3.19	145,522	663,166
Total	622,788			619,061	2,867,272



As little is known about the proper management of Bhutan's Himalayan yew, foliage collection at this point may do more harm than good and even threaten the resource.

Yew growing stock for central and eastern Bhutan is estimated at 1,238 cubic metres, equivalent to 0.6 percent of the total. The annual volume increment is estimated at 0.76 to 1.5 percent. The total area of upland and lowland hardwoods is 1,385,940 hectares. This figure has not yet been separated into upland and lowland areas. Since the occurrence of yew is more likely in the upland areas, only upland hectareage is considered here. Only 15 percent of the total area is considered in estimating yew volume.

Regeneration

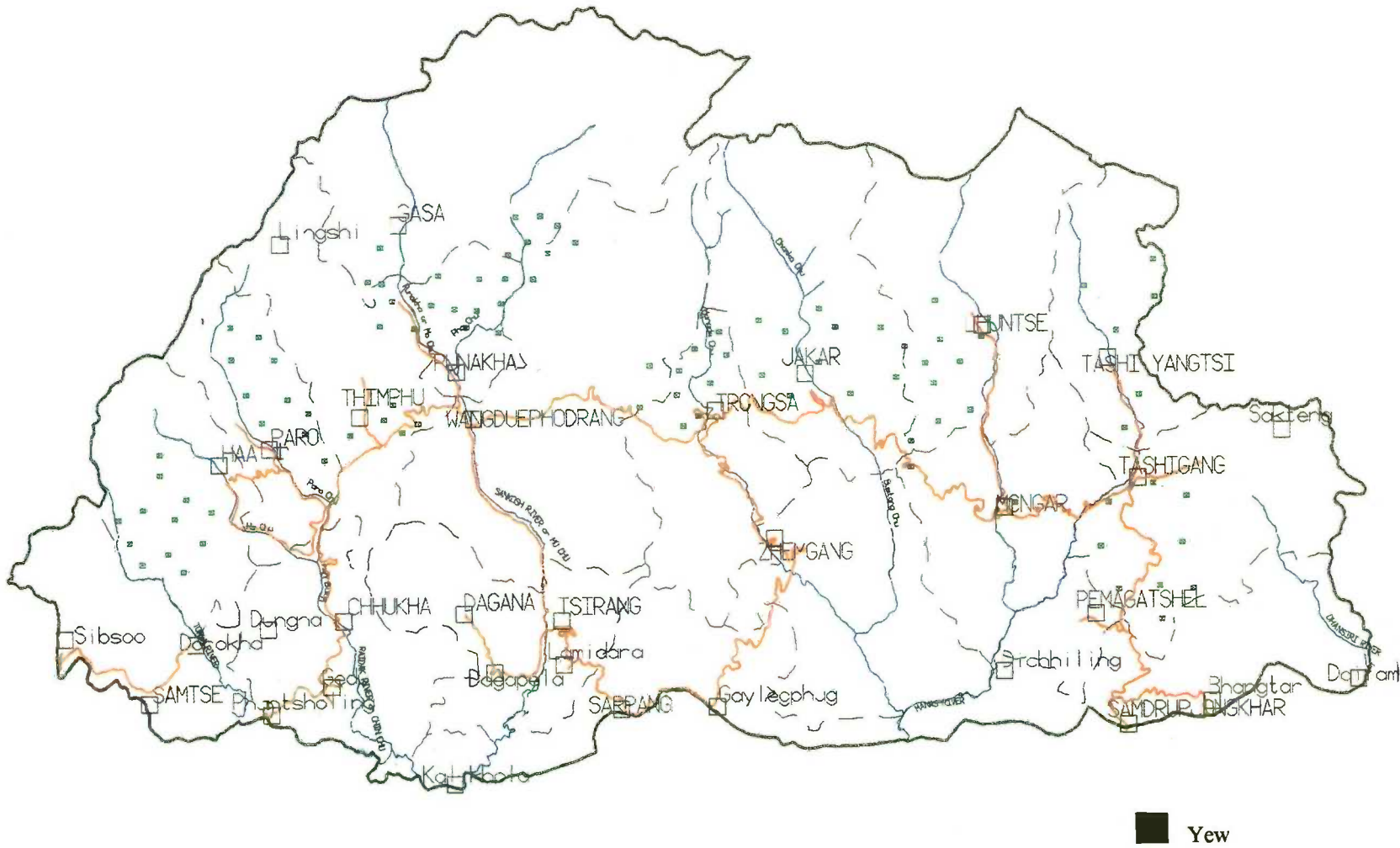
Yew has evergreen, needle-like leaves, but produces berry-like fruits instead of cones and is usually dioecious. Monoecious individuals occur very rarely. Like most trees, it does not produce a good seed crop every year. Visits to the yew growing areas of Bhutan reveal that there is a lack of natural regeneration. The reason for this is still unknown. Some believe that yak herders uproot the seedlings, as they are toxic to yaks, while others believe that intense browsing by yaks checks the growth of seedlings.

Himalayan yew has very thin bark and, as is the case with the Pacific yew found in northwestern United States, may be easily killed even by a light ground fire. The fruit is edible and ripens from October to November. Germination of the Himalayan yew is difficult and usually scarification is required to break the dormancy. Himalayan yew sprouts readily from stumps and cut branches. It can be propagated easily with stem and root cuttings.

Uses of Yew Wood

The sap wood is white; the heart wood is orange red, close-grained, hard, smooth, and elastic. It works and polishes extremely well, but is somewhat slow to season. The wood is eminently suitable for cabinet work and other furniture. In some parts of India's Uttar Pradesh State, local people use the bark as a substitute for tea. In Bhutan, especially in the East, people use the wood for making milk and water containers.

