

Information and analysis for sustainable forest management:
linking national and international efforts in South and Southeast Asia

NON-WOOD FOREST PRODUCTS IN 15 COUNTRIES OF TROPICAL ASIA AN OVERVIEW



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**Information and Analysis for Sustainable Forest Management:
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**NON-WOOD FOREST PRODUCTS
IN 15 COUNTRIES OF TROPICAL ASIA
AN OVERVIEW**

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The EC-FAO Partnership Programme on *Information and Analysis for Sustainable Forest Management: Linking National and International Efforts in South Asia and Southeast Asia* is designed to enhance country capacities to collect and analyze relevant data, and to disseminate and up-to-date information on forestry, and to make this information more readily available for strategic decision making. Thirteen countries in South and Southeast Asia (Bangladesh, Bhutan, Cambodia, India, Indonesia, Laos, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam) participate in the Programme. Operating under the guidance of the Asia-Pacific Forestry Commission (APFC) Working Group on Statistics and Information, the initiative is implemented by the Food and Agriculture Organization of the United Nations in close partnership with experts from participating countries. It draws on experience gained from similar EC-FAO efforts in Africa, and the Caribbean and Latin America and is funded by the European Commission.

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FOREWORD

This regional study presents an overview of the socio-economic importance of the use of non-wood forest products (NWFP) in 15 countries of Tropical Asia. The document consists of two main parts: (1) presentation of background information on the programme activities and methodology and an analysis of the available information at the regional level; and (2) presentation of data on NWFP at the national level (so-called “country profiles”).

Most of the data presented in this report are indicative figures, which have been collected in published and unpublished reports, and therefore do not represent official statistics. The results presented show that qualitative and quantitative information on NWFP at the national level continues to be weak. It is hoped that this report will support the ongoing process of data improvement on NWFP. Improved data are considered to be essential to ensure that the use and importance of NWFP are taken adequately into consideration by decision-makers, land-use planners, politicians or other concerned experts.

Additional information and comments from readers to improve data on NWFP in Asian countries would be appreciated very much. Information and comments can be sent to:

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Various colleagues at FAO headquarters and at the FAO Regional Office in Bangkok have been involved in the compilation, editing and finalization of the NWFP country profiles. Thomas Enters, Ma Qiang, Johan Lejeune, and Sven Walter, contributed to the collection, analysis and editing of the information presented. Their efforts are appreciated. Furthermore, we would like to thank the European Commission for the financial support given for this work through the Tropical Forestry Budget Line B7-6201/97.

It is hoped that readers will find this publication useful and that it will contribute to improving data collection on NWFP in Asia.

BACKGROUND

Scope of the study

In most tropical countries, non-wood forest products (NWFP)¹ play an important role in the daily lives and well being of the local population. In particular rural and poor people depend on NWFP *inter alia* as sources of food, fodder, medicines, gums, resins and construction material. In addition to local consumption, NWFP are also important traded commodities on local, regional, national as well as international markets. Traded NWFP contribute to the fulfilment of daily needs and provide employment as well as income. Internationally traded NWFP, such as aromatic oils and medicinal plants, can achieve high prices in comparison with NWFP traded on national markets and thus contribute to the economic development of the respective country.

However, very limited statistical data are available on the exploitation, management, consumption and trade of NWFP. Unlike timber and agricultural products, no regular monitoring and evaluation of the resources and socio-economic contribution of NWFP at the national level are being carried out. In the *FAO yearbook of forest products*, for example, statistical data on NWFP such as cork, tannins, bamboo and various oils are only available from 1954 to 1971 (Chandrasekheran 1995) Consequently information is limited today to selected NWFP of national importance. But even for several of these major NWFP, data are often incomplete and cannot be extrapolated to the national level or compared among countries.

FAO assists national governments and institutions to improve the availability of national qualitative and quantitative data related to NWFP. This activity is carried out within the framework of the EC-FAO Partnership Programme "Information and Analysis for Sustainable Forest Management: Linking National and International Efforts in South Asia and South East Asia" (Project GCP/RAS/173/EC), a four-year programme funded by the European Commission (Directorate-General Development). The overall aim of this programme is to strengthen national capacity to collect and compile reliable information on forestry and analyse the forest sector.

This report contains the NWFP country profiles compiled for 15 Asian countries at the national level. These country profiles include a standardized text providing the available qualitative and quantitative data on NWFP and a standardized table showing quantitative information. Furthermore, the report includes an analysis of regional data.

Methodology

Under the EC-FAO Partnership Programme, the available information on NWFP was reviewed and compiled at the national level, in each country, to assess the socio-economic significance and ecological impact of its utilization. Existing data gaps and constraints related to data collection were identified for each country to elaborate practical proposals for improved monitoring of NWFP. In particular, desk studies were carried out to compile draft "country profiles" on NWFP, including information available at FAO headquarters. A standard format for the presentation of information was elaborated showing key information requirements for the evaluation of NWFP.

During a regional workshop for data validation, held in January 2002, in Kuala Lumpur, Malaysia, the draft country profiles were discussed with country representatives to validate available information and add missing data.

¹ NWFP consist of goods of biological origin other than wood, derived from forests, other wooded lands and trees outside forests.

Kind of information collected

To evaluate the socio-economic importance and ecological impact of NWFP exploitation, key information on the products, resources and their economic value has been collected.

(a) Product information

A standard classification of NWFP does not exist yet. NWFP can be classified in many different ways according to their end use (medicine, drinks, utensils, etc.) or the plant-parts used (roots, leaves, bark, etc.). For further information see Chandrasekharan (1995), Cook (1995), FAO (1992) and Shiva and Mathur (1996). Chandrasekharan (1995) developed a classification of NWFP in accordance with the major international classification systems, such as the Harmonised Commodity Description and Coding System, the Standard International Trade Classification Rev. 3 and the Provisional Central Product Classifications.

To simplify the classification, NWFP were categorized according to their end use, as described in Table 1.

Table 1. Main categories of NWFP

Plant products		Animals and animal products	
Categories	Description	Categories	Description
Food	Vegetal foodstuff and beverages provided by fruits, nuts, seeds, roots, mushrooms, etc.	Living animals	Mainly vertebrates such as mammals, birds, reptiles kept/bought as pets
Fodder	Animal and bee fodder provided by leaves, fruits, etc.	Honey and beeswax	Products provided by bees
Medicines	Medicinal plants (e.g. leaves, bark, roots) used in traditional medicine or by pharmaceutical companies	Bushmeat	Meat provided by vertebrates, mainly mammals
Perfumes and cosmetics	Aromatic plants providing essential (volatile) oils and other products used for cosmetic purposes	Other edible animal products	Mainly edible invertebrates such as insects (e.g. caterpillars) and other "secondary" products of animals (e.g. eggs, nests)
Dyeing and tanning	Plant material (mainly bark and leaves) providing tannins and other plant parts (especially leaves and fruits) used as dyes	Hides and skins	Hides and skins of animals used for various purposes
Utensils, handicrafts and construction materials	Heterogeneous group of products including thatch, bamboo, rattan, wrapping leaves, fibres	Medicine	Entire animals or parts of animals such as various organs used for medicinal purposes
Ornamentals	Entire plants (e.g. orchids) and parts of the plants (e.g. pots made from roots) used for ornamental purposes	Dyes	Entire animals or parts of animals such as various organs used as dyes
Exudates	Substances such as gums (water soluble), resins (water insoluble) and latex (milky or clear juice), released from plants by exudation	Other non-edible animal products	For example, bones that are used as tools
Others	For example, insecticides, fungicides		

Monitoring of the resources and evaluation of the economic value of all NWFP in a given country is neither feasible nor desirable. Therefore, only NWFP of national relevance for which

monitoring and evaluation are needed strongly were identified. Exported or widely used products in national markets should be well identified as opposed to NWFP of minor importance, or limited significance. Selecting relevant NWFP initially should help the country to focus its efforts on improving data collection on major NWFP. A further step would be to include other NWFP.

(b) Resource information

Evaluation and monitoring of the resources providing NWFP are important to estimate the actual and potential socio-economic and ecological value of these products at the national level. The first step in this process is the identification of the plant or animal species. In some cases, this identification can be difficult because the same commercial product can be extracted from more than one species and, vice versa, several different NWFP can be taken from a single species. For example, the neem tree (*Azadirachta indica*) provides several products, such as edible leaves, seeds, fodder, bark and fuel. On the other hand, bamboo or rattan canes can be obtained from many different species.

Another important element worth knowing is which part of the plant is harvested (e.g. roots, bark, exudates). In fact, the harvesting of different plant parts has a different impact on the sustainability of the species considered.

Knowledge of the habitat (or production system) and the source (management system) of the exploited species are also important factors. Harvesting of NWFP might cause degradation of the habitat if the exploitation is carried out in an unsustainable way (e.g. utilization of fire for bee hunting). On the other hand, habitat degradation (e.g. through shifting cultivation) might also have a negative influence on the availability of NWFP (e.g. forest fires reduce honey harvests).

Furthermore, resource information on whether the species used is cultivated or gathered from wild sources is important. The exploitation of wild species versus cultivated species (generally integrated in a man-made management system) has direct implications on choices at the management level and can have far reaching ecological and socio-economic effects. For example, once most valued NWFP have become popular and commercialized on markets, usually they are transferred into a more intensive cultivation system (see Homa 1994), largely depriving the forest dweller from their socio-economic benefits that could be generated otherwise. In some cases, classifying a species according to a specific habitat or management system can prove to be difficult, since some products may be produced simultaneously by gathering and through cultivation (e.g. bamboo).

(c) Socio-economic information

To evaluate the socio-economic importance of NWFP, quantitative data on resources, product consumption and trade are required. Figures should indicate quantity (tonnes, m³, etc.), product status (dried, graded, semi-processed, etc.) and value (US\$) for a given period (year).

It is important to know if the product is used mainly for subsistence or commerce. Therefore, it is better to distinguish between utilization at the national level (including subsistence and trade on a local, regional or national market) and the international level.

Besides this quantifiable information, qualitative information is important regarding the cultural and socio-economic context of the NWFP utilization (for example, access to the resources, the main social categories of the harvesters, etc.).

Lessons learned

In the framework of the EC-FAO Partnership Programme, efforts have been undertaken, for the first time, to collect and collate qualitative and quantitative data on the socio-economic importance and ecological impact of the use of NWFP at the national and regional levels. Due to the scarcity and unreliability of available information, most of the presented data must still be

regarded as "tentative" and "preliminary", and only as a reflection of the "tip of the iceberg" of the large and heterogeneous group of NWFP.

The following key problems related to the collection and analysis of statistical data on NWFP have been identified during the implementation of the programme:

- *Insufficient collaboration and networking:* Institutions involved in NWFP statistical collection and analysis do not collaborate sufficiently. Therefore, data remain fragmented and sometimes duplicated.
- *Lack of lead institutions for NWFP statistics:* In most countries, various institutions are involved in data collection and analysis. An official national focal point on NWFP statistics does not exist.
- *Weak capacities:* Most institutions involved in data collection have limited human and financial resources.
- *Poor stakeholder involvement:* Statistical data are gathered mainly by national organizations. Industry and local communities are not involved in data collection and analysis, although they may possess relevant information.
- *Inadequate research:* Little research has been carried out to improve the availability of NWFP statistics.
- *Incomplete data:* Statistical data only cover a limited number of NWFP and their aspects (e.g. on trade, self-consumption, exploitation). In particular, information on resources and on products used for subsistence purposes is lacking. Furthermore, existing information is often based on case studies, which cannot be extrapolated at the national level.
- *Poor quality of data:* Available information is often unclear, inconsistent and contradictory, for example regarding the state of the described product (raw material, processed, semi-processed, graded, etc.), production figures (different units used) and export values.
- *Weak data storage/process facilities:* Most of the statistical data on NWFP has yet to be stored and analysed in specific electronic databases.
- *Inadequate methodologies:* Appropriate methodologies to collect and analyse viable key information on NWFP are still under development.

Taking into consideration the limitations of the availability of NWFP statistical data in Asia, this first version of country profiles and regional synthesis is considered to be the starting point of the process during which additional and more complete information on the socio-economic importance and the ecological implications of NWFP in Asia will be added.

REGIONAL SYNTHESIS

The forest resources in the region

The region, as defined for this study, includes 15 countries, namely Bangladesh, Bhutan, China, Cambodia, India, Indonesia, Lao PDR, Nepal, Malaysia, Myanmar, Papua New Guinea, Pakistan, Philippines, Sri Lanka, Thailand and Viet Nam.

These countries vary widely in size, population and economy. The areas of the countries range from 47 000 km² (Bhutan) to 9 327 420 km² (China). In 1999, the region supported a population of 2 954 300 000 (FAO 2001).

Forest cover and its annual rate of change also vary widely. The region is a reservoir of great biodiversity in and outside forests. Bhutan, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar and Papua New Guinea have a forest cover of between approximately 50 and 60 percent. The total annual reduction of forest cover is greatest in Nepal and Sri Lanka. The only countries with a positive forest cover change are China and Viet Nam. Plantation forestry is important in many countries of the region.

Table 2. Basic data and forest cover of the countries described

Country	Land area, 2000 (1 000 ha)	Population, 1999 (thousands)	GNP per capita 1997 (US\$)	Forest area, 2000	
				1 000 ha	% of land area
Bangladesh	13 017	126 947	352	1 334	10.2
Bhutan	4 700	2 064	406	3 016	62.3
Cambodia	17 652	10 945	303	9 335	52.9
China	932 742	1 274 106	668	163 480	17.5
India	297 319	998 056	392	64 113	21.6
Indonesia	181 157	209 255	1 096	104 986	58.0
Lao PDR	23 080	5 297	414	12 561	54.4
Nepal	14 300	23 385	216	3 900	27.3
Malaysia	32 855	21 830	4 469	19 292	58.7
Myanmar	65 755	45 059	n.a.	34 419	52.3
PNG	45 240	4 702	931	30 601	67.6
Philippines	29 817	74 454	1 170	5 789	19.4
Sri Lanka	6 463	18 639	770	1 940	30.0
Thailand	51 089	60 856	2 821	14 762	28.9
Viet Nam	32 549	78 705	299	9 819	30.2

Source: FAO (2001)

The main NWFP in Asia

The main NWFP in the region include edible plants (fruits, nuts, mushrooms and wild vegetables), exudates (resins, gums and oleoresins), medicinal and aromatic plants, perfumes and cosmetics (including essential oils and incenses), tans and dyes, honey and beeswax, fibre and floss-producing plants, fodder, rattan and bamboo for utensils, handicrafts and construction materials, wildlife products and lac produced by insects.