Diagram 3 Yew Occurrence in Bhutan



Produced in the GIS/Computer Unit, Resources Development Section, Forestry Services Division, Ministry of Agriculture, Thimphu, June 1995.

Scale 1:1,550,000

CONCLUSIONS

Since all individual tree species, including yew, are routinely measured during forest management inventories, more information may be available from established forest management units. While processing the data from the Karshong Forest Management Unit of Bumthang District, for example, it was revealed that more yew occurred there than in the western districts.

More work is needed to screen existing databases and inventory reports to pinpoint the most important strata and individual plots where yew is found. Diagram 3 shows the probable areas where yew might be found. These areas are indicated on the map by dots. The density of dots and their number do not reflect the quantity of yew, but are exclusively an indication of the localities where yew occurs.



Different varieties of berries grow in Bhutan's forests. Some form a valuable food crop, others are used in making natural dyes.

Natural Vegetable Dyes; Food, Fruit Species and Mushrooms; Gums and Waxes; and Incense

by *Sonam Tshering*
Divisional Forest Officer, Sarpang
The Royal Government of Bhutan

Although Bhutan is largely covered with natural forests, a detailed survey of forest products has not been carried out. Hence accurate and authentic data on the various types of minor forest produce, such as edible products, dyes and wax, are still to be ascertained. Moreover, Bhutan has few industries or factories engaged in the collection and marketing of forest products. Collection and processing methods are still crude and traditional. Improving this situation would undoubtedly lead to an increase in both local and national revenue, as there are many abundant plant products that could be extracted. Other plants are simply not yet known and go to waste as their profitable use, if any, remains unknown.

NATURAL VEGETABLE DYES

There are a number of dye-yielding plants in Bhutan (Table 15). Local people obtain dyes from plants and minerals by simple, traditional extraction methods. These dyes can be grouped into five categories: leaf dyes, bark dyes, flower and fruit dyes, stem and root dyes, and mineral dyes.

Leaf Dyes

Leaf dyes yield a variety of colours and are used by local people for dyeing hand-woven materials, a fairly large cottage industry in Bhutan. Species include *Symplocos* sp., *Strobilanthes flaccidifolious*, *Holcia nilagirica* and *Indigofera*.

Bark Dyes

These can potentially be extracted from species such as *Terminalia tomentosa*, *Berberis nepalensis*, *Acacia* spp., and *Alnus* sp. Due to a lack of knowledge and experience, however, only dyes from the bark of walnut trees and *Berberis* sp. are presently extracted by local people.

Natural dyes play an important role in making traditional Bhutanese fabrics.



Flower and Fruit Dyes

In Bhutan, flower and fruit dyes are the most important category of natural dyes. Most of the dye species are raised from seeds by rural people, then sold. Their fruit can be used as mordants. Particularly important are khomany-shing (*Choenomeles lagenaria*), robtangshing (*Rhus similata*), churoo, amla (*Phyllanthus emblica*), *Cedrala toona*, *Michelia champaka* and *Mallotus philippenensis*. The dyes are normally used for colouring or dyeing silk clothes. *Mallotus philippenensis*, for example, produces a red dye called “sinduri,” which is commonly used in colouring cloth.

Stem and Root Dyes

Stem and root dyes are used for many varied purposes. Dyes from *Curcuma longa* are used for colouring foodstuff, from *Acacia catechu* for tanning and dyeing canvas and leather goods, and from jackfruit for dyeing robes for monks.

Mineral Dyes

Found throughout Bhutan, these dyes are obtained from natural mineral salts (dochur) and oxidized iron (marchelo).

EDIBLE PRODUCTS FROM FORESTS—FOOD, FRUIT SPECIES AND MUSHROOMS

There are a number of plant species in Bhutan's forests whose fruits, seeds, tubers, roots, or stem parts are collected and consumed directly by the local people. The full extent of such use, however, has not yet been surveyed. A better understanding of the uses of such

products would clearly lead to an improvement in the country's economic situation, particularly in rural areas.

A description of some of the species used as food follows (see also Table 16):

Food

- Wild yams (*Dioscorea* spp.) are found in abundance in southern Bhutan. The tubers are eaten once a year as part of a ritual. At times of famine, however, wild yams become a staple for those lacking other food. The tubers have an excellent taste. During difficult times even the bulbil, which is bitter, is eaten.
- *Bamboo shoots* are a common vegetable in Southeast Asia. Bhutan has many edible bamboo species. The roots are harvested during the rainy season—normally when they are about one foot high. The shoots are then boiled with wood ash to remove all poison. Without boiling, some bamboo shoots are extremely poisonous. Some bamboo varieties, however, do not have to be boiled.
- *Elatostema* spp. is consumed as a vegetable, known locally as “damroo.”
- Algae (e.g., *Ulva* spp.) is mixed in curries.
- Tubers such as *Dioscorea* spp. and *Alocasia* spp. are eaten as vegetables.
- Jackfruit is also eaten as a vegetable.
- Oil can be extracted from sal seed and from *Symplocos paniculata* and consumed with ferns and other food.

Fruit

Forest fruit includes:

- pears (*Pyrus* spp.)—known locally as “phoetsi” in Dzongkha
- *Eleagnus latifolia*—small, red fruit
- “tong” in Dzongkha—somewhat like a pear (*Docynia indica*)
- “humpa” in Dzongkha (*Citrus* spp.)
- “nimbu” in Nepali
- Bel-Aegle marmelos—eaten after boiling

- wild banana (*Musa* spp.)—the fruit is eaten raw; the flowers are eaten as vegetables
- mango (*Mangifera* spp.)—eaten as fruit
- baer (*Ziziphus* spp.)—grows mainly in Bhutan's southern riverine plains and degraded areas
- amla (*Phyllanthus emblica*)
- strawberries (*Fragaria*)
- “khalangji” (*Solanum* spp.)
- jackfruit (*Artocarpus heterophyllus*)

Details of various other fruit species are given in Table 16.

Spices

Generally used as food flavouring agents. Many also have medicinal properties. Most important of all the spices found in Bhutan are cardamoms and peppers (*Curcuma aromatic* and *Cinnamon zeylanicum*). Other species include mentha, curry patta (*Murraya koenigii*), *Amaranthus* spp. and *Zanthoxylum* spp. (see Table 17 for a detailed list of various Bhutanese spice species).

Mushrooms

Bhutan prizes its wide variety of mushrooms (Table 18). They come from both the country's tropical and temperate regions. More edible mushroom varieties are found in temperate regions than in tropical areas.

Some of the commonly eaten mushrooms are “jilli namcho” (*Auricularia auricula*), which grows on rocks and rotten logs; “jichu kangroo” (*Calvaria* spp.); “ga shamu” (*Clitocybe odora*); “sisishamu” (*Cantherellus cibarius*); “taa shamu” (*Polyporus* spp.); and “sangey shamu” (*Tricholoma matsutake*). Many varieties are marketed commercially.

GUMS AND WAXES

Gums

Gums are translucent, amorphous exudations from the wounds of trees. Bhutan has not yet begun intensive gum tapping. Local people collect gum as and when required and the

damage done to the trees is negligible. Gum (latex) from *Ficus elastica* is extracted for sealing bamboo baskets, and other bamboo work, using simple methods.

Commercial processing of gums has not yet begun. Bhutan's climate is favourable for the cultivation of gum trees, however, and the launching of such commerce would be beneficial to the whole country. Bhutan presently has only a few gum-yielding species (Table 19).

Trees from which the people extract gum include: brongshang (*Ficus elastica*), simal (*Bombax ceiba*), khair (*Acacia catechu*), and semla gum (*Bauhinia retusa*).

Waxes

Waxes are generally obtained from insect products, such as the honeycomb-cells of bees and wasps (*Apis* spp.). Local people collect honeycombs after the bees or wasps leave their nests. The empty combs are melted and all crude material removed. The wax is generally used for smoothing the thread when weaving cloth, or it is rubbed into the woven cloth to give it gloss and strength. Some waxes are now processed into candles, sealing materials, and other products (see Table 20 for a list of the various species found in Bhutan).

INCENSE

Incense sticks are manufactured from many plant species which yield sweet scents (Table 21). Most people use the leaves, barks or whole plant directly as incense. In Bhutan, the demand for incense sticks for religious use is high. At least one large-scale factory is now manufacturing incense, in addition to many small-scale factories.

Some of the commonly used incense species are "shup" (*Juniperus* spp.), grown at high altitudes; "pang pee" roots (*Nardostachys jatamansi*); "sanze kachu" (*Tancetum tibeticum*); "poikar" (*Cannarium sikkimensis*); and *Rhododendron* spp. In the absence of these species, people use pine leaves or *Artemisia* spp. as incense.

The raw materials required by a typical incense industry are shown in Table 22.



Quality mushrooms are one of the prime non-wood products of Bhutan's many forests.

Table 15 Natural Vegetable Dyes in Bhutan

Botanical name	Local name	Parts used	Collection time	Colour of dye obtained	Quantity available	Distribution
<i>Mallotus philipensis</i>	Sinduri (N)	Powder of fruit	March-September	Red	Abundant	Found in sub-tropical areas
<i>Acacia catechu</i>	Khair (N) Taeja (Dz) Jasenshing (Sh)	Heart-wood	Throughout the year	Dark brown	"	Kalikhola, Samtse and Sarpang
<i>Symplocos ramosissima</i>	Domzim (Dz) Kharane (N) Serzim (Sh)	Leaves	"	Yellow	"	Available in every district
<i>S. glomerata</i>	"	"	"	"	"	"
<i>Symplocos paniculata</i>	Pangtsi (Dz) Zimshing (Sh)	"	"	"	"	Found only in patches in western Bhutan
<i>Strobilanthes flaccidifolius</i>	Ram/Tsangja (Dz) Yangshaba (Sh)	"	"	Blue	Once cultivated, but now grows naturally in the wild	Mongar, Trashigang, Pemagatshel, and Trashiyangtse
<i>Lacifer lacca</i>	Jatsho (Dz) Tshos (Sh) Laha (N)	Encrustation	September-October	Red	Cultivated by villagers	Mongar, Trashigang, Pemagatshel and Trashiyangtse
<i>Choenomeles lagenaria</i>	Khomang (Sh) Mentsim (Dz)	Fruit	"	Mordant	Fairly abundant	Southern Bhutan, Mongar, Bumthang and Trashiyangtse
<i>Rubia manjit</i>	Choid (Dz) Mangito (N) Lanyi roo(Sh)	Whole plants	June-September	Red	Abundant	Trashigang, Mongar, Pemagatshel, Punakha Wangdue, Thimphu and Paro
<i>Curcuma longa</i>	Yongka (Dz) Hardi (N) Gung (Sh)		October-November	Yellow	Can be easily cultivated	Mongar, Samdrup Jongkha, Pemagatshel, and throughout southern Bhutan
<i>Phyllanthus emblica</i>	Churoo (Dz) Chorgon sey (Sh) Amla (N)	Fruit	August-December	Mordant	Abundant	Dagana, Trashigang, Mongar, Punakha, Wangdue and Lhuntse
<i>Rhus chinensis</i>	Robtangshing (Sh) Kharabshing (Dz) Bhakimlo (N)	"	April-May	"	Abundant	Tsirang, Sarpang, Manas and Samtse