Asia is by far the world's largest producer and consumer of NWFP, not only because of its population size but also and to a greater extent because of the traditional use of a vast variety of products for food, shelter and cultural needs. NWFP have been vital to forest-dwellers and rural communities for centuries. Local people collect, process and market bamboo, rattan, resins, fruits, honey, mushrooms, gums, nuts, tubers, edible leaves, bushmeat, lac, oil seeds, essential oils,

medicinal herbs and tanning materials. Both rural and increasingly urban communities (both affluent and poor, but for different products) draw upon forests for a variety of needs.

Asia is unique in that most countries in the region have included data on production and trade of major NWFP in their national statistics for many decades and have developed their own nationally applicable definitions, terminology and classifications for their “minor forest produce”². The types and the relative importance of the listed products change from country to country, but the most important products at the regional level are rattan, bamboo, medicinal and aromatic plants, spices, herbs, resins, mushrooms, forest fruits – nuts and vegetables, leaves and fodder. In addition, the Philippines, Indonesia and Malaysia include assessments of NWFP resources in their national forest inventories. These NWFP resources include rattan, bamboo, resin and essential oil-providing species like sandalwood (*Santalum* spp.) and agarwood (*Aquilaria* spp.), as well as some palm species, such as *Nypa fruticans*, *Oncosperma* spp. and *Metroxylon* spp. (sago).

As for the rest of the world, the bulk of NWFP consumption in Asia is for subsistence needs or for local barter; there is no official data reporting in country statistics. However, compared with other regions, in Asia more NWFP are being entered on official national accounts and in international trade statistics. They contribute significantly to rural income generation and country export earnings, such as (in order of importance for the whole region): rattan and bamboo products, medicinal plants/preparations, essential oils, resins (copal), pine nuts, mushrooms, spices and herbs (mainly cardamom and cinnamon), fodder and animal products like bushmeat, trophies, wild honey and lac.

China and India are by far the world’s largest producers and consumers of NWFP. China produces and processes more wild products than any other country in the world. There is growing interest worldwide in its natural foodstuffs, traditional medicines and herbs, and in its handicrafts, made mainly from rattan and bamboo. Thus, China dominates world trade in NWFP (estimated at US\$11 billion in 1994). It is followed closely by India, and then Indonesia, Viet Nam, Malaysia, the Philippines and Thailand.

By subregion, medicinal plants are of major importance in continental Asia, particularly for the higher elevation regions of Nepal, Bhutan, northern India and Pakistan, and southwestern China. High-value medicinal plants include *Nardostachys jatamansi*, *Dioscorea deltoidea* and *Swertia chiraita*. In the drier regions in continental and South Asia, grazing of livestock in the forests and production of fodder (from fodder tree branches and leaves) are the main NWFP.

Traditionally, the rich forests of insular and Southeast Asia have been a major source of many NWFP; in terms of significant production and trade these include bamboo and rattan, medicines and herbs (*Ephedra* sp., *Anamirta cocculus*, *Cinnamomum camphora*) essential oils (*Styrax* spp., *Pogostomon cabin*, *Cassia*, *Citronella*), spices, sandalwood, fruits and resins (copal).

Globally, rattan is the most important NWFP that is traded internationally. At the local level, it is of critical importance as a primary, supplementary or emergency source of income in rural areas. There are approximately 600 species of rattan, of which some 10 percent are used commercially for industrial processing (mainly furniture making). Key genera are *Calamus*, *Daemonorops*, *Korthalsia* and *Plectocomia*. Indonesia hosts the bulk of the world rattan resources (by both volume and number of species) and is the largest supplier of cane, with an estimated annual production of 570 000 tonnes.

However, Asian rattan resources are being depleted through overexploitation and loss of forest habitats. Only Indonesia, the Philippines and Malaysia, and, to a lesser extent, Lao PDR and Papua New Guinea, still have some significant rattan resources left. In the Philippines, the latest

² In China, for example, all crops obtained from trees on forest lands, including walnuts, apples and grapes are by law under the Ministry of Forestry and included in the country’s forest products statistics.

national forest inventory data of 1988 showed an available growing stock of approximately 4 500 million linear metres (lm) of rattan (all species combined) in the country. However, no follow-up rattan inventory has been made and it is presumed that most of the commercial species have been cut down already. The total area of rattan plantations in the Philippines is estimated to be between 6 000 and 11 000 ha.

In the Peninsular Malaysian Permanent Forest Reserves, the 1992 National Forest Inventory estimated a total of 32.7 million rattan plants (irrespective of age), of which the most abundant (about 37 percent) were the *Korthalsia* spp. Of *Calamus* spp., *C. manan* is the most abundant with around 5.9 million clumps. The rattan plantation area is estimated to be around 30 000 ha (depending on the definition of a “rattan plantation”, which may range from rattan enrichment planting in logged-over forests to full-scale rattan planting under tree crops like rubberwood). In the case of some of the traditional rattan-producing countries, such as China, India, Thailand, Sri Lanka, Bangladesh, Nepal, Myanmar, Viet Nam and Cambodia, the long-term sustainability of their rattan-processing industries has been undermined by the depletion of rattan stocks in natural forests. Although some smallholder rattan gardens exist, presently, investment in industrial-scale rattan plantations is negligible resulting in an insecure future supply.

Bamboo is by far the most commonly used NWFP in Asia. There are more than 500 species. Although international trade in bamboo products is still less important than rattan or medicinal plants, it has increased dramatically in the last decade. Unlike rattan, bamboo is moving out of the crafts industry phase and now provides raw material for industrial products (shoots, construction poles, panelling and flooring products, pulp). This has important repercussions for the bamboo resource base. Increasingly, bamboo is becoming a domesticated crop grown by farmers. Harvesting of bamboo in forests is still important in countries like Myanmar, Lao PDR, and in remote mountain forests in northern India, central China and Viet Nam.

China has the largest area of bamboo forests with an estimated area of 7 to 17 million ha (depending on how a “bamboo forest” is defined – from dispersed bamboo in degraded natural forests to full-scale plantations), mostly of *Phyllostachys* and *Dendrocalamus* spp. Annual production of bamboo poles ranges from 6 to 7 million tonnes (one-third of total known world production). The estimated value of world trade in bambooware is approximately US\$36.2 million. China (US\$20 million in 1992) and Thailand are the main suppliers; Malaysia, Myanmar, the Republic of Korea, Indonesia, Viet Nam, the Philippines and Bangladesh are minor exporters. Bamboo shoots supply a rapidly expanding and fashionable export market, with China being the major world producer and exporter (1.6 million tonnes of fresh shoots in 1999), followed by Thailand, with minor quantities from Indonesia, Viet Nam and Malaysia. Bamboo shoots are produced on farms.

For thousands of years, forest-gathered medicinal plants have been a key component of the traditional health systems of the region, and this is still the case today. Most countries maintain and have legalized a dual system of providing both “western medicine” and traditional health care (Aryurveda, Jamu and others). Traditional health-care systems in the region recognize a long list of about 4 000 medicinal plants of commercial importance. Some species have become active ingredients in western medicine, resulting in growing demand and trade. This demand has led to overharvesting of several species to the point that some species have been listed as endangered by the Convention on International Trade in Endangered Species (CITES). It is estimated that three-quarters of the total production is still gathered from wild sources. However, domestication and production of medicinal plants in home gardens is increasing rapidly. Total world trade in medicinal plants in 1992 was about US\$171 million. China is the biggest producer as well as exporter of medicinal plants, accounting for 30 percent of world trade (by value) in 1991, followed by the Republic of Korea, the United States, India and Chile. Singapore and Hong Kong are the main re-exporters in Asia.

The extensive pine forests in the region provide the resources for the collection of pine-related products such as resins, seeds and mushrooms. China and Indonesia dominate world production of oleoresins from all sources (largely *Pinus* spp.), which ranges between 1.1 and 1.2 million tonnes annually. China has emerged as the world's largest producer of rosin, with an annual production level of nearly 400 000 tonnes. Pine nuts (seeds of *Pinus gerardiana*, *P. pinea*, *P. korainsis* and *P. cembra*) are an important product with a growing and high-value market, particularly in developed countries. Seeds of the chilgoza pine (*P. gerardiana*) are produced and exported by India, Afghanistan and Pakistan. China is the world's largest producer and exporter of *Pinus korainsis* seeds – one of the larger-seeded species – as well as seeds of *Pinus cembra*, the Siberian equivalent of the edible seeds from the European *Pinus pinea*. Production levels vary greatly from year to year.

Wild edible mushrooms, particularly morels belonging to the genus *Morchella*, are another product of considerable economic and commercial significance. Morels are prized for culinary uses, particularly as a gourmet food. Morels grow naturally in the temperate forests of India, Pakistan, Afghanistan, China, Nepal and Bhutan. Total world production is estimated at 150 tonnes. Pakistan and India are the major producers, each producing and exporting about 50 tonnes of dry morels annually (equivalent to 500 tonnes of fresh morels). Total world trade in morels is approximately US\$50 to 60 million. China is also a major producer and exporter of other wild mushroom species. The Chinese black auricular fungus (*Auricularia auricula*) is well known for its quality, and 1 000 tonnes are exported annually, earning US\$8 million. The annual production of *Tremella fuciformis* often reaches 1 000 tonnes, a third of which is exported. The annual harvest of shiitake mushroom (*Lentinus edodes*) is about 120 000 tonnes, accounting for 38 percent of world production. China is the second largest producer in the world with annual exports of over 1 000 tonnes of dried shiitake mushrooms, valued at US\$20 million.

Asia is also the world's leading producer of several essential oils. Total world trade in raw essential oils exceeds US\$1 billion, but the major share comes from cultivated sources. Major wild sources of essential oils in the region include sandalwood (*Santalum* spp.), agarwood (*Aquilaria* spp.), tung oil (*Aleurites* spp.) and eucalypt oils. China, Indonesia, Thailand, India and Viet Nam are the major suppliers of these oils.

Spices, condiments and culinary herbs are another important group of products (although most now comes from domesticated sources) that constitute a significant component of world trade. Indonesia is the largest world producer of nutmeg and mace and accounts for three-quarters of world production and export. Indonesia produced 15 800 tonnes of nutmeg during 1990. World trade in cinnamon is between 7 500 to 10 000 tonnes annually. Sri Lanka contributes 80 to 90 percent, most of the balance coming from the Seychelles and Madagascar. The world trade in cassia is about 20 000 to 25 000 tonnes annually, of which Indonesia accounts for two-thirds and China most of the remainder. Minor producers include Viet Nam and India. About 2 000 to 3 000 tonnes of cassia bark are exported from Viet Nam annually. The European Union, the United States and Japan are the major markets.

Products of lesser importance include sago, illipe nuts, bird nests, karaya gum, kapok and shellac. Sago is starch obtained from the stem of the sago palm (*Metroxylon* spp.). Indonesia is the major producer and exporter. During 1991, Indonesia exported 10 108 tonnes of sago flour and meal to Japan, Hong Kong and Singapore, valued at US\$2.32 million. Malaysia also produces small volumes.

Illipe nut is the commercial name for the winged fruits produced by about 20 different species of *Shorea* trees. The seeds from these fruits contain an oil whose chemical and physical properties are remarkably similar to cocoa butter. Large quantities of illipe nuts are collected and sold to be used in the manufacture of chocolate (as a cocoa butter improver), soap and cosmetics. Indonesia dominates world trade in illipe nuts, exporting about 15 000 tonnes annually, worth about US\$8 million.

Salanganes or bird nests are built by two species of cave-dwelling swiftlets, *Collocalia fuciphaga* and *C. maxima* in Malaysia and Thailand. These are collected for sale to the Chinese market at home and abroad. Malaysia is the major producer and exporter of bird nests. Malaysian exports during 1991 totalled 18.6 tonnes, mainly to Hong Kong, Singapore, Japan and Taiwan, valued at around US\$1 million.

Karaya gum, also known as Indian tragacanth, is obtained from tapping trees of the genus *Sterculia*. India is the only major producer. Total world production is about 5 500 tonnes per annum.

Kapok is a mass of silky fibres in the fruit of the ceiba tree (*Ceiba pentandra*), used as a filling for mattresses, life preservers, and sleeping bags and as insulation. The tree grows in many South Asian countries but also on the Pacific islands, in Africa and in Central America. Thailand and Indonesia are the main suppliers in the world trade. Japan, China, the European Union and the United States are the major markets. During 1992 the total value of world trade was approximately US\$11 million, of which about 66 percent was contributed by Thailand and 16 percent by Indonesia.

Thailand and India dominate world trade in shellac, each exporting, on average, about 6 000 tonnes per annum. Shellac is an animal product. The basic material comes from the *Coccus lacca*, a scaly insect that feeds on certain trees in India and southern Asia. After feeding, the insect produces through its pores a gummy substance which hardens into a protective covering called lac. This lac is collected and then it is crushed, washed and dried. After further treatment, it is skillfully drawn into thin sheets of finished shellac. Vietnamese annual exports average around 300 tonnes. China produces about 3 000 tonnes.

At country and local levels, there are still many more NWFPA that are important for subsistence and the income generation activities of rural people (such as bushmeat, wild honey, fodder). Descriptive and qualitative information on them is included in the specific country profiles, as well as information on ecotourism in forests, when available.

Forest services are also important in the region. Most of the countries of the study have established protected forest areas, developed both national parks and forest recreation services and are emphasizing the development of ecotourism as a means of income generation for the country. Sustainability has been taken into account in this development; for instance the Wildlife Institute of India has initiated studies and experiments in the high altitude forests in the Garhwal Himalayas to assess tourism impact on habitats and wildlife for the planning of sustainable tourism.

Governments have been prompted to support and promote an active conservation policy regarding natural resource areas. Protected areas (e.g. national parks, wildlife sanctuaries, reserves) provide ecotourism services while also playing a significant role in the preservation of biodiversity and the gene reserves of the region. Protected areas provide habitats for endangered animals, such as the Bengal tiger, spotted deer, crocodiles, jungle fowl, wild boar, lizards and rhesus monkeys in Bangladesh.

Outdoor recreation is in great demand for many people living in big cities. Other important non-wood services derived from forests are grazing and fishing. Forest wildlife also has a symbolic significance for local people. In Papua New Guinea, for instance, different clans have special relationships with particular species that serve as their totems and the wildlife contributes to the cultural identity of the villagers.