(continued on page 93)

Table 15 Natural Vegetable Dyes (continued)

Botanical name	Local name	Parts used	Collection time	Colour of dye obtained	Quantity available	Distribution
<i>Juglans regia</i>	Tashing (Dz) Okhar (N) Kheshing (Sh) Walnut (Eng)	Bark	Whole year	Black	Moderate	Haa, Wangdue, Punakha, Trashigang, Mongar, Zhemgang, Trongsa, Chhukha and Pemagatshel
	Dochur (Natural Salt)	White substance	Whole year	-	-	Found in land slips and rocky areas
	Manchala (Ironoxide)	"	"	Orange-red	-	Found in some streams
<i>Artocarpus integrifolia</i>	Jackfruit (Eng) Katar (N) Dranaashing (Dz) Bojang (Kh) Drimling sey (Sh)	Wood	"	Brownish yellow	Abundant	Cultivated in southern Bhutan
<i>Holcia nilagirica</i>	Potorshing (Sh) Potala (Dz) Bandarey (N)	"	"	Yellow	Abundant	Found in warm, broad-leaved forests
<i>Indigofera</i> spp.	Indigo (Eng)	Leaves	"	Indigo	Abundant	Thimphu, Trashigang, Paro and Mongar
<i>Mangifera indica</i>	Amshing (Sh) Amp (N) Mango (Eng)	Wood	"	Light yellow	Moderate	Found in southern Bhutan
<i>Onosma hookari</i>	Mugtsi (Sh) Drimug (M)	Root, bark	April-September	Grey	"	Lhuntse, Lingtshi, Laya, Lunana, Paro and Thimphu
<i>Punica granatum</i>	Pomegranate (Eng) Thalimsey (Sh) Darim (N) Sendu (Dz)	Rind	March-May	Golden yellow	Moderate	Also cultivated in sub-tropical regions by villagers
<i>Rheum emodi</i>	Chumtsa (M)		July-August	Yellow	"	Alpine
<i>Barberis aristata</i>	Korshuen (M)		Whole year	"	"	Alpine

Note: (Dz) = Dzongkha, (Eng) = English, (M) = Medical, (N) = Nepali, (Sh) = Sharchop-kha.

Table 16 Food and Fruits in Bhutanese Forests						
Scientific name	Local name	Parts used	Collection time	Quantity available	Distribution	Remarks
<i>Juglans regia</i>	Tashing (Dz) Khashing (Sh) Okhar (N) Walnut (Eng)	Fruit	September-October	Abundant	Wangdue, Punakha, Paro, Haa, Chhukha, Mongar, Lhuntsi, Zhemgang, Trashigang, Trashiyangtse and Pemagatshel	
<i>Pyrus</i> spp. <i>Docynia indica</i>	Lue (Dz) Pear (Eng) Litong (Sh) Naspati (N)	"	July	"	"	Cultivated
<i>Diplocknama butareace</i>	Yika (Dz) Pinsa (Sh) Chowri (N)	"	August-September	Abundant	Rare; Punakha, Wangdue, Mongar, Trashigang, Dagana, Samtse, Sarpang and Samdrup Jongkha	Fruit pulp is eaten and oil is extracted from seed
<i>Cornus capitata</i>	Phasti/Namimpluse (Sh) Poitsi (Dz)	"	October-November	"	Punakha, Wangdue, Trashigang and Mongar	
<i>Cornus macrophylla</i>	Chapoi/Baminpa (Sh) Boray poitsi (Sh) Poitsi (Dz)	"	"	"	"	
<i>Elagnus latifolia</i>	Bjee (Dz) Dangbur (Sh)	"	February-March/ September-October	Abundant	Found only in Montane Zone	
<i>Docynia indica</i>	Tong (Dz) Thungchurpu (Sh) Mel (N)	"	October-December	"	Punakha, Wangdue, Trashigang, Zhemgang, Trongsa, Trashiyangtse, Tshirang and Pemagatshel	Wild, as well as cultivated
<i>Punica</i>	Chindu (Dz) Darim (N) Thalim (Sh)	"	August-September	"	Punakha, Wangdue, Trashigang, Mongar and southern Bhutan.	Cultivated
<i>Citrus</i> spp.	Bokoley/Humpa (Dz) Noompang (Sh)	"	October-February	"	Found wild, scattered throughout every district.	
"	Nimbu/Kagati (N)	"	"	"	Cultivated in southern Bhutan	
<i>Aegle marmelos</i>	Bell (N)	"	"	Moderate	"	
<i>Musa</i> spp.	Ngala (Dz) Banana (Eng) Laishing (Sh) Kera (N)	"	Whole year	Abundant	Southern Bhutan	Cultivated

(continued on page 95)

Table 16 Food and Fruits (continued)

Scientific name	Local name	Parts used	Collection time	Quantity available	Distribution	Remarks
<i>Zizyphus</i> spp.	Khangkhalingsay (Sh) Khankarisey (Sh) Baer (N)	Fruit	March-April	Abundant	Samtse, Sarpang, Samdrup Jongkha, Trashigang and Trashiyangtse	
<i>Phyllanthus emblica</i>	Chhorengsey (Dz) Amla (N) Chhoroo (Sh)	"	August-October	"	Trashigang, Mongar, Wangdue, Punakha and Trashiyangtse	
<i>Eugenea</i> spp.	Jamuna (N) Mantsisey (Sh) Nasi or Nyasey (Dz)	"	August-September	Fairly abundant	Punakha, Wangdue, Trongsa, Trashigang, Mongar and Lhuntshi	
<i>Fragaria</i> spp.	Marip (B) Sagang (Sh) Strawberry (Eng)	"	"	Abundant	Found in all pine forests	
<i>Morus</i> spp.	Kimbu (N) Tshadey (Dz) Shakhongmasey (Sh) Phrumtagpasey (Sh)	"	May-July	Rare	Found scattered throughout all districts.	
<i>Dioscorea</i> spp.	Phantang (Sh) Phantang (Sh) Khalagtang (Sh) Gongjogtang (Sh) Borang jogtang (Sh) Rantang (Dz) Bantarul (N) Ghartarul (N) Wild yam (Eng)	Tuber	February-April	Abundant	Found in southern Bhutan	
<i>Randia</i> spp.	Nertingaey (Sh) Maidal (N)	Fruit	June-July	Abundant	Found in sub-tropical regions	
<i>Calamus</i> spp.	Patsha (Dz) Dreyngang (Sh) Cane (Eng) Bet (N)	Shoot	"	"	Found mostly in cool, moist sub-tropical forests	
<i>Girardiana palmata</i>	Zochha (Dz) Gonjazu (Sh) Phagpajazu (Sh) Sisnu (N) Nettle Plant (Eng)	Inflor-scense	"	"	Tropical and sub-tropical regions	
<i>Adhatoda vasica</i>	Bashaka (Dz) Khatsarim (Sh) Bashaka (N)	Flower	"	"	"	

(continued on page 96)

Table 16 Food and Fruits (continued)						
Scientific name	Local name	Parts used	Collection time	Quantity available	Distribution	Remarks
<i>Elatostema</i> spp.	Damroo (Dz) Drimmom (Sh)	Stem and leaves	Whole year	Abundant	Cool, moist sub-tropical regions	
<i>Ulva</i> spp.	(LEON) Algae (Eng) Churoo (Dz) Lungai (Sh)	Whole plant	"	"	Found on boulders in rivers	
<i>Eleocarpus varuna</i>	Badrasey (N) Gasha-thungsey (Sh)	Fruit	"	"	Sub-tropical regions	
<i>Bambusa</i> spp.	So (Sh) Bans (N)	Shoot	June-July	"	Tropical regions	
<i>Rhus hookeri</i>	Tarsishing (Sh)	Fruit	September-October	"	Temperate to sub-tropical alpine climates	
<i>Lorenthus</i> spp.	Khainingroo or Rumlung (Sh) Lorenthus (Eng)	Leaves	Whole year	"	"	Substitute for tea leaves
-	Neshing jormo (Sh)	"	"	"	Temperate areas	
<i>Calamus</i> spp.	Phakre (N) Tikir (Sh)	Fruit	"	Abundant	"	
-	Thakal (N)	"	June-July	Rare	"	
-	Nakey (Dz) Dawai (Sh) Neguro (N) Fern (Eng)	New shoots	June-August	Abundant	In every district of Bhutan	
<i>Solanum</i> spp.	Khalanji (Sh)	Fruit	March-May	Rare	Tropical and sub-tropical regions	Can be cultivated
<i>Rhus chinensis</i>	Chakashig (Kh) Kharabshing Datrit (M) Robtangshing (Sh) Bhakimlo (N)	"	April-May	Abundant	"	
<i>Hodsoni</i>	Ghewphal (N) Tershe (Sh)	Seeds	"	Fairly abundant	Tropical regions	
<i>Machilus edulis</i>	Guli (Sh) Phamphal (N) Aracado (Eng)	Fruit	July-August	Abundant	Moist, sub-tropical regions	
<i>Spondius</i> spp.	Lapsi (N)	"	"	"	Sub-tropical regions	
<i>Spondius</i> spp.	Amarsey (Sh) Amaroo (N)	"	"	"	"	

(continued on page 97)

Table 16 Food and Fruits (continued)

Scientific name	Local name	Parts used	Collection time	Quantity available	Distribution	Remarks
<i>Artocarpus</i> spp.	Lathar (N)	Fruit	July-August	Rare		
<i>Mangifera sylbistris</i>	Amchukili (Dz) Mango (Eng) Amp (N)	"	May-June	"	"	
-	Amsey shingsi (Sh)	"	July-August	Abundant	"	
<i>Symplocos paniculata</i>	Pangtshi (Dz)	"	"	"	"	
<i>Phyllanthus emblica</i>	Churoo (Dz) Amla (N) Chhorgensey (Sh)	"	May-June	"	"	
<i>Zizyphus</i> spp.	Tshoshing (Sh) Khangkhalingsey (Sh) Baer (N)	"	March-May	"	"	
-	Gothanapaisey (Sh)	"	May-July	"	"	
<i>Bidens</i> spp.	Zumphirobu (Sh)	Leaves	Whole year	"	"	
<i>Piper</i> spp.	Pani (Dz) Pan (Sh/N)	"	"	"	"	Leaves used as a substitute for tea
<i>Acacia catechu</i>	Toeja (Dz) Khair (N) Jasenshing (Sh)	Heart-wood	"	"	Tropical	Heartwood is boiled and used as a substitute for tea
<i>Alocasia</i> spp.	Mane/Piralu (N) Bozang (Sh)	Tuber	"	"	Sub-tropical regions	
<i>Orchid</i> spp.	Ola-chhoto (Dz) Sunakhari (N) Orchid (Eng)	Flower	May-July	Rare	"	

Note: (B) = Bumthap, (Dz) = Dzongkha, (Eng) = English, (M) = Medical, (N) = Nepali, (Sh) = Sharchop-kha.