Table 3. Main NWFP by country with examples of production and trade figures

Country	Main NWFP	Selected statistical data available
Bangladesh	Bamboo, cane, medicinal plants, sungrass, golpatta, horitaka, hantal, murta (pati pata), hogla and honey and beeswax, fish and wildlife resources.	Golpatta (1990–91): 2.63 million kg, value: Tk.5.8 million; 1992–93: 75 600 MT Hantal (1990–91): 6.7 MT, value: Tk.334 400 Bamboo (1986–1987): 92 616 000 culms Harvesting of 4 821 MT of fish during 1990–99
Bhutan	Food, fodder, medicinal plants, natural dyes, exudates, rattan, bamboo, lemon grass, handmade paper, fibres and flosses, brooms, handicraft items, ornamentals, incense sticks and honey and beeswax.	Mushrooms (1999): 7 525 kg. Price for canned mushrooms can reach Nu.5(US\$1.65)/kg Export of medicinal plants (1998): 297 kg, value: Nu.78 867 Export of lemon grass oil (1999): 21 504 litres, value: Nu.6 480 413 Export of handmade paper and paperboards (1999): 497 kg, value: Nu.310 612; 1998 exports: 33 269 kg, value: Nu.2 848 810 Turpentine (1999): 66 000 kg, value: Nu.717 500 Rosin (1999): 504 310, value: Nu.1 257 0684
Cambodia	Resin, rattan and bamboo, mushrooms, medicinal plants and incense.	1999: export of rattan: 120 MT 2000: export of resins: 42 MT
China	Exudates, essential oils, bamboo, food (e.g. fruits, nuts and mushrooms), honey and medicinal plants.	Dry bamboo shoots p/a: 20 000 MT; fresh bamboo shoots p/a: 1.5 million MT Shiitake mushroom p/a: 120 000 MT Export of shiitake mushrooms p/a: 1 000 MT, value: US\$2 000/MT Gingko kernels p/a: 5000–6 000 MT; leaves 7 000 MT; fleshy seed coats: 10 000–12 000 MT Value of bamboo (1993): ¥5.5 billion, exports of US\$150 million
India	Edible plants, fibres and flosses, bamboos, exudates (gums, resins and oleoresins), medicinal plants, essential oils, tans and dyes, wrapper leaves and animal products (e.g lac and silk).	Export of edible plant products (1996–97): 348 541 MT, value: lakh* Rs.268 392 Export of oil seeds and fatty oils (1996–97): 264 139 MT, value: lakh Rs.61 173 Export of medicinal plants (1996–97): 42 592 MT, value: lakh Rs.51 500 Export of spices (1996–97): 73 046 MT, value: lakh Rs.515 000 Export of essential oils (1996–97): 3 554 MT, value: lakh Rs.17 663 Export of dyes and tans (1996–97): 8 193 MT, value: lakh Rs.2 765 Export of gums and resins (1996–97): 107 158 MT, value: lakh Rs.50 500
Indonesia	Rattan, bamboo, resins (gondorukem and turpentine, jelutung gum, damar, kemenyan, gaharu and kopal), tengkawang seed, sandalwood oil, cayeput oil, honey, shellac, fruits and medicinal plants.	Export of rattan-finished products (1999): 112 078 MT, value: US\$294 million Export of gondorukem (1999): 39 166 MT, value: US\$18.5 million Export of turpentine (1999): 7 188 MT, value: US\$2.13 million Export of gaharu (1995): 309.8 MT, value: Rp. 6.2 billion Sandalwood oil (1997): 145 446 MT Honey (1997–98): 2 615 728 MT Export of lac (1999): 93 MT, value: US\$130 200
Lao PDR	Medicinal plants, food (nuts, fern roots, fruits), fibres, exudates (damar resin, oleoresin, benzoin), incense, spices, orchids	Export of sugar palm fruit (1998): 982 000 kg, value: US\$320 132 Export of malva nuts (1998): 837 940 kg, value: US\$1 340 704 Export of cardamom (1998): 424 347 kg, value: US\$2 376 343 Export of damar resin (1998): 1 525 566 kg, value: US\$305 113 Export of oleoresin (1998): 274 400 kg, value: US\$92 198 Export of benzoin (1998): 15 500 kg, value: US\$46 500
Malaysia	Rattan, bamboo, medicinal plants, wild fruits, vegetables, palms, resin, tannin, barks and wood-oil.	Export of medicinal plants (1996): \$M55 871 852 Export of bamboo (1990): US\$176 474 Local market of bamboo products is worth \$M3 million annually

Myanmar	Bamboo, rattan, edible bird nests, natural rubber, spices, medicinal plants, tanning barks, perfumes, exudates, honey and beeswax, bushmeat, lac and bat guano.	Bamboo (1994): 946 million nos.; export of 843 million nos. (1996–97), value: US\$582 000 Rattan (1994–95): 73 million nos.; export of 2 804 MT (1996–97), value: US\$1 601 000 21 MT of honey and 1 134 kg of beeswax (1994–1995) Edible bird nests (1994–95): 2 923 kg; export of 1 197 kg (1996–97), value: US\$440 000
Nepal	Medicinal and aromatic plants, resin, turpentine, sal seed, katha and cutch, lokta paper, sabai grass, bamboo and cane.	Rosin: 1 518 MT (1999) Turpentine: 341 MT (1999)
Papua New Guinea	Food from plants (tubers, fruits, nuts and vegetables), mushrooms, medicinal plants, rattan, bamboo and orchids, bushmeat, copal gum, vatica, massoy bark, tannins and insects (butterflies).	The value of the domestic orchid cut-flower trade has been evaluated at K50 000 + p/a Estimated value of butterfly trade US\$250 000 Export of rattan (1992): 108 5 00 kg (FOB K758 000)
Philippines	Rattan, bamboo, fibres, vines, palms, exudates, essential oils, dyes, wild food plants, medicinal plants, honey and butterflies.	1998: 10 463 lm of unsplit rattan; 5 000 lm of split rattan 1998: 448 000 pcs of bamboo 1998: 6 746 000 nipa shingles 1998: export of 645 840 kg of salago bark, value: US\$443 990 1998: 261 000 kg of Almaciga resin; exported 355 000 kg, value: US\$(FOB)254 000 1998: export of 221 000 kg of elemi gum, value: US\$(FOB)448 000
Sri Lanka	Rattan, bamboo, medicinal plants, kitul products, edible plants, honey and bushmeat.	Export of medicinal plants: SL Rs.116 million (US\$1.7 million) 1999: import of SL Rs.66 million (US\$943 000) 1993: export of rattan – SL Rs.1.5 million (US\$20 000) Export of bamboo and bamboo products: SL Rs. 80 000 (US\$1 150) Income from the sale of bushmeat in the dry zone: SL Rs.120 000–150 000/ p/a Household income from grazing in the dry zone: SL Rs.15 000–20 000 p/a (US\$150–225) and SL Rs.50 000–120 000 p/a (US\$550–1 300) for large-scale cattle owners in the same area
Thailand	Bamboo, rattan, lac, honey, gums and resins, spices, medicinal plants, food and bark for tanning and dyeing.	1992: export of medicinal plants – 3 379 MT, value: B173 394 000 1999: export of spices – 83 680 kg, value: US\$0.20 million. 1999: export of raw rattan cane – 36 011 kg, value: US\$0.02 million 1999: export of rattan furniture: 493 852 kg, value: US\$1.33 million; export of 122 810 kg, value: US\$0.05 million 1999: export of lac – 3 722 902 kg, value: US\$4.30 million 1999: export of honey – 1 053 103 kg, value: US\$0.61 million
Viet Nam	Handicrafts (rattan and bamboo), resin, essential oils, medicines, spices, mushrooms and honey.	1995: export of mushrooms – 896 192 kg, value: US\$1 881 963 2000: export of anise star seeds – 3 000 MT, value: D70 billion (US\$5 million) 1995: export of cardamom – 17 800 kg, value: US\$143 880 1995: export of medicinal plants – 855 912 kg, value: US\$1 733 967 1997: export of eaglewood – 34 071 kg, value: US\$6 046 091 1991: export of rattan – 50 542 MT, value: US\$26.3 million

*1 lakh = 100 000

Socio-economic aspects

The importance of specific NWFP should be viewed in relation to time, location, demand and resource availability. Some products which were less important some years ago are now becoming more important (e.g. bamboo shoots). At the same time, others which were among the most important are now becoming scarce and as a result they are no longer considered at this moment to be important but continue to be mentioned on the list of recorded NWFP (e.g. dammar resin).

The ranking of NWFP is a difficult process. The importance of these products is very much dependent on their availability and accessibility in certain geographical areas, the attitude and preferences of the local population, market demand, the contribution they make to families and the national economy and also the categories of people involved in the ranking process. Unlike timber, NWFP have multistakeholders who directly benefit from NWFP through free access to the natural resources.

In some countries the interest and activity of local people in NWFP have increased. The private sector has started to invest in small-scale NWFP-processing industries and local people have started to domesticate some NWFP (e.g. medicinal plants in home gardens). Some communities have initiated sustainable-use systems, for example fish conservation zones, frog conservation schemes and other NWFP-use rules and multivillage agreements to conserve large blocks of forests.

NWFP contribute to food security by supplementing agricultural crops during seasonal shortages. They are also important for health care, materials for farm implements and construction, fodder and for fuelwood. In given cases, NWFP may yield higher economic returns than upland agriculture or timber forest products (e.g. mushrooms). It is also important to note that urbanization can increase the demand for NWFP, as people moving from rural areas maintain and disseminate their consumption patterns in the cities (e.g. consumption of wild honey).

The irregular and subsistence nature in consumption of these products makes it difficult to gather useful and reliable information on them, as the users keep no records. Sometimes users may neglect and undervalue these products as in most cases they do not earn any direct cash benefits from them and they gather these products largely free of charge utilizing only their labour and time inputs.

Currently the usage of NWFP is still quantified poorly and usually their value is not included in forest valuations. Some countries have attempted to compile statistics for (some of the major) NWFP used in national forest statistics. However, for most of the species used by local people, no reliable statistics exist.

Forest-use practices and patterns change with the increasing pressures of population growth and market economies. Where community land is poor, NWFP are used to generate income as raw materials for cottage industries. Only some NWFP are being managed properly as a business entity (e.g. bamboo plantations in China). Property rights or ownership of the NWFP resources have not been well defined in most of the countries. In some cases the collection of NWFP is entirely free and only very seldom is a collection licence needed; if one is required, it is seldom verified. This has led to the unregulated collection of most NWFP, such as rattan, wild honey and key medicinal plants.

Presently much support for NWFP collectors is being provided through (inter-)national support programmes, as they are the primary target groups for poverty alleviation programmes; mostly this is done by improving their marketing channels for commercialization of their NWFP. In the

NWFP marketing chain, collectors suffer most when resource scarcity problems arise because of increased NWFP commercialization. Middlemen and contractors often take advantage of people's ignorance regarding the actual market prices, as alternative marketing channels are not so easily available to the local collectors. Middlemen tend to exploit the ignorance of collectors and growers and offer insignificant returns to them.

The NWFP sector is a labour-intensive industry and faces various problems, such as minimal capital investment, a low percentage of skilled labour, a low technological level in product processing, poor quality control and lack of marketing skills. In addition, extraction, processing, production and marketing of most NWFP are carried out in traditional ways using worn-out equipment or obsolete methods. The potential of many NWFP is not being utilized fully because of insufficient knowledge and experience on modern processing techniques and lack of product development.

In order to reduce the pressure on remaining NWFP resources, and to utilize the full potential of NWFP to provide employment and increase the income levels of rural people, more attention should be given to domesticating important plants and promoting their cultivation by individuals, communities, private industries etc., (i.e. rattan, bamboo and some medicinal plants). Useful plants should be cultivated in home gardens and on other agricultural land, and their cultivation could be included and further promoted in agroforestry management systems.

The Asia-Pacific Forestry Sector Outlook Study, conducted by FAO in 1998, included a study on NWFP: "Non-Wood Forest Products Outlook Study for Asia and the Pacific". According to this study, major findings and the problems associated with the development of NWFP in the Asia-Pacific region included problems associated with the collection and analysis of statistical data on NWFP. In addition, countries are facing depletion of their NWFP resources because of, on the one hand inadequately regulated harvesting, and on the other hand the increasing market demand for commercially popular species (e.g. rattan, gaharu trees, various barks, roots, stems and leaves used as medicines). Also, the NWFP sector tends to be overlooked or discounted in national-level forest programmes and resource planning due to the lack of investment in research and development, institutional and policy neglect, and because of the small scale of the industry. The NWFP-dependent communities continue to be weak economically. Collectors are facing limited marketing options or negotiating power and are faced typically with only a single buyer. Inventory information is scarce and forest management is timber-oriented. The success of NWFP development in many places will depend on the ability to implement management systems which recognize and promote the production of both timber and non-timber resources.

Conclusions

NWFP have multiple uses and involve multistakeholders with conflicting needs; these are very difficult to deal with in terms of resource assessment, management and control, ownership, access rights and trade regulation. NWFP regulations are inadequate. In addition, NWFP resources have not been identified or mapped sufficiently to inform NWFP stakeholders about key species and zones for conservation, domestic consumption and commercial development for sector planning, research and development. In various countries, the concerned line ministry and its technical departments cannot cope with the huge demand for technical advice and support from the various stakeholders in the sector.

However, governments are now paying more attention and are becoming involved increasingly in the development of their NWFP sectors. Some are evincing strong interest and already have undertaken assessments of research and development needs and of the ways to improve the coordination of relevant activities and the collection and dissemination of information about NWFP.

The country reports in this document vary in depth of coverage and in their approaches. Some papers provide descriptive information complemented or not with statistical data and many others illustrate discrepancies among existing figures from various sources. Within the scope of this study no attempts could be made to analyse and explain these discrepancies. Also, the quality of bibliographies attached to the country reports is variable and often the statistical data is provided without quotation to the original source. In some papers either local or trade names are provided making the identification of the species providing the product difficult. All country reports expressed the need to assist further the development of their NWFP sectors.

Many of the country reports reveal the difficulties in obtaining data and information on potential sources and distribution, ecology, uses, harvesting and processing methods, trade prospects and the depletion rates of major NWFP. Therefore it was proposed to place major NWFP in the list of priorities of local and central governments. Also, the inventory of valuable NWFP resources is very important in order to understand their potential production, their location and distribution. The inventory of NWFP resources should involve the NWFP collectors with assistance from local governments, local scientists, forestry authorities and research institutions.

The constraints for the development of NWFP in the countries reviewed in this study can be summarized as follows:

- Lack of coordination among the existing institutions and countries.
- Insufficient research and development activities for the key NWFP.
- Lack of conservation and management policies for sustainable production.
- Few initiatives to involve and assist the private sector in NWFP development.