Table 17 Spices in Bhutanese Forests					
Botanical name	Local name	Parts used	Collection time	Quantity available	Distribution
<i>Elettaria cardamomum</i>	Allaichi (N) Cardamum (Eng) Kakola (M)	Fruit	June-July	Abundant	Samtse, Sarpang, Samdrup Jongkha, Wangdue, Tsirang and Shemgang
<i>Cinnamomum tamala</i> <i>Cuinnamomum zylanicum</i>	Tezpata (N) Shingtsha or Soloshing (Sh)	Leaves	Whole year	"	All southern districts
<i>Piper nigrum</i>	Pipla (N) Pansa (Sh)	Fruit	September-October	Moderate	Sarpang, Samtse and Samdrup Jongkha
<i>Piper nigrum</i>	Round Pipla	"	September-December	Abundant	All southern parts of Bhutan
<i>Cornus longa</i>	Hardi (N) Jung (Dz) Yongka (Sh)	Rhizome	Winter season	"	Trashigang, Mongar, Samdrup Jongkha and Samtse, Sarpang and Tsirang
<i>Myrica negi</i> (small)	Tsutsusey (Sh)	Fruit		"	Temperate zones
<i>Myrica</i> spp. (big)	Omsa tsutsusey (Sh)	"		"	"
<i>Rubus elliptica</i>	Sergong (Sh) Ainselu(N)	"		"	"
<i>Muraya koenigii</i>	Curry patta (Eng/N)	Leaves	Whole year	Abundant	Tropical regions
<i>Mentha</i> spp.	Nombarang (Sh) Padena (N) Mentha (Eng)	"	"	"	Sub-tropical and temperate regions
<i>Hantonia</i> spp.	Nombareng (Sh) Padena (N)	"	"	"	"
<i>Corriandum</i> spp.	Wuse (Dz) Dhania patta (N)	"	"	"	Tropical
<i>Amaranthes</i> spp.	Zimtsi (Dz) Naam (Sh)	Whole plant	June-August	"	Temperate regions
<i>Zanthoxylum alatum</i>	Gee (Sh) Thingne (Dz) Chhawa (Kh) Pepper (Eng) Timbur (N)	Fruit	May-August	"	Sub-tropical regions
<i>Z. budrunga</i>	Waosey (Sh) Bokey Timbur (N)	"	May-August	Fairly abundant	"

Note: (Dz) =Dzongkha, (Eng) = English, (M) Medical, = (N) = Nepali, (Sh) = Sharchop-kha.

Table 18 Forest Mushrooms in Bhutan

Scientific name	Commercial name	Local name	Collection time	Quantity available	Distribution
<i>Auricularia auricula</i>	Jew's ear	Jilli namchu	June-August	Common	Temperate regions
<i>Agaricus campestris</i>	Button		"	Fairly common	"
<i>Armillaria mellea</i>	Honey		"	"	
<i>Agrocybe cylindracea</i>			"		
<i>Agaricus bisporus</i>	Button		"		Temperate regions
<i>Agrocybe paludosa</i>					
<i>Amanita schinocoephala</i>			June-August	Fairly common	
<i>Amanita caesarea</i>	Caesar's	Connngsey	"	"	
<i>Boletus subtomentosus</i>	Bee		"	"	
<i>Boletus aleggans</i>	"		"	"	
<i>Boletus bresadolae</i>			"	Fairly common	
<i>Boletus variegatus</i>			"	"	
<i>Boletus edulis</i>	Cap	Bam shamu	"	"	
<i>Boletus cavipes</i>			"	"	
<i>Boletus luridus</i>			"	"	
<i>Boletus erythropus</i>			"	"	
<i>Boletus lividus</i>			"	"	
<i>Boletus viscidus</i>			"	"	
<i>Clavaria</i> spp.		Bjichu kangro	"	Common	
<i>Clitocybe odora</i>	Green milk	Ga shamu	"	Fairly common	
<i>Coprinus atramentarius</i>	Ink cap	Ruru shamu	"	"	
<i>Coprinus micaceus</i>			"	"	
<i>Cortinarius collinitus</i>	Pig's stomach		"	"	
<i>Clitocybe aggregate</i>		Ga shamu	"	"	
<i>Clitocybe infundibuliformis</i>			"	"	
<i>Collybia valutipes</i>	Enokitake		"	"	
<i>Cantherellus cibarius</i>	Chanterelles	Sisishamu	"	"	Temperate regions

(continued on page 100)

Table 18 Forest Mushrooms (continued)					
Scientific name	Commercial name	Local name	Collection time	Quantity available	Distribution
<i>Common hydnum</i>	Hydnum		June-August	Fairly common	
<i>Clavaria botrytis</i>	Purple coral	Jichu kangru	"	Common	
<i>Calvaria viscosa</i>	White coral		July-August	Fairly common	
<i>Copricus comatus</i>	Ink cap	Ruru shamu	"	Common	
<i>Clavaria flaya</i>			"	Fairly common	
<i>Cyathus olla</i>			"	"	
<i>Collybia velutipes</i>	Velvet shank		"	"	
<i>Clitocybe geotropa</i>			"	"	
<i>Cantharellus cinereus</i>			"	Rare	
<i>Drosophila hydrophilax</i>			"	Fairly common	
<i>Entoloma lividoalbus</i>			"	"	
<i>Fistulina hepatica</i>	Beef steak	Chimp shamu	"	"	
<i>Geastrum rufescens</i>	Earth flower		"	"	
<i>Ganoderma lucidum</i>	Monkey's seat		"	"	
<i>Hygrophorus hypothejus</i>			"	"	
<i>Hygrophoris</i>			"	"	
<i>Helvella crispa</i>			"	Common	
<i>Hericium erinceus</i>	Monkey head		"	Fairly common	
<i>Inocybe piriadora</i>			"	"	
<i>Inocybe nipipes</i>			"	"	
<i>Inocybe godeyi</i>			"	"	
<i>Lycoperdon perlatum</i>	Puff ball	Daybongthe	"	Common	
<i>Lactarius deliciosus</i>	Golden milk		"	Fairly common	
<i>Lactarius piperatus</i>	White milk		"	"	
<i>Lepiota procera</i>	Parasol		"	"	
<i>Lepiota mastoidea</i>	"		"	"	
<i>Lepiota clypoilaria</i>	Silky volvaria		"	"	

(continued on page 101)

Table 18 Forest Mushrooms (continued)					
Scientific name	Commercial name	Local name	Collection time	Quantity available	Distribution
<i>Lactarius scrobiculatus</i>			July-August	Fairly common	
<i>Lactarius sanguifluus</i>	Pink		"	"	
<i>Lactarius luteus</i>			"	"	
<i>Lactarius vellereus</i>			"	"	
<i>Lycoperdon pyriforme</i>			"	"	
<i>Lepiota mastoidea</i>	Betel		"	"	
<i>Lentinus edodes</i>	Oak	Soke shamu	"	Common	
<i>Lepiota molybdites</i>			"	Fairly common	
<i>Leary maria velutina</i>	Large		"	"	
<i>Marasmius oreades</i>	Coarse teeth		"	"	
<i>Panaelus sphinctrinus</i>	Manure		"	"	
<i>Peziza aurantia</i>		Kangchu shamu	"	"	
<i>Polyporus sulphureus</i>		Taa shamu	"	Common	
<i>Polyporus frondosus</i>	Myetake	"	"	"	
<i>Pholiota squarrosa</i>	Wooly cap		"	Fairly common	
<i>Pleurotus cornucopiae</i>	Oyster	Nakey	"	Common	
<i>Pleurotus eryngii</i>	"	"	"	"	
<i>Pleurotus ostreatus</i>	"	"	"	"	
<i>Pleurotus sajor caju</i>	"	"	"	"	
<i>Polyporus picipes</i>			"	Fairly common	
<i>Pseudocolus schellenbergiae</i>			"	"	
<i>Russula cyanoxantha</i>	Green	Damsha	"	"	
<i>Russula lepida</i>		Maley sha	"	"	
<i>Russula albonigra</i>			"	"	
<i>Russula rubra</i>			"	"	
<i>Russula foetens</i>			"	"	

(continued on page 102)

Table 18 Forest Mushrooms (continued)

Scientific name	Commercial name	Local name	Collection time	Quantity available	Distribution
<i>Pholiota carperata</i>			July-August	Fairly common	
<i>Russula amoena</i>	Quelet		"	"	
<i>Russula alutacea</i>	Flies		"	"	
<i>Strobilomyces floccopus</i>			"	Common	
<i>Sparassia crispa</i>	Golden coral		"	"	
<i>Stropharia semiglobata</i>	Dung, round-head		"	Rare	
<i>Tremella mesentrica</i>	Golden jelly	Tsili sha	"	Common	
<i>Tricholoma matsutake</i>	Matsutake	Sangay shamu	"	"	Genekha, Ura, Isuna and Betekha (2.5 tons). Exported
<i>Tuber spp.</i>	Truffles		"	Rare	Trongsa
<i>Morchella esculenta</i>	Morel	Gep shamu	"	-	Temperate regions
<i>Schizophyllum commune</i>	Split gill	Cinchiring (Sh)	"	Common	
<i>Volvariella volvacea</i>	Straw	Sorbang Bamu	"	Rare	Lingmethang; tropical to temperate regions

Source: Project Mushroom, Simtokha.

Note: (Sh) = Sharchop-kha.

Botanical name	Local name	Parts used	Collection time	Quantity available	Distribution	Remarks
<i>Ficus elastica</i>	Rubber tree (Eng) Brongshig (Sh) Kakola (M), Labar (N)	Exude	Whole year	Rare	Found in tropical forest	Can be cultivated
<i>Bombax ceiba</i>	Simal (N) Pemgeser shing (Sh)	Exude	January- April	Abundant	Bukatading, Kalapani and Pugli in Samtse District. It is also found scattered throughout southern Bhutan.	
<i>Acacia catechu</i>	Khair (N) Toeja (Dz) Jasenshing (Sh)	Heart- wood	Whole year	Abundant	"	
<i>Bauhinia retusa</i>	Semla gum	Exude	January- April	Abundant	Found in Samtse, Tsirang, Sarpang and Samdrup Jongkha	Used as colouring for sweets

Note: (Dz) =Dzongkha, (Eng) = English, (M) Medical, (N) = Nepali, (Sh) = Sharchop-kha.

Scientific name	Local name	Parts used	Collection time	Quantity available	Distribution
<i>Apis dorsata</i>	Mouri (N) Wagoma (Sh) Bee (Eng)	Beehive	September- January	-	Found in Tsirang, Genekha and Jimina. Also found in other districts in limited numbers.
<i>Apis apis</i>	Mouri (N) Mizuma (Sh) Bee (Eng)	"	"	Moderate	
<i>Apis sp.</i>	Putka (N) Yingburing (Sh)	"		"	Topical and sub-tropical regions.