Since existing knowledge on NWFP is poor, there is a need to carry out research, field surveys and resource assessments in order to obtain the required data for the development of this resource.

The following are the major areas identified for further research and development work:

- Resource inventories of key NWFP species.
- Ethnobotanic studies to improve knowledge on utilization of NWFP.
- Growth and yield studies and natural regeneration studies of key NWFP species.
- Studies on propagation, domestication techniques and genetic improvement.
- Improvements in processing, transport and storage techniques.
- Income generation and market surveys.
- Focused marketing studies on key NWFP for national and Asian markets.

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BANGLADESH

INTRODUCTION

Main non-wood forest products

The most important NWFP in Bangladesh are bamboo, rattan cane, sungrass, golpatta, medicinal plants, horitaka, hantal, murta (pati pata), hogla and honey and beeswax. Other important NWFP include mangrove fish and wildlife resources.

General information

In Bangladesh, all usufructs/utility products of plant, animal and mineral origins except timber obtainable from forests or afforested lands are defined as Minor Forest Products (MFP). Services for tourism and recreation in forests are also attributed as MFP.

NWFP are consumed mostly by local people, who also harvest them. The increased demand for NWFP is causing high pressure on the NWFP resources owing to continued extraction from the forests.

Table 1. Exports of selected NWFP (1991/92 and 1992/93)

Commodity	Exports (in million taka)	
	1991-92	1992-93
<i>I) Edible products</i>	28.13	50.71
1. Fruits		0.28
2. Dried fruits	0.07	
3. Tamarind		16.07
<i>II) Medicinal and aromatic plants</i>	4.64	0.16
1. Black cumin seed	Primary products: 0.24; Manufactured: 47.94	Manufactured: 82.48
2. Crude drugs	-	6.83
3. Pharmaceuticals	1.20	-
4. Goods for perfumery: cinchona bark (1986-97)	3.7	-
5. Plants and parts for pharmacy (1986-97)	0.28	-
6. Plants for insecticides and fungicides (1986-97)		6.83
<i>III) Bamboos</i>	28.32	-
1. Bamboo poles	0.14	-
2. Hukka nali	Manufactured: 0.41	-
<i>IV) Fibres</i>	-	3.30
1. Coir and coir products	1.89	-
2. Brooms	2.10	2.21
3. Raw cotton	0.15	-
4. Cotton waste	Manufactured: 5 499.65	Manufactured: 5 746.16
<i>V) Tans</i>	Manufactured: 3.69	Manufactured: 45.90
1. Leather crust/finished	Manufactured: 157.69	Manufactured: 370.72
2. Leather bags/purses	Manufactured: 5.63	Manufactured: 66.40
3. Footwear	-	
4. Hand gloves	0.33	12.84
<i>VI) Miscellaneous NWFP</i>	0.23	-
1. Beeswax	Manufactured: 36.55	Manufactured: 21.89
2. Cosmetics	-	Manufactured: 7.48
3. Soaps	Manufactured: 331.90	Manufactured: 210.97

4. Handicrafts	Manufactured: 1.69	Manufactured: 6.43
5. Silk fabrics	Primary products: 66.29 Manufactured: 6 085.15	Primary products: 92.04 Manufactured: 6 558.43
<i>VII) Fish products (mangrove)</i>		
1. Frozen food (fish, shrimps and frog legs)	6 423.46	4 969.14
2. Shark fins and fishmaws	54.09 155.07	142.48 220.93
3. Dried fish (dehydrated and salted)	56.65	146.85
4. Crabs	9.53	69.07
5. Tortoises and turtles	6.15	31.80
6. Duck breast feathers	1.91	-
7. Sea shells	3.06	3.60

Note: If not specified the figures stand for primary products.

Sources: Bangladesh Export Statistics (1992–1993), Export Promotion Bureau, Dhaka; Bangladesh Bureau of Statistics (1987)

The Government of Bangladesh collects significant earnings from the royalties, taxes and other charges on NWFP. Modest export earnings are derived from the sale of bamboo and shells. Sophisticated finished articles and souvenirs made from NWFP are major exportable items that often carry with them the cultural dignity of the nation. The collection, processing and marketing of NWFP provides employment for an estimated 300 000 rural Bangladeshis (Khan 1994). Much of this employment continues throughout the year. The Sundarbans mangrove forest accounts for a major part of the NWFP produced in Bangladesh with an annual contribution of approximately Tk.717 million (US\$17.9 million) to the Bangladesh economy (Basit 1995).

PLANTS AND PLANT PRODUCTS

Food

Edible plants in Bangladesh include various species, such as *Acrostichum aureum*, *Avicennia alba*, *Avicennia marina*, *Avicennia officinalis*, *Bruguiera gymnorrhiza*, *Bruguiera sexangula*, *Heritiera fomes*, *Nypa fruticans*, *Rhizophora mucronata*, *Sonneratia caseolaris*, *Sonneratia acida* and *Xylocarpus granatum*.

Mushrooms provide subsistence food for the local people. No current information is available on the utilization of mushrooms.

Medicines

The leaves, bark, and fruit of many plants are used commonly as medicines in Bangladesh. Among the most common are kurus pata (*Holarrhene antidysenterica*), horitaka (*Terminalia chebula*), amlaki (*Phyllanthus emblica*) and bohera (*Terminalia belerica*) (Khan 1994).

Perfumes and cosmetics

Blumea sp. (bria ghash), *Clerodendrum inerme* (sitakaa, sitakai), *Cyprus javanicus* (kucha, kusha), *Ipomea pes-caprae* (chhagalkuri), *Leea aequata* (kaka junga), *Pandanus foetidus* (kewa kata) and *Premna corymbosa* (serpoli) have been identified in the Sundarbans, which yield essential oils for perfumery as well as medicinal uses. The leaves of *B. lacera* yield 0.5 percent of essential oil, after steam distillation, from which camphor is made. The root is also medicinal. Another species, *B. densiflora* also yields camphor. An essential oil called kewa katta attar is produced from the ripe inflorescence of *P. odoratissimus*. Kewa katta attar is a highly popular perfume that has been extracted and used since ancient times. It blends well with almost all types of perfumes and is used for, *inter alia*, scenting clothes, bouquets, lotions and cosmetics. Kewa katta and water are used for flavouring various foods, sweets, syrups and soft drinks. *Cyprus*

javanicus is used commercially for the extraction of essential oil from its tuberous roots that are aromatic and may be useful for perfumes and agarbatties or joss sticks.

Dyeing and tanning

Excellent grades of leather are produced from mangrove bark tannins. Bangladesh tans huge quantities of leather. Skins are tanned with the tannin extracts from bark, fruits and leaves of local trees in the Sundarbans mangroves, along with some imported tanning material. Data on the production of tanning barks are not available. The economic value of catechu bark for tannin in Bangladesh was Tk.77 million in 1992.

Goran (*Ceriops decandra*), kankra (*Brugiera gymnorrhiza*) and passur (*Xylocarpus mekongensis*) have been collected from the Sundarbans for the extraction of tannins. Many of the tannin factories in Bangladesh have, however, depended considerably on imported tannin extracts. About 10 000 tonnes of mangrove bark are estimated to be harvested annually at the felling coups in the Sundarbans.

Utensils, handicrafts and construction materials

The golpatta palm (*Nypa fruticans*) has a variety of uses. The leaves are used principally as thatching material, but they can also be made into bags, baskets, hats, mats, raincoats and wrappers. The leaf's mid-ribs can be made into brooms. Sun-dried petioles are cut as firewood and fresh petioles are used as tying materials and coarse brushes. Sap can be used in the production of alcohol, wine, sugar and vinegar. Ripe fruits can be eaten raw (Basit 1995). Young shoots, decayed wood, burnt roots or leaves are useful for the treatment of herpes, toothache and headache. Annually about 19 200 people collect golpatta fronds and market them in nearby communities (Basit 1995).

According to the Forest Department the annual production during 1991 to 1992 and 1992 to 1993 was 74 583 and 75 600 tonnes respectively. The present average annual production of golpatta leaves is about 75 600 tonnes. The estimated productive area of golpatta in the Sundarbans forest is about 595 739 ha (Basit 1995). Some researchers have reported the species to be endangered.

After golpatta, the hantal palm (*Phoenix paludosa*) is the next most important palm in the Sundarbans. Hantal is a small, clump-forming erect palm. It is a valuable material for villagers near the Sundarbans. Stems are harvested and used as purlins and rafters for village houses, as posts for trellises for growing betel leaf, and for animal shelters and fencing. The leaves are used in the making of walls for houses and other shelters (Basit 1995).

Table 2. Hantal production and revenue

Year	Production (MT)	Revenue (taka)
1990-91	6.7	334 400
1989-90	7.2	339 100
1988-89	8.3	223 400
1987-88	7.8	210 200
1986-87	6.1	170 200
1985-86	5.4	142 400
1984-85	8.9	38 700
1983-84	6.8	33 100
1982-83	5.7	24 200
1981-82	4.7	21 500
1980-81	6.2	24 700

Source: Basit (1995)

Sungrass (*Imperata* spp.) is the most common roofing and thatching material for temporary low-cost housing in the villages and forests of Bangladesh. Sungrass grows naturally, especially in the

forests of low-lying areas, or around the denuded and barren hills that are unfit for growing high-quality timber trees (Khan 1994). Green sungrass is used locally as fodder.

Murta (pati pata) (*Clinogynae dichotoma*) grows naturally in the low-lying areas of Sylhet and also in rural areas of Tagail and Dhaka districts. It can be grown artificially in other areas of the country using suitable planting material. Pati pata is an excellent material for floor mats and woven utensils, and is used extensively by the rich and poor alike. Finished products are exported (Khan 1994).

Hogla (*Typha elephantina* Roxb.) leaves are woven into mats that are used for beds, to dry crops on and for prayer mats. They are also used for making storage containers and hut walls. The young succulent leaves are a palatable forage crop for animals. Hogla pollen grains are collected and sold in the markets or used to make home-made cakes (Basit 1995). The value of murta and hogla production together was Tk.8.3 million in 1992.

Although bamboo (e.g. *Melocanna baccifera*, *Bambusa tulda*) is grouped officially as an MFP, it plays a crucial role in the rural economy of Bangladesh. Over 20 species of bamboo grow in Bangladesh's natural forests and village homesteads. Bamboo is used for hundreds of purposes and it is an essential material for the construction of temporary housing for rural people, especially hilltribes (Khan 1994).

Table 3. Production of bamboo in Bangladesh

Year	Quantity (1 000 culms)
1975-76	47 268
1976-77	62 579
1977-78	73 586
1978-79	60 135
1979-80	78 115
1980-81	74 028
1981-82	77 865
1982-83	92 335
1983-84	92 061
1984-85	76 989
1985-86	75 786
1986-87	92 616

Source: Khan (1994)

Rattan (*Calamus viminalis*, *C. guruba*) is a climbing palm grown in homesteads and the low-lying areas of reserved forests. Canes are used for domestic purposes by the rural population and for processing into more sophisticated furniture and luxury souvenirs that are suitable for export (Khan 1994).

In Bangladesh, MFP also includes stones, gravel and sand extraction in forests. Stone is one of the most important MFP, and is available only in some areas of Bangladesh, such as Sylhet, Hill Tracts and Dinajpur. Stone is required for the construction of highways, buildings and other infrastructural needs. In Dinajpur alone, there is an estimated deposit of 115 million cubic feet of hardstone. The Government of Bangladesh earns substantial revenue from the sale of stone (Khan 1994).

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

Honey and beeswax are important NWFP in the mangrove forests. Honey and pollen are used as medicines, high-energy food and as a source of vitamins and minerals. Honey is collected using the

traditional method, which uses fire or smoke to drive away the bees, and in the process destroys the queen and the brood. The honey is sold to processors in nearby communities (Basit 1995).

The collector's selling price is Tk.20 (US\$0.50)/kg. Processed honey sells for Tk.80 (US\$2.00). Honey and beeswax collection, although a very risky job, continues to provide a seasonal source of income. An average of 2 640 collectors harvest honey and beeswax from the mangrove forests of the Sundarbans (Basit 1995).

Table 4. Sundarbans honey and beeswax production and revenue

Year	Honey (MT)	Honey revenue (taka)	Beeswax (MT)	Beeswax revenue (taka)
1990-91	211.27	536 400	52.8	211 200
1989-90	146.55	620 280	36.5	195 400
1988-89	99.45	84 560	24.9	39 840
1987-88	223.31	178 650	55.8	89 280
1986-87	229.11	183 930	57.5	92 040
1985-86	224.52	180 450	56.4	89 220
1984-85	255.80	102 800	64.2	51 390
1983-84	260.35	114 610	65.4	52 360
1982-83	232.65	93 460	58.12	46 730
1981-82	225.26	107 050	53.92	53 520
1980-81	310.93	120 450	75.03	60 030

Source: Divisional Forest Office, Sundarbans, Forest Department (in Basit [1995])

Honey is probably the most promising NWFP in Bangladesh in terms of export potential provided its production can be organized in a better fashion (Khan 1994). Honey is produced from the forest regions of the Sundarbans, Chittagong, Sylhet, Cox's Bazar and Mymensingh. Recently, apiculture has been introduced in some areas of north Bengal and Mymensingh District with considerable success (Khan 1994).

Other animal products

Fishing and shell collection within the mangroves are controlled by the Forest Department, and for a long time have been considered to be extremely valuable forest produce in the Sundarbans. Fish, prawns, shells and other fishery resources abound in the rivers and water systems within the Sundarbans and serve as a major source of food and employment, as well as providing revenue for the government (Basit 1995). Recently the cultivation of Bagda shrimp has revolutionized fish harvesting in the Sundarbans. From 1990 to 1991, 4 821.4 tonnes of fish were harvested (Alam 1992; Salamat 1994).

Some 67 000 boats crewed by 165 000 fishermen annually visit the Sundarbans mangroves and fish for their livelihoods. Recent data reveal that the collection of "seed" prawns involves about 25 000 men, women and children. Shell collection also contributes to the employment of young boys and girls. The number of shell collectors increases during the winter tourist season (Basit 1995).

Table 5. Economic value/revenue of fishery resources of Sundarbans mangroves

Product	Economic value	Revenue 1987-88	Revenue 1991-92	Revenue 1992-93	Reference
Fish, prawns and shells	Tk.666.4 million				
Fish, shrimps and crabs		Tk.7 437 815		Tk.16 210 499	
Shell lime and molluscs				Tk.93 390	
Fish extraction		297 520 MT		615 122 MT	
Bagda shrimp seedlings		14 104 800 (number) Tk.519 432	110 321 383 (number) Tk.4 332 993		
Oyster extraction		2 454 MT, Tk.48 213	3 652 MT Tk.141 45		Islam 1992

Fiddler's crab extraction			4 million kg		
Mud crab extraction			1 million kg		Ali 1994

Shells (conch etc.) are collected in large numbers in the coastal forest belts of Cox's Bazar, Taknaf, Moheskhal, Berisal, Patuakhali and Sundarbans. This activity provides local income from their retail to tourists as souvenirs. Some of these products are exported.

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ANNEX 1. FOREST SERVICES

The actual level of tourism has remained low, underscored by figures which indicate that less than 10 000 visitors entered the country in 1992. Domestic tourism on the other hand appears to be a strongly growing sector of the market and it is believed widely that emphasis should be placed on the development of this sector to increase the country's share of international tourism. The main tourist attractions in Bangladesh include the Sundarbans mangroves for wildlife photography, touring the mangrove forest, boating, and meeting local fishermen, woodcutters and honey collectors. The Sundarbans is the natural habitat of the world-famous Bengal tiger, spotted deer, crocodiles, jungle fowl, wild boar, lizards, rhesus monkeys and a great variety of birds. Boats are the only means of transportation inside the forest. There are no roads (Basit 1995). Three types of

protected areas are defined in the Bangladesh Wildlife Preservation Act (1974): Wildlife Sanctuary, National Park and Game Reserve (Hussain 1986).

Table 6. Wildlife Sanctuaries (WS), National Parks (NP) and Game Reserves (GR)

Name	Area (ha)	Established/ notification	Purpose
Sundarbans (WS)	16 065	-	To preserve breeding habitats
Sundarbans East (WS)	5 439	1960/1977	To preserve the Bengal Tiger (<i>Panthera tigris</i>) and its habitats
Sundarbans South (WS)	17 878	-/1977	
Sundarbans West (WS)	9 069	-/1977	
Rema-Kalenga (WS)	1 095	-/1981	To preserve existing fauna and flora in the area
Char Kukri-Mukri (WS)	40	-/1981	To preserve existing habitats used by local and migratory birds
Pablakhali (WS)	42 087	1962/1983	To preserve fauna and habitats for white-winged wood duck (<i>Cairina scutulata</i>)
Hail Haor (WS)	1 427	-	To preserve habitats for migratory ducks
Rampahar-Sitapur (WS)	3 026	-	To preserve local fauna and habitats
Hazarikhal (WS)	2 909	-	
Chunati, Chittagong (WS) (proposed)	19 177 (acres)	-	
Dulahazara, Cox's Bazar (WS) (proposed)	3 950 (acres)	-	
Khagrachari (WS) (proposed)		-	To preserve the Asian elephant (<i>Elephas maximus</i>) and its habitats.
Himchuri (NP)	1 729	-/1980	To preserve fauna and habitats as well as to provide facilities for research, education and recreation
Bhawal (NP)	5 022	1974/1982	To preserve and develop habitats and provide facilities for research, education and recreation
Madhupur (NP)	8 436	1962/1982	
Ramsagar (NP)	52	1960/1974	
Teknaf (GR)	11 615	1960/1983	To preserve the Asian elephant (<i>Elephas maximus</i>) and its habitats.

Source: Hussain (1986)

QUANTITATIVE NWFP DATA OF BANGLADESH

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food		Fruits					N, I	Export (primary products) of Tk.50.71 million in 1992-93		Bangladesh Export Statistics 1992-93
Dyeing, tanning		Catechu						Economic value of catechu: Tk.77 million in 1992 (outside Sundarbans)		
		Mangrove bark		ba				About 10 000 MT of mangrove bark are estimated to be available at the felling coups in Sundarbans		
Utensils, handicrafts, construction materials		Golpatta	<i>Nypa fruticans</i>					1990-91: 2.63 million kg, revenue Tk.5.8 million Annual production in 1992-93 of 75 600 MT	About 19 200 people p/a collect golpatta fronds and market them Annual demand: (roofing) 68 800 MT; (walling) 4 400 MT; (animal shelters) 1 900 MT Estimated productive area in Sundarbans about 595 739 ha	Basit 1995; Bangladesh Forest Department
		Hantal	<i>Phoenix paludosa</i>					Economic value of hantal for housing about Tk.2.40 million in 1992 1990-91: 6.7 MT, revenue Tk.334 400	About 2 400 people engaged p/a in production	Basit 1995

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
		Sungrass	<i>Imperata</i> spp.					Value: Tk.24 million in 1992 (outside Sundarbans) 1 710 000 bundles in 1986–87		Statistical Yearbook of Bangladesh 1989
		Murta and hogla	<i>Clinogynae dichotoma</i> , <i>Typha elephantina</i> Roxb					Combined production: Tk.8.3 million in 1992		
		Bamboo	<i>Melocanna baccifera</i> , <i>Bambusa tulda</i> , etc.					92 616 000 culms (1986-87)		Statistical Yearbook of Bangladesh 1989
Others		Stone						In Dinajpur estimated potential of 155 cubic feet of hardstone		Khan 1994

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey, beeswax		Honey						1990-91: 211 27 MT, revenue Tk.536 400 Economic value of honey has been estimated at Tk.6.9 million (of which Tk.0.4299 million from Sundarbans)	Collector's selling price: Tk.20/kg (US\$0.50/kg), processor's buying price Tk.50/kg (US\$1.25/kg) Processed honey sold at Tk.80/kg (US\$2.00/kg)	Basit 1995
		Beeswax						1990-91: 52.8 MT, revenue Tk.211 200 Export of Tk.0.28 million (1991–92)		Basit 1995
Other edible animal products		Fish resources						1990-91: 4 821.4 MT of fish harvested Economic value of fish, prawns and shells: Tk.666.4 million Revenue from fish, shrimps and crabs: Tk.7 437 815 (1987–88) and	An average of 165 270 fishermen fish the Sundarbans Bagda shrimp seedlings: 14 104 800 pcs., value, Tk.519 432 (1987–88) and	Alam 1992; Salamat 1994; Basit 1995; Islam 1992; Ali 1994

								Tk.16 210 499 (1992–93) Oyster revenue: Tk.48 213 (1987–88) and Tk.141 458 (1991–92) Shell lime and mollusc revenue: Tk.693 390 (1992–93) Fish extraction: 297 520 MT (1987–88) and 615 122 MT (1992–93) Oyster extraction: 2 454 MT (Tk.48 213) in 1987–88, 3 652 MT (Tk.141 45) in 1991–92 Fiddler's crab extraction: 4 million kg (1991–92) Mud crab extraction: 1 million kg (1991–92)	110 321 393 pcs., value, Tk.4 332 993 (1991–92)	
Hides, skins		Leather goods						Value of production (1985–86): Tk.78 49 million		

Importance: 1– high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

BHUTAN

INTRODUCTION

Main non-wood forest products

The most important NWFP of Bhutan are food, fodder, rattan, bamboo, medicinal plants, natural dyes, exudates, lemon grass, handmade paper, fibres and flosses, brooms, handicraft items, ornamentals and incense sticks. Other NWFP include honey and beeswax.

General information

NWFP affect nearly every aspect of the life of a Bhutanese citizen. The country's forests provide food, fodder, medicine, oils, resins, fibres, dyes and raw materials for baskets, traditional paper, houses, brooms, mats and numerous other items (FAO 1996). Approximately 840 species of NWFP used for various purposes have been documented but most of the species used by rural people remain undocumented.

Table 1. Exports of forest products in Bhutan

Commodities	Years		
	1997	1998	1999
Total export (Nu. in million)	4 274 000	4 455 000	4 987 000
Wood and wood products excluding NWFP (Nu. in million)	584 280	444 475	304 067
NWFP export (Nu. in million)	49 477	46 910	29 000

Source: Royal Government of Bhutan (1997, 1998 and 1999)

Besides the use of NWFP by local people, NWFP are utilized for commercial purposes (e.g. paper making, handicraft items, extraction of edible oil and manufacturing of incense sticks). Some NWFP are also traded internationally. People in rural areas earn extra income by collecting and processing NWFP or working in small manufacturing units established in the country. NWFP collection, by nature, is seasonal and occurs during the off-farm season (FAO 1995).

PLANTS AND PLANT PRODUCTS

Food

Forests play an important role in assuring food security in the country. Due to variable climatic conditions, drought and poor soil, food problems occur throughout Bhutan periodically. For instance an important substitute for grains is *Dioscoria*. Fern shoots, bamboo shoots, mushrooms, cane shoots and even orchid flowers and other wild vegetables from the forests are used by villagers (FAO 1995).

The most common edible mushrooms are jilli namcho (*Auricularia auricula*), jichu kangroo (*Calvaria* spp.), ga shamu (*Clitocybe odora*), sisi shamu (*Cantherellus cibarius*), taa shamu (*Polyporus* spp.) and sangay shamu (*Tricoloma matsutake*), which has the highest price of all mushrooms. Shiitake (*Lentinus edodes*) is cultivated by many farmers in Thimphu and there is considerable potential for cultivating other mushrooms like *Pleurotus* spp. and sangay shamu. Sangay shamu normally grows wild in Bhutan. Mushrooms are also exported. In 1998, the amount of *Tricoloma matsutake* exports increased, due to their high price. Mushrooms in general,

and *Cantharellus cibarius* in particular, are canned and sold for as much as Nu.50 (US\$1.65)/kg (FAO 1995).

Table 2. Quantity of mushrooms exported

Year	Quantity (kg)	Value (Nu)
1997	13 191	13 362 079
1998	7 143	18 916 469
1999	7 525	6 962 475

Source: Royal Government of Bhutan (1997, 1998 and 1999)

Many plants yield high quality edible oil but the demand for edible oil is largely met by imports. Coconut oil, soya-bean oil and mustard oil are imported from India and palm oil from Malaysia. Small quantities of mustard oil are produced locally. There is good potential for producing edible oils within the country. The potential for exporting edible oils needs to be studied further as there are many wild plants that yield edible oil in Bhutan, such as: *Gynocordia odorata*, *Aesandra butyracea*, *Symplocos paniculata* and *Shorea robusta*.

Some of the important fruit-bearing plants are *Eleagnus latifolia*, *Aegle marmelos*, *Docynia indica*, *Zizyphus* spp. and *Phyllanthus emblica*. A variety of forest fruits is collected (e.g *Phyllanthus emblica*) and marketed (FAO 1995).

Forests also produce spices, which are used locally and exported. Pepper is one of the most important spices that is collected. *Cinnamomum* bark and leaves are collected and exported. The seeds of *Zanthoxylum* are used extensively in the country (FAO 1995). Other important plants used as spices are *Allium* spp., *Illicium anisatum* and *Zingiber officinales*.

The seeds and nuts of *Castanopsis* spp., *Juglans regia*, *Phoenix humilis* and *Pinus roxburghii* are edible, but they are used at the local level only. However, the nuts of *Juglans regia* have a high potential for export.

The following forest plants are used as vegetables: *Cymbidium grandiflorum* (flowers), *Adhatoda vasica* (terminal shoots), *Braken fern* (shoots), *Pandanus* sp. (terminal shoots), *Musa* sp. (terminal shoots and inflorescence), bamboo (shoots), *Asparagus* (shoots), *Alocasia* sp. and *Elatosteme* sp. *Asparagus* is cultivated by farmers in Thimphu and it commands a high price in local as well as export markets.

Table 3. Quantity of asparagus exported

Year	Quantity (kg)	Value (Nu)
1997	2 277	98 791
1998	2 004	198 637
1999	1 718	185 582

Source: Royal Government of Bhutan (1997, 1998 and 1999).

Fodder

More than 80 percent of the people of Bhutan depend on agriculture and animal husbandry for their livelihoods. The farming system in Bhutan depends on the forests (FAO 1995). About 80 percent of the total animal fodder requirement is met by utilizing agricultural residues but the pressure in the forest is very high in districts where the head of cattle is very large.

Almost every household maintains a few cattle for draught power, animal products and for their manure. Many people maintain large herds as a status symbol or as insurance in times of difficulty. The animal population has been recorded as 300 000 cattle and buffaloes; 28 000 yak; 40 000 sheep; 42 000 goats and 22 000 horses (FAO 1995). These animals largely depend on the forests for fodder. Herders drive the animals into the forests to forage for whatever is available

and thus much of the forest is used as grazing land. During winter, when fodder in the forests of the colder highlands becomes scarce, cattle are moved down to warmer areas in the valleys.

Medicines

More than 600 medicinal plants have been reported in Bhutan. About 250 plants are used commonly by the traditional practitioners of the Gso-ba-rig-pa system of medicine. Almost all the medicinal plants are collected from the forest. Indigenous knowledge of medicinal plants is handed down from father to son. Some healers combine spiritualism and perform elaborate rituals while dispensing medicines (FAO 1995).

The National Institute of Traditional Medicine (NITM) is the only institute with a programme for cultivating medicinal plants. Large quantities of *Innula helenium* (manu) and *Saussurea lappa* (ruta) are cultivated and are used locally for medicinal purposes either at the NITM or by the villagers themselves. There is good scope for the cultivation of more medicinal plants and for developing a medicinal plants industry that could generate employment for a large number of people and also earn foreign exchange.

Pipla (*Piper longum*) is one of the most important medicinal plants. Chirata (*Swertia chirata*) is used as medicine by the local people. The exact quantity used by the villagers is not documented. The heartwood of *Acacia catechu* (khair) contains catechin (katha) and catechu tannic acid (cutch). Katha is exported to India. Oil is also extracted from agarwood (*Aquilaria agallocha*). In Bhutan, oil from agar is not extracted because the quantity available is so small that setting up an extraction unit is not viable. Only a small quantity of agarwood is exported and this quantity is reported together with the exports of katha. From 1999 the export of katha roots has been banned with the implementation of the Timber Marketing and Pricing Policy by the Ministry of Agriculture.

Table 4. Exports of selected medicinal plants and plant parts

Product	1997		1998		1999	
	Quantity (kg)	Value (Nu)	Quantity (kg)	Value (Nu)	Quantity (kg)	Value (Nu)
Pipla	21 578	2 300 586	9 618	607 265	5 874	350 801
Chirata	3 755	92 650	18 405	432 519	3 367	265 131
Khair and agar	12 640	204 320	72 770	2 018,610	35 580	641 210
Khair roots	280 380	3 094 530	15 000	18 000	Na	Na
Herbal medicinal plants	Na	Na	297	78 867	Na	Na

Na = not available

Source: Royal Government of Bhutan (1997, 1998 and 1999)

Perfumes and cosmetics

Currently the most important essential oil-bearing plant is lemon grass (*Cymbopogon flexuosus*). Essential oils occur in some 60 plant families and almost any part of a plant may yield oil (FAO 1996).