Note: (Dz) =Dzongkha, (Eng) = English, (M) Medical, (N) = Nepali, (Sh) = Sharchop-kha.

Table 21 Forest Plants Used As Incense in Bhutan

Botanical name	Local name	Parts used	Collection time	Quantity available	Distribution
<i>Juniperus</i> spp.	Shup (Dz) Dhup (N) Shugposhing (Sh)	Whole plant	Throughout the year	Abundant	Gasa, Thimphu, Trongsa, Bumthang, Wangdue, Trashigang, Haa, Paro, Lhuntse, Trashiyangtse and Mongar
<i>Nardostachys jatamansi</i>	Pang Poi (Dz)	Roots	"	In pockets	Halajola, Selela, Sagala, Jewlela, Dagye Phangtsho, Soi Yatsa, Lingtshi, Laya, Lunana, Naro, Pelela, Bumthang, Dagapela, Thrumshingla, Merak Sakten, Phajuing, Dochula and Sinchula.
<i>Daphne</i> spp.	Shogushing (Sh) Deyshing (Dz) Kagatey or Argeli (N)	Inner wood	"	Abundant	Trashigang, Mongar, Thimphu and Haa
<i>Tanacetum tibeticum</i>	Sangze kachu (Dz) Khenka (Dz)	Whole plant	"	Rare	Haa, Paro, Thimphu, Bumthang, Lingtshi and Laya
<i>Artemisia</i> spp.	Khampa (Dz) Titeypati (N) Dungmin (Kh)	"	March-December	Abundant	Found in abundance in all districts.
<i>Rhododendron, anthopogon</i>	Baloo (Dz/Sh) Sunpatte (N)	"	Whole year	Abundant	Halajula, Pelela, Sagala, Jewlela, Soy Yak-sa, Lingtshi, Laya, Lunana, Naro, Bumthang, Dagapela, Dagana, Thrimshingla, Merak-Sakten and Phajuding
<i>Rhododendron, setosum</i>	Sunpatte (N) Suloo (Dz/Sh)	"	"	"	"
<i>Abies densa</i>	Dungshing (Dz) Wangshing (Sh) Silver fir (Eng)	Leaves/ twigs	"	Abundant	Paro, Haa, Pelela, Gasa, Bumthang and Lhuntse
<i>Cupressus</i> spp.	Tsendenshing (Sh) Dhupi (N) Tsendey (Dz)	Whole plant	"	Rare; found only in patches	Kukuchhu, Lunana, Dangchhu, and Nobding; found planted in patches

(continued on page 105)

Table 21 Forest Plants Used As Incense in Bhutan (continued)					
Botanical name	Local name	Parts used	Collection time	Quantity available	Distribution
<i>Aquilaria agallocha</i>	Agar (Eng) Agarwood (Eng) Agaroo (Dz) Agur (Sh) Agori (N)	Infected heartwood	Whole year	Extremely rare	Manas and Phipsoo Game Sanctuaries and Samdrup Jongkha
<i>Cannarium sikkimensis</i>	Poikar (Dz) Poskar (Sh) Gokuldhup (N)	Exude	"	"	Sarpey in Samtse, Samdrup Jongkha and Sarpang
<i>Shorea robusta</i>	Sal dhup (N)	"	"	Abundant	Samtse, Kalikhola, and Sarpang and in plantations in the south
<i>Cinnamomum cecidodaphne</i>	Phagpanengshing (Sh) Malagiri (N) Wood (Eng)	Wood	"	"	Punakha, Mongar and Samdrup Jongkha
<i>Delphinium brunonium</i>	Jagoipoi	Whole plant	July-August	Rare	Lingtshi
<i>Gaultheria</i> spp.	Chanze kain (Dz) Machino (N) Shogshingma shing (Sh)	"	Whole year	Abundant	Trashigang, Mongar and Trongsa
<i>Terminalia bellerica</i>	Myrabolen (Eng) Baroo (Dz/Sh) Barra (N)	Fruit	March-May	Abundant	Abundant in tropical forests
<i>Terminalia chebula</i>	Myrabolen (Eng) Baroo (Dz/Sh) Harra (N)	"	"	"	"
<i>Phyllanthus emblica</i>	Churoo (Dz) Churoo (Dz) Chhorgansey (Sh) Amla (N)	"	"	"	"
-	Wangpo Lakpa(Med)	Root	June-August	Fairly abundant	Laya, Lingtshi, Haa, Thimphu and Bumthang
<i>Machilus</i> spp.	Kaula (N)	Bark	Whole year	Abundant	Tropical forests

Note: (Dz) =Dzongkha, (Eng) = English, (M) Medical, (N) = Nepali, (Sh) = Sharchop-kha.

Table 22 Raw Materials Used in Bhutan's Incense Industry					
Botanical name	Local name	Parts used	Distribution	Quantity required (kg. per annum)	Remarks
<i>Rhododendron-anthropogon</i>	Balu	Leaf	Paro, Haa and Gasa	200	Can be replaced by juniper
<i>R. setosum</i>	Sulu	"	"	200	
<i>Angelica</i> sp.	Tangkun	Root	Paro, Gasa and Lingtshi	150	
<i>Nardostachys jatamansi</i>	Pangpoe	"	"	100	
<i>Cinnamomum tamala</i>	Shingtsha	Bark	Punakha and Wangdue	150	
<i>Artemesia vulgaris</i>	Khengkar	Leaf	Throughout Bhutan	500	
<i>Innula</i> sp.	Manu	Root	Gasa, Paro and Lingtshi	250	

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