Table 5. Exports of lemon grass oil

Year	Quantity (litres)	Value (Nu)
1997	58 636	13 457 608
1998	16 306	9 960 555
1999	21 504	6 480 413

Source: Royal Government of Bhutan (1997, 1998 and 1999)

Lemon grass collection and oil extraction have enormous potential as a source of employment for villagers and oil exports have good prospects for earning foreign exchange. Lemon grass distillation provides incomes for around 400 families in the eastern districts. For these families, distillation has become an even more important source of income than farming (FAO 1995). Of all the Bhutanese NWFP this commodity has the most direct impact on the earning capacity of a large number of villagers in areas where the plant is abundant.

Dyeing and tanning

Natural dyes are another group of NWFP that are associated with the traditional art and culture of Bhutan. Cloth weaving is an important economic activity in the central and eastern districts. Gradually, natural dyes are being replaced by chemicals or ready-made thread. Improvements in the quality of natural dyes may revive their use. A project at Khaling in eastern Bhutan is compiling research results and other information on natural dyes (FAO 1995).

The dyes can be grouped under five categories: (i) leaf dyes (*Symplocos* sp., *Strobilanthes flaccidifolious*, *Holcia nilagirica* and *Indigofera*); (ii) bark dyes (*Terminalia tomentosa*, *Berberis nepalensis*, *Acacia* spp. and *Alnus* sp.); (iii) flower and fruit dyes (khomany-shing [*Choenomeles lagenaria*], robtangshing [*Rhus similata*], churoo, amla [*Phyllanthus emblica*], *Cedrala toona*, *Michelia champaka* and *Mallotus phillipenensis*); (iv) stem and root dyes, (*Curcuma longa* and *Acacia catechu*); and (v) mineral dyes (natural mineral salts [dochur] and oxidized iron [marchelo]).

Utensils, handicrafts and construction materials

Traditional hand-made paper is manufactured from *Daphne* spp. and *Edgeworthia* spp. About 4 000 to 5 000 acres are covered by these species. The hand-made paper is very strong and durable and no chemicals are added while manufacturing the paper. Many small family-operated factories are engaged in the manufacturing of this paper. The only semi-mechanized unit is in Thimphu (M/S Jungshi Hand-made Paper Factory). The annual raw material requirement of this factory is about 32 000 kg (full capacity) but since raw material is in short supply, utilization of the factory at full capacity is not possible. Hand-made paper has very high demand both within the country as well as in the export market and the paper is often preferred to other kinds of paper.

The most important rattan species are *Calamus acanthospathus*, *Calamus tenuis*, *Calamus latifolius*, *Plectocomia himalayana* and *Daemonorops jenkinsianus*. Rattan is used for making ropes, furniture frames, walking sticks, umbrella handles and other household items such as mats, screens and furniture. Raw rattan canes are also exported.

Table 6. Exports of rattan

Year	Quantity (kg)	Value (Nu)
1997	18 220	138 632
1998	Na	Na
1999	21 600	132 200

Source: Royal Government of Bhutan (1997, 1998 and 1999)

Bhutan has more than 19 species of bamboo. Important bamboo genera are *Arundinaria*, *Bambusa*, *Dendrocalamus*, *Thamnocalamus* and *Drepanostachyum*. Bamboo is used for making baskets, rope and also containers. Young bamboo shoots are used as vegetables. Bamboo is consumed locally and internationally.

The making of fine bamboo baskets and containers is a specialty of the people in eastern districts. Such products are marketed all over Bhutan and are also popular with tourists (FAO 1995). Many

poor houses are made entirely of bamboo. The small bamboos that are found in central and west Bhutan are also woven into mats, used for fencing and for roofing temporary shelters (FAO 1995).

Table 7. Exports of bamboo

Year	Quantity (kg)	Value (Nu)
1997	60 551	27 248
1998	14 000	11 400
1999	2 700	7 150

Source: Royal Government of Bhutan (1997, 1998 and 1999)

Bhutan's main sources of fibre are from various stems and leaves, though fibre may also be extracted from roots, fruits and seeds. Fibres of economic importance are obtained from the following families: Bombacaceae, Sterculiaceae, Leguminosae, Moraceae, Urticaceae, Musaceae and Graminae. Local people use the fibres for various purposes (e.g. rope making and weaving mats). 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*. 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. (FAO 1996).

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 subtropical areas of southern Bhutan. Rural Bhutanese collect floss to make pillows and mattresses. Another floss species is kapok, *Ceiba pentandra* (FAO 1996).

The most common species used to make brooms is *Thysanolaena maxima*, known locally as kucho, amkso or tsakusha. 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 (FAO 1996). About 1 500 kg of grass for making good quality brooms were exported in 1997 (earnings of Nu.1 162). Locally, the use of grass for making brooms is quite high, but no data are available.

Handicraft items are famous in Bhutan. These items are used locally for various purposes, as well as being exported. The socio-economic importance of the units manufacturing handicraft items is high because many people depend on this profession.

Table 8. Exports of handicraft items

Year	Quantity (kg)	Value (Nu)
1997	2 690	755 332
1998	7 059	3 825 260

Source: Royal Government of Bhutan (1997 and 1998)

Leaves, barks and whole plants are used as incense. The demand for incense sticks is very high since they are used daily in households for offering morning and evening prayers. Some of the commonly used species used are *Juniperus* spp., *Nardostachys jatamansi*, *Tancetum tibeticum*, *Cannarium sikkimensis* and *Rhododendron* spp. There are good prospects for setting up small-scale units for manufacturing incense sticks and creating more jobs in Bhutan.

Table 9. Exports of incense sticks

Year	Quantity (kg)	Value (Nu)
1997	394	24 680
1998	46	8 430
1999	110	32 947

Source: Royal Government of Bhutan (1997, 1998 and 1999)

Ornamentals

Many domesticated plants are used by people for ornamental purposes. They are planted either in their houses, in compounds or in public places. In 1997 about 28 000 planting materials such as bulbs, tubers and roots of different plants were exported; they were valued at Nu.435 000. Important ornamental plants at the national level include *Cupressus cahmerina*, *Cupressus himaliaca*, *Daphne bholua*, *Deutzia bhutanensis*, *Magnolia campbellii*, *Mahonia nepalensis*, *Michelia doltsopa*, *Michelia nepalensis*, *Rhododendron kesangiae*, *Rhododendron thomsonii*, *Rhododendron triflorum*, *Viola bhutanica* and *Juniperus pseudosabina*.

Exudates

In Bhutan, the following gum-yielding plants are found: khair (*Acacia catechu*), semla gum (*Bauhinia retusa*), simal (*Bombax ceiba*) and brongshang (*Ficus elastica*). *Ficus elastica* is cultivated also. Resin is obtained from tapping chirpine trees (*Pinus roxburghii*). Turpentine and rosin are two important bi-products obtained by resin distillation and they are exported mainly to India. Resin tapping is one of the most important economic activities in the eastern part of Bhutan. According to the study conducted by FRDD/DoFs (2000) about 44 percent of the population in eastern Bhutan is engaged in this activity.

Table 10. Production of resin

Year	Quantity (kg)
1998	472 869
1999	431 053

Source: Tashi Commercial Corporation (2000)

Table 11. Exports of turpentine oil and rosin

Products	Year	Quantity (kg)	Value (Nu)
Turpentine oil	1997	52 000	855 000
	1998	47 040	536 100
	1999	66 000	717 500
Rosin	1997	453 767	12 892 935
	1998	233 129	7 412 463
	1999	504 310	12 570 684

Source: Royal Government of Bhutan (1997, 1998 and 1999)

More than 270 tonnes of resin are collected by villagers in the eastern districts and sold to distilleries. As the distilleries are next to farms, local farmers work in the distilleries when they are free. These activities directly contribute more than Nu.30 million (US\$1 million) to the rural economy. No major expansion is envisaged for resin production and the main emphasis is to refine the tapping technique so that the trees are not damaged.

Wax is obtained from the seeds of *Rhus verniciflua* and *Rhus syccedanea*.

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

Honey in Bhutan is provided by wild bees (*Apis dorsata*) and domesticated bees (*Apis indica*). Most of the honey collected is consumed locally and only a small quantity is exported to India. In

1999 about 1 020 kg of honey were exported (from the *Apis indica* bees), with a reported value of Nu.98 100 (Trade Statistics of Bhutan 1999).

Beeswax is obtained from the honeycomb of bees and wasps (*Apis* spp.). Villagers collect the honeycombs, drain the honey and melt the empty honeycombs. The impurities are removed and the remaining material is wax.

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Additional information on NWFP in Bhutan would be appreciated and duly acknowledged.

CONTACTS

Organizations involved in the development of NWFP in Bhutan (FAO 1995):

- Forest Research Section, REID, Ministry of Agriculture
- Forestry Services Division
- Research, Extension and Irrigation Department (REID), Ministry of Agriculture
- Ministry of Trade and Industries
- National Institute of Traditional Medicine (NITM)
- Handloom Weaving Centre, Khaliling
- Cottage industries (Yatha weaving centres).

ANNEX 1. FOREST SERVICES

Bhutan has extensive areas managed under the Protected Area Management system including areas such as National Parks, Wildlife Sanctuaries and Reserves. These areas account for 26 percent of the geographical area of the country. Another 9 percent is declared as biological corridors, which link the National Parks and Wildlife Sanctuaries located in different ecological zones.

The most important non-wood services derived from forest are grazing and fishing.

About 90 percent of the population in Bhutan own livestock. Livestock is an integral feature of the farming system and it supports agricultural land use through the provision of manure and draught power. The Forest and Nature Conservation Act (1995) allows grazing and collection of firewood, fodder and leaf mould for domestic use, either free or on payment of royalty. Firewood collection is permitted only from dead and fallen trees.

There are some areas (tsamdos) within the Government Reserved Forest, which are leased annually to herdsman or communities at Nu.100.00/year/tsamdo. Grazing is a usufructuary right of the villagers. The Forest and Nature Conservation Act of Bhutan, 1995 gives authority to the Department of Forestry Services to regulate and restrict grazing anywhere in the country, in order to prevent environmental damage.

The national cattle population is decreasing (in 1992 about 310 000 compared to 400 000 in 1990). This decrease may be attributed to the introduction of improved breeds, but it is also a possible result of exceeding the carrying capacity of the shrinking grazing resources (Dorji 1993, quoted in Davidson 2000). This decrease in the cattle population might also reduce cattle-grazing pressure in the forest. Because of heavy and free range grazing, the productivity of the forest seems to have declined. The decline may also be because of the expansion of unpalatable plant communities dominated by genera such as *Eupatorium*, *Artemisia*, *Anaphallis*, *Rumex*, *Pterinium*, *Cassis*, *Berberis*, *Elaeagnu* and *Rubus*.

Fishing is a major source of nutrition for most rural households. Many people living in urban areas enjoy fishing as a hobby. Fishing is allowed after obtaining a license issued by the Department of Forestry Services. The fee structure is as follows:

- for one day Nu.200
- for one month Nu.1 000
- for six months Nu.2 000
- for one year Nu.2 500

QUANTITATIVE NWFP DATA OF BHUTAN

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food		Mushrooms	<i>Auricularia auricula</i> <i>Calvaria</i> spp. <i>Clitocybe odora</i> <i>Cantherellus cibarius</i> <i>Polyporus</i> spp. <i>Tricoloma matsutake</i> <i>Lentinus edodes</i>		F	W, C	N, I	1999: export of 7 525 kg. Prices for canned mushrooms can reach Nu.50 (US\$1.65)/kg		RGB 1999 FAO 1995
		Asparagus	<i>Asparagus</i>			W, C	N, I	1999 export: 1 718 kg (Nu.185 582)		RGB 1999
Medicines		Herbal medicinal plants			F	W	N, I	1998 export: 297 kg (Nu.78 867)		RGB 1998
		Pipla	<i>Piper longum</i>		F	W	N, I	1999 export: 5 874 kg (Nu.350 801)		RGB 1998
		Chirata	<i>Swertia chirata</i>		F	W	N, I	1999 export: 3 367 kg (Nu.265 131)		RGB 1999
		Khair and agar	<i>Acacia catechu</i>				N, I	1999 export: 35 580 kg (Nu.641 210)		RGB 1999
		Khair roots	<i>Acacia catechu</i>	ro				1998 export: 15 000 kg (Nu.18 000)		RGB 1998
Perfumes, cosmetics		Lemon grass oil	<i>Cymbopogon flexuosus</i>				N, I	1999 export: 21 504 litres (Nu.6 480 413)		RGB 1999
Utensils, handicrafts, construction materials		Hand-made paper and paperboards	<i>Daphne</i> spp. <i>Edgeworthis</i> spp.				N, I	1999 export: 497 kg (Nu.310 612); 1998 export: 33 269 kg (Nu.2 848 810)	The raw material for hand-made paper is in short supply	RGB 1998 and 1999
		Rattan	<i>Calamus</i> spp. <i>Plectocomia himalyana</i> , <i>Daemonorops jenkisianus</i>				N, I	1999 export: 21 600 kg (Nu.132 200)		RGB 1999

Product			Resource				Economic value			
Category	Import -ance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Utensils, handicrafts, construction materials		Bamboo	<i>Arundinaria</i> <i>Bambusa</i> <i>Dendrocalamus</i> <i>Thamnocalamus</i> <i>Drepanostachyum</i>							RGB 1999
		Broom	e.g. <i>Thysanolaena maxima</i>				N, I			FAO 1996
		Handicraft items					N, I	1998 export: 7 059 kg		RGB 1998
		Incense sticks	<i>Juniperus</i> spp., <i>Nardostachys jatamansi</i> , <i>Tancetum tibeticum</i> , <i>Cannarium sikkimensis</i> , <i>Rhododendron</i> spp.				N, I	1999 export: 110 kg (Nu.32 947)		RGB 1999
Ornamentals		Planting materials					N, I	1997 export: 28 000 planting materials	Planting materials include bulbs, tubers	
Exudates		Resin	<i>Pinus roxburghii</i>				N, I	4 310 53 kg in 1997	More than 270 MT collected by villagers in the eastern districts (direct contribution to the rural economy Nu.30 million [US\$1 million])	Tashi Commercial Corporation 2000
		Turpentine and rosin	<i>Pinus roxburghii</i>				N, I	1999 production of turpentine: 66 000 kg (Nu.717 500) and of rosin 504 310 kg(Nu.12 570 684)		RGB 1999

Animals and animal products										
Honey, beeswax		Honey	<i>Apis dorsata</i> , <i>Apis indica</i>		F, O	W, C	N, I	1999: export of 1 020 kg (Nu.98 100)	Most of the honey collected is consumed locally. Exports mainly of <i>Apis indica</i> honey and mainly to India	RGB 1999

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

CAMBODIA

INTRODUCTION

Main non-wood forest products

The most important NWFP in Cambodia are resin, rattan and bamboo. Other NWFP include mushrooms, medicinal plants and incense.

General information

Cambodia has significant natural resources that could supply its people and foreign investors with many kinds of raw materials. The last 30 years of war have seriously depleted the forest infrastructure and the documentation on NWFP is scarce (Hang Suntra 1995). Currently people are collecting NWFP mainly for nourishment, housing, health care and small industries.

Most of the population is rural and more than 85 percent of the total population is settled along the Tonle Sap and Mekong rivers, as well as around the Tonle Sap Great Lake. Besides rice, which is the main source of nourishment, the products coming from the forest play a very important role in the nation's economy, although unfortunately the role and importance of NWFP has not been recognized adequately.

Table 1. NWFP exports of Cambodia from 1983 to 2000

Production	1983–95	1997–98	1998–99	1999–00
<i>Aquilaria crasna</i>	3 653 kg	0		0
<i>Aquilaria crasna</i> (wet)	265 MT	0	0	0
<i>Strychnos nux-vomica</i> (seed)	214 MT	0	0	0
<i>Sterculia colicata</i> (seed)	50 MT	0	0	0
<i>Cinnamomum incerme</i> (fruit)	1.7 MT	0	0	0
<i>Diospyros</i> sp. (fruit)	2.4 MT	0	0	0
<i>Melanorrhoea laccifera</i> (varnish or lacquer extracted)	494 MT	0	0	0
Rattan	1 167 MT	518 MT	120 MT	0
Resin	0.480 MT	0	0	42 MT

Sources: Annual Report of Ministry of Commerce (1983–1993); Annual Report of CAMFOREXIM (Cambodia Forestry Export and Import Office) from 1994 to 1995; Annual Report of CAMFOREXIM in the Department of Forestry and Wildlife

PLANTS AND PLANT PRODUCTS

Food

Mushrooms (e.g. phdeak, Ingea, popel, trangok and tracheak khla) are eaten by the local people. They also provide income. Harvesting is conducted during both the rainy and dry seasons, depending on the kind of mushrooms. Mushrooms can be dried for storage, but they are also consumed fresh. Mushrooms are found almost everywhere. The collection of mushrooms is free and there is no management system. The amount of mushrooms harvested depends on the demand. The amount of mushrooms collected by one person per day is 3 to 5 kg. The price for 1 kg is CR500 to 1 500 (US\$1.00 = CR3 900).

The shoots of bamboo (e.g. *Dendrocalamus giganteus*, *Dendrocalamus membranaceus*, *Bambusa vulgaris*, *Bambusa bambos*) are eaten.

Wild fruits are collected from the forests (e.g. kuy, *Baccaurea matleyana*, *Sandorium indicum* and *Elaeocarpus madopetalus*).

Some plant species also provide fodder, for example *Albizza lebbek*, *Arundiaria pusilla*, *Arundinaria falcata*, *Pterocarpus pedatus*, *Peltophorum ferrugineum* and *Careya sphaerica*.

Medicines

Several forest plants are used as medicines in Cambodia but not much documentation is available. The following species and plant parts have been reported: *Spirolobium* (bark and stumps), *Cinnamomum incerme* (roots and bark), *Leucaena leucocephala* (seeds and fruit), *Dioscorea hispida* (yam), *Albizza lebbek* (bark, seeds and flowers), *Mornda tomentosa* (trunks and roots), *Azadirachta indica* (trunks/fruit/bark/leaves) and *Cassia alata* (trunks/leaves/bark). Others include khmear, *Amomum galanga*, tromoung sek (*Gelonium multiflorum*) and dong koa (*Diospyros* spp.).

The documentation on fragrant plants in Cambodia is also scarce. Some species of fragrant plants are used for the treatment of diseases, for example the fragrant juice of the trunk of *Aquilaria crasna* and the incense from the trunks/stalks of fragrant creeper, var chhnot and *Pterocarpus santalinus*.

Exudates

An important Cambodian NWFP is resin. Resin is collected from chheu teil (*Dipterocarpus alatus*), cheur chong (*Shorea vulgaris*), *Shorea obtusa*, *Careya arborea* and *Shorea guiso*.

Resin from *Dipterocarpus alatus* is used for waterproofing wooden boats and for candles. It is also used for fishery equipment and for improving fish storage. The *Dipterocarpus alatus* tree is found almost anywhere near streams and the harvest is conducted depending on the demand. The harvesting takes place during the dry season (December to May) when the quality of the resin is better. The trees are owned and managed by local people and heritage rights to tap a tree can be awarded. The trees are also under the management of the Department of Forestry and Wildlife. *Dipterocarpus alatus* resin is often mixed with resin from *Shorea vulgaris*. Another resin-providing tree is *Shorea guiso*, but nowadays it is difficult to find since its habitat has been degraded. Resins are also exported to the neighbouring countries of Viet Nam and Thailand.

Utensils, handicrafts and construction materials

Rattan is the most important raw material for handicrafts, tools and construction. *Calamus salicifolius* and *Calamus dioicus* (rum peak) are used for handicrafts, baskets and fishing tools. *Calamus salicifolius* is found almost everywhere, except in the mountain zone. Harvesting is conducted when people are free from farming or rice-harvesting activities. There is no management of *Calamus salicifolius* and collection is free.

Calamus petreus (phdov dambong) is used for handicrafts and furniture and farm tools. Harvesting is conducted mostly by local people and usually after the rainy season (December – April). *Calamus petreus* is found in almost all natural forest areas. The management of *Calamus petreus* is under the responsibility of the Department of Forestry and Wildlife, Ministry of Agriculture, Fishery and Forestry.

Var yiev (*Strychnos axillaris*) is a very popular fibre source in Cambodia for making fishing tools and house construction. Other fibre species used are *Cyclea peltata*, *Chukrasia tabularis* and other species (their botanical names are not known). The harvesting of *Strychnos axillaris* is conducted after the rainy season and the species is found in all of the natural forest area.

Bamboo is used widely for house construction in Cambodia (especially *Dendrocalamus giganteus*, *Dendrocalamus membranaceus*, *Bambusa vulgaris* and *Bambusa bambos* and *Bambusa arundinacea*). Bamboos are also used for the production of paper, farm tools and fishing tools. Items made of bamboo include baskets, chopsticks, lattice (floor grating), columns of cottages, carrying bars (shoulder perched) and palm juice containers/tubes.

Harvesting is conducted throughout the year. Bamboo is found mostly in the dense and semidense forest areas of western and northeastern Cambodia. The resource is under the management of the Department of Forestry and Wildlife but people are free to collect it for home consumption. *Dendrocalamus membranaceus* is grown on farms.

ANIMALS AND ANIMAL PRODUCTS

Medicines

Some wildlife species are used for the treatment of diseases, such as: *Hystrix cristata* (stomach), *Nyctebus tardigradus* (body), *Python reticulatus* (skin, bone), *Ursus thibatanus* (bone), gecko (body) and black monkey (blood/bone). *Manus javanika* is also used as a medicine.

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Additional information on NWFP in Cambodia would be appreciated and duly acknowledged

CONTACTS

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ANNEX 1. FOREST SERVICES

The Royal National Government has taken action to support and promote an active conservation policy for Cambodia's natural resources. The Royal Decree of 1 November 1993 adopted 23 sites (totalling 3.4 million ha) for protection, including seven national parks, 10 wildlife sanctuaries, three important landscapes, and three multiple-use sites. These sites are under the supervision of

the Ministry of Agriculture, Forestry and Fishery, and the Secretariat of Environment (Hang Suntra 1995).

QUANTITATIVE NWFP DATA OF CAMBODIA

Product			Resource				Economic value			
Category	Importance	Trade name	Species	Part used	Production system	Source	Destination	Quantity, value	Remarks	References
Plants and plant products										
Food	2	Phdeak mushroom, Ingea mushroom, Popel mushroom, Trangok mushroom, Tracheak khla		pl	F	W	N	CR500–1 500 for 1 kg	The amount of mushrooms collected by one person per day is 3–5 kg	
		Varnish, lacquer	<i>Melanorrhoea laccifera</i>	re			N, I	Export: 494 MT in 1983–95		Annual Report of Ministry of Commerce, 1983–93
			<i>Diospyros</i> sp.	fr			N, I	Export: 2.4 MT in 1983–95		Annual Report of Ministry of Commerce, 1983–93
			<i>Cinnamomum incense</i>	fr			N, I	Export: 1.76 MT in 1983–95		Annual Report of Ministry of Commerce, 1983–93
			<i>Sterculia colicata</i>	se			N, I	Export of seed: 50.5 MT in 1983–95		Annual Report of Ministry of Commerce, 1983–93
			<i>Strychnos nux-vomica</i>	se			N, I	Export of seed: 214 MT in 1983–95		Annual Report of Ministry of Commerce, 1983–93
			<i>Aquilaria crasna</i>				N, I	Export: 3 653.95 kg in 1983–95 Exports to the west of <i>Aquilaria crasna</i> : 265 MT in 1983–95		Annual Report of Ministry of Commerce, 1983–93 Annual Report of CAMFOREXIM, 1994–95.
Utensils, handicrafts, construction materials	1	Rattan	<i>Calamus salicifolius</i> <i>Calamus rudentum</i> <i>Calamus viminalis</i>	st	F	W	N, I	Export: 120 MT in 1999		
Exudates	2	Resins	<i>Dipterocarpus alatus</i> <i>Dipterocarpus intricaryus</i> <i>Shorea vulgaris</i>	st	F	W	N, I	Export: 41.975 MT in 2000		

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
 Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
 Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
 Source: W – wild, C – cultivated

Destination: N – national; I – international

CHINA

INTRODUCTION

Main non-wood forest products

The important NWFP of China are exudates, essential oils, bamboo, food (e.g. fruits, nuts and mushrooms), honey and medicinal plants.

General information

NWFP hold great significance in China for the nutrition and health care of rural households. NWFP statistics have been compiled on data which were issued in publications such as Forestry Yearbook of China (1980–1997), Forestry Information of China (1980–1996), Agriculture Yearbook of China (1980–1996) and the Chinese Customs Yearbook (1996).

In China, NWFP are divided into 10 categories: woody plants for food and oil; resins; perfumes or spices; beverages; mushrooms; medicinal plants; plants for fodder; animal products; bamboo and rattan; fruits and nuts. In addition, forest services (including ecotourism) are included in the concept of NWFP.

Table 1. The production of major NWFP in China (in tonnes)

NWFP	1995	1996	1997
Raw lacquer	2 971	3 994	4 415
Tong oil tree seed	402 148	410 066	453 355
Camellia oil seed	623 126	695 733	856 868
Tallow tree seed	38 834	42 306	40 912
Chinese gallnut	10 085	9 879	11 060
Palm tree bark	52 955	58 549	58 158
Pine seeds	548 157	580 819	702 982
Dried bamboo shoots	174 561	183 052	217 216
Walnut	230 677	239 162	248 383
Chestnut	247 025	340 302	378 183
Scraped lac	3 415	3 019	2 711

Source: China Forestry Yearbook (1995–1997)

Forest plantations are a very important feature of the forest resources in China; over 670 000 ha of plantations for economic purposes (called locally “economic forests”) have been established each year since the 1990s. Presently, the economic forests of China have an annual production value of over ¥40 000 million. Economic forests are established for cash crops of (woody) plants for food, fruits, nuts, tea, silk and medicines. At present, there are over 1 000 factories, employing over 100 000 people, and producing many kinds of products; they form an integrated production system based on the chemical extraction and processing of harvested NWFP from economic forests.

Table 2. Average annual domestic consumption levels of major NWFP in China

NWFP	Production x10 ⁴ MT	NWFP	Production x10 ⁴ MT
<i>Lycium barbarum</i>	0.45	Walnut	15
Chinese tea	7.58	Chestnut	12
Apple	450	Chinese date	40–50
Pear	250	Camellia oil	15
Orange	460	Dried bamboo shoots	2
Grape	87	Fresh bamboo shoots	150
Banana	140	Bamboo poles	600–700
Kiwi fruit	34.7	<i>Xanthoxylum</i> sp.	3.1
Honey	17.8	<i>Illicium verum</i>	2

Source: China Forestry Yearbook (1995–1997)

The ownership of the NWFP resources in the forests belongs to the government or a collective, but people are allowed to harvest them. The NWFP are marketed domestically and internationally and a substantial proportion of NWFP is consumed by farmers and householders in the forest regions. Most of the NWFP is obtained from natural forest, but an increasing amount is being produced in plantations (economic forests; bamboo shoots, fruits and nuts are cultivated intensively. Resin, tong oil and tallow are collected from natural stands or plantations. Most NWFP are collected in small quantities, seasonally and manually, by women and children.

Table 3. International markets and trade flow for major Chinese NWFP

NWFP	Annual production x10 ⁴ MT	Annual export amount x10 ⁴ MT	International market or trade flow
Resin	50.4	26.0	Japan, Germany, UK, France, Holland, Italy
Tong oil	12.0	2.0	EU, USA, Southeast Asia, Hong Kong
Tallow oil	2.0	1.5	EU, USA
Essential oil	0.45	0.26	European and American countries
Lacquer varnish	0.3	0.2	Germany, Egypt, Indonesia, USA
Bamboo poles	600-700	9.0	Germany, France, Holland
Dried bamboo shoots	17.0	2.0	Hong Kong, Southeast Asia
Shiitake	12.0	2.0	Transit trade in Hong Kong
Black auricular fungus	0.5	0.1	Transit trade in Hong Kong
White auricular fungus	0.1	0.05	Transit trade in Hong Kong
Walnut	15.0	5.0	USA, EU, Australia, Canada, Japan, Switzerland
Chestnut	3.3	2.5	Hong Kong, Southeast Asia, USA, Canada
Pear	250.0	5.0	Hong Kong, Southeast Asia
Tea	7.6	2.5	USA, EU, Egypt, Russia
Honey	17.8	--	Germany, UK, USA, Japan
<i>Eucomia ulmoides</i> gum	0.2	0.1	Japan, USA, Germany, France, Italy, Malaysia, Spain, UK
Ginkgo leaves	0.7	0.2	USA, Germany, France, Japan, Korea
Wild brake	0.25	0.1	Japan

Source: China Forestry Yearbook 1995–1997

PLANTS AND PLANT PRODUCTS

Food

In China, some 375 edible mushroom species can be found in the forests. Annually, over 1 000 tonnes of dried mushrooms are exported at a value of US\$20 million. According to the Forestry Statistics (1977) the forestry sector produced 0.176 million tonnes of edible mushrooms and wild ferns.

Edible mushrooms are a major NWFP in China. Chinese mushrooms are also popular in international markets. Mushrooms exported from China are mainly black and white auricular fungus, winter mushroom and pine mushroom.

The total production of black auricular fungus (*Auricularia auricula*) and its production per unit area are increasing every year as cultivation techniques improve and better strains are being utilized. China is the main world producer of this fungus with an annual production of 46 000 tonnes and annual exports of about 1 000 tonnes, earning close to US\$8 million. Most of the exports are to Japan, Southeast Asia, western Europe and northern America.

About 1 000 tonnes of white auricular fungus (*Tremella fuciformis*) are produced every year, of which about 300 tonnes are exported.

Winter mushroom (shiitake) (*Lentinus edodes*) is one of the best edible mushrooms in the world. China is the largest producer of winter mushroom in the world with production of around 120 000 tonnes. Annually, over 1 000 tonnes of dried winter mushroom are exported at a price of some US\$2 000/tonne.

Other valuable fungi are *Dictyophora duplicata*, *Hericium erinaceus*, *Pleurotus citrinopileatus*, *Boletus* spp., *Morchella esculenta*, *Ganoderma lucidum*, *Grifola umbellata* and *Cordyceps sinensis* (Kunshan 1994).

The forestry sector produced 23.5 million tonnes of fruits (mainly apples, pears and oranges in economic forest plantations) and 0.5 million tonnes of nuts in 1997 (National Forestry Bureau 1997). The annual production of fruits increased on average by 11.4 percent (1.3 million tonnes) from 1979 to 1992. The increase in fruit production will slow down in the future. The production of nuts is increasing annually by more than 5 percent. The domestic consumption of fruits and nuts has increased from 9.037 million tonnes in 1980 to 50.465 million tonnes in 1995.

Chestnut (*Castanea* spp.) plantations cover a total area of some 300 000 ha. The annual production of chestnuts averages about 330 000 tonnes, accounting for one-tenth of the world total. China exports annually some 25 000 tonnes of chestnuts (mostly to Japan), earning about US\$50 million (Kunshan 1994).

The total area of walnut (*Juglans regia*.) plantations in the country is over 1 million ha, and annual production averages about 250 000 tonnes. The nuts contain protein and fat. The annual export quantity of walnuts from China is about 47 000 tonnes, with an export value of US\$30 to 50 million. Walnuts are exported mainly to Europe, Canada and other countries in Asia (Kunshan 1994).

Many wild vegetables are found in the forests of northeastern China. There are over 100 species of edible ferns in the forests of Heilongjiang Province. Currently, about 2 000 tonnes of wild brake (*Pteridium aquilum*) are collected each year when the collection potential could be some 100 000 tonnes. Ferns are increasingly in demand on international markets and their price is rising (to over US\$10 000/tonnes for *Pteridium aquilum* and *Osmunda cinnamome*). Chinese wild vegetables are exported mainly to Japan, where the demand for salted wild vegetables is over 10 000 tonnes per year. Chinese root vegetables are popular in Germany, the United States and Japan.

Bamboo shoots are another major output; they are a traditional component of Chinese food. Each year about 1.6 million tonnes of fresh bamboo shoots are harvested.

Jujube (*Zizyphus* spp.) is another important wild vegetable. The total area of jujube is about 240 000 ha and the annual production of fresh jujube is 400 000 tonnes. China exports about 4 700 tonnes of dry jujube, earning US\$5 million in foreign exchange each year (Kunshan 1994).

Tea oil (*Camellia oleigera*) grows in 15 provinces over an area of more than 4 million ha. The annual production of tea oil is 500 tonnes, accounting for 8.6 percent of the edible plant oil produced in the country. In Hunan and Jiangxi provinces, which are the central production areas of tea oil in China, over half of the edible oil consumed in the rural areas is tea oil. Saponin, which can be extracted from tea dregs, is used to manufacture cleansers, detergents, foaming agents and insecticides. It also acts as medicine to lower cholesterol and prevent heart disease (Kunshan 1994).

Forest drinks are natural drinks, produced or extracted from tree juice, wild berries, fruit, leaves and flowers of plants, as well as the pollen of nectariferous plants. In 1997, China produced 74 600 tonnes of forest beverages. Forest drinks are made from birch, seabuckthorn (*Hippophae*

rhamnoides), yangtao (*Actinidia chinensis*), bureja gooseberry (*Ribes burejense*), raspberry (*Rubus*), amur grape (*Vitis amurensis*), wild rose, cowberry (*Vaccinium vitis-idaea*), black currant (*Ribes nigrum*), Siberia nitaria (*Nitraria sibirica*) and pine needle powder (Kunshan 1994). Birch juice is a popular soft drink in China. China has abundant birch resources, with 34 species covering a total area of 10 million ha. Products such as birch syrup, birch cola and birch honey peach produced by the Forest Drink Factory of Dailing Forestry Bureau, Heilongjiang Province, have an annual value of ¥2.94 million (Kunshan 1994).

Seabuckthorn (*Hippophae rhamnoides*) is a wild shrub growing in 20 provinces in northern China, covering an area of over 1 million ha. Seabuckthorn has rich nutritional and medicinal qualities. In 1990, there were over 150 seabuckthorn-processing factories in China, with an annual production capacity of about 150 000 tonnes. The variety of products made from seabuckthorn has evolved from the original crude juice and soft drinks, to over 200 finished products in eight different categories, including soft drinks, food, wine, daily-use chemicals, medicine, health protection, forage and additives. Fifteen tonnes of juice can be obtained from 1 ha of wild seabuckthorn forest. The Seabuckthorn Beverage Factory of Youyu County, Shanxi Province, has an annual production capacity of 4 000 tonnes, with production of 1 640 tonnes of condensed seabuckthorn juice, powder and light sparkling wine, valued at ¥5 million. The total value of seabuckthorn products in the seven provinces in the middle and upper reaches of the Changjiang River exceeded ¥100 million in 1988. Joint ventures have been set up between China and the United States, Japan and Switzerland to develop seabuckthorn products (Kunshan 1994).

Yangtao actinidia (*Actinidia chinensis*, better known under its international name “kiwi”) is an important wild fruit, growing in 24 provinces, with an annual production of about 300 000 tonnes. Xixia County, Henan Province, has abundant yangtao actinidia with an average annual production of 2 500 tonnes. The biggest plantations of yangtao actinidia in China are situated in Sichuan Province. A research institute has been set up specifically to support yangtao actinidia development. Yangtao actinidia products such as drinks, wine and jam produced in Xixia County are sold both on domestic and international markets. The yangtao actinidia wine produced by Guanxian County Yangtao Actinidia Wine Factory, Sichuan Province, has won awards and wide recognition (Kunshan 1994).

The fruits of black currant (*Ribes nigrum*) are rich in nutrients and a variety of vitamins, organic acids, trace elements, sugar and others. Black currant can be processed into wine, fructose, fruit juice and jam. As one of the major NWFP in Heilongjiang Province, the cultivation area of black currant covers 14 000 ha supplying more than 70 processing factories (Kunshan 1994).

Medicines

The consumption of traditional Chinese drugs accounts for about 40 percent of the total consumption of medicaments in China. About 6 000 species of Chinese medicinal plants have been recorded and many of them grow in forests. Important medicinal plants include: ginseng, pilose antler, the fruit of *Macrocarpium officinalis*, tall gastrodia (*Gastrodia elata*), bezoar, fulling (*Portia cocos*), eucommia (*Eucommia ulmoides*), the roots of common baphicacanthus (*Baphicacanthus cusia*), liquorice (*Glycyrrhiza uralensis*), lily magnolia (*Magnolia liliflora*), Chinese thorowax (*Bupleurum chinense*), officinal magnolia (*Magnolia officinalis*), Chinese wolfberry (*Lycium chinense*), cinchona (*Cinchona*), Chinese magnoliavine (*Schisandra chinensis*), manyprickle acanthopanax (*Acanthopanax senticosus*), common stone crop (*Hylotelephium erythrostictum*), amur corktree (*Phellodendron amurense*) and glossy ganoderma (*Ganoderma lucidum*) (Kunshan 1994).

Ginseng (*Panax ginseng*) is one of the key medicinal products from north China. Jilin Province, a major ginseng-producing area, produces about 80 percent of the ginseng of the country, making up around 40 percent of the world total (Kunshan 1994). American ginseng (*Panax*

quinquefollius) was introduced to China in 1975 and is planted in more than 10 provinces with an annual production of over 50 tonnes. Muling Forestry Bureau, Heilongjiang Province, is the biggest production base in China of American ginseng. The total annual sales exceed ¥3.5 million. The bureau has experienced good economic results from the management of ginseng and American ginseng, employing more than 8 000 people in its operations (Kunshan 1994).

The annual production of the fruit of common macrocarpium (*Macrocarpium officinalis*) fluctuates between 600 and 900 tonnes. The production of fresh fruit is about 30 to 50 kg/ha. As of 1987, the total area planted reached 1 333 ha, with an annual production of 160 tonnes, producing an income of ¥82 million (Kunshan 1994).

Pilose antler is a high-grade tonic medicine costing ¥1 300 to 1 400/kg (first class pilose antler produced in Jilin Province: ¥2 260/kg). Over 30 tonnes of pilose antler were produced in Jilin Province in 1987, yet the supply falls short of the demand (Kunshan 1994).

Ginkgo (*Ginkgo biloba*) is used as food and medicine. The annual production is 5 000 tonnes, most of which is exported. The foreign exchange earnings top US\$7 million each year (Kunshan 1994). Great attention has been paid to the medical value of ginkgo kernel and leaf. Presently, ginkgo leaf is quite often in short supply on international markets. There are 0.7 to 0.8 million fruit-producing ginkgo trees and the annual production of kernels is 5 000 to 6 000 tonnes, the production of leaves amounts to 7 000 tonnes and the annual production of fleshy seed coats reaches 10 000 to 12 000 tonnes. About ¥1 500 million can be earned through the export of ginkgo products.

Pine needle powder is a supplementary forage for fowl and livestock. The cost of processing pine needle powder is about ¥2/kg. As of 1987, 19 provinces had produced and used needle powder forage. Sixty pine needle powder factories have been established, with an annual production of 15 000 tonnes. Pine needle ointment is also used as a forage for fowl. Pine needle ointment has been shown to cure diseases of the mouth. A factory has been set up in Xugou Forestry Bureau, Lianyungang, Jiangsu Province to produce pine needle ointment (Kunshan 1994).

Perfumes and cosmetics

China's aromatic plant resources account for annual production of 20 000–30 000 tonnes of essential oils. There are 0.67 million ha of eucalyptus plantations in China. The annual production of eucalyptus oil is 4 500 tonnes, exports accounting for 2 580 tonnes.

Mountain spicy tree (*Litsea cubeba*) is an important aromatic oil plant that is distributed widely in almost all provinces. Most parts of the plant, including the root, stem, leaf, bark and fruit, contain aromatic oil. Especially useful is the fruit, from which aromatic oil (cubeba oil) can be obtained. It can be used directly as fragrant materials in soda drinks and beer, and indirectly for perfume, medicine, plastics, synthetic rubber, printing and food. The Yiyang Chemical Factory, Hunan Province has produced a variety of products from the oil with an annual production value of ¥8.5 million yuan. As the content of the oil is similar to that of coconut oil, it has been used in Hunan to replace the latter, saving a large amount of foreign exchange (Kunshan 1994).

Dyeing and tanning

In 1996 China produced 20 000 tonnes of tannins and further processed tannin products, and 22 000 tonnes of tannin extracts.

Utensils, handicrafts and construction materials

In China, over 460 species of fibre plants can be found in the forests. There are more than 40 species of palm and rattan plants in China. The area of natural rattan stands is about 0.3 million ha with annual production of 4 000 to 5 000 tonnes.

China is extremely rich in bamboo resources with 17 million ha of bamboo forests and over 500 species of bamboo. The area of bamboo plantations is estimated to be over 7 million ha with a commercial production of 97 million tonnes of bamboo. Annual production of bamboo poles ranges between 6 to 7 million tonnes, accounting for one-third of total world production. In 1992, export of bamboo poles amounted to 90 000 tonnes earning more than US\$20 million. The total export value of all processed bamboo products from China in 1993 totaled over US\$240 million and US\$400 million in 1997.

Exudates

Resin is among China's most important NWFP. Resin is extracted from *Pinus massoniana* and *P. elliotii*; 1.6 million ha of coniferous forests in China are estimated to be available for resin production. China is the world's largest resin producer with production of 580 000 tonnes and exports of 260 000 tonnes during 1997.

The provinces of Guangdong, Guangxi and Fujian are major resin producers accounting for two-thirds of the total production of the country. Until 1997, there were more than 280 small- to medium-sized enterprises for resin production of which 20 had an annual production capacity of more than 5 000 tonnes. An estimated 300 000 people are employed in the resin sector.

Yellowhorn (*Xanthoceras sorbifolia*) is an important oil tree species in northeast, north and northwest China. It has been introduced and cultivated in 14 provinces over a total area of about 50 000 ha. The annual production is about 3 750 tonnes (Kunshan 1994).

The tallow tree (*Sapium sebiferum*) is an important woody oil plant in China, found in 15 provinces. It covers more than 200 000 ha with annual production of about 85 000 tonnes. The oil is extracted from the seeds. Its fat and pulp are important chemical materials which are used widely in soap, wax candles, paint, printing ink, wax paper, skin-protection lotions, metal-painting agents and others. The leaf contains tannin. The leaves and roots are used as medicinals. The bark is a source for tanning extracts and the flower is a nectar source. A small quantity is exported, mainly to Europe and the United States.

The tung oil tree (*Aleurites fordii*) is one of the major industrial oil tree species in China, occurring in 16 provinces of the south, with a total planted area of about 1.8 million ha and an annual production of 105 000 tonnes in 1989 (Kunshan 1994). The annual export volume is about 20 000 tonnes (Kunshan 1994).

Raw lacquer is made from the leaf liquid of the lacquer tree (*Toxicodendron vernicifluum*) and has strong absorptive and anti-corrosive qualities (Kunshan 1994). The lacquer tree is distributed over the provinces of Shaanxi, Guizhou, Hubei, Yunnan and Hunan, covering an area of about 500 000 ha. The annual production of raw lacquer is 2 750 tonnes. Raw lacquer is a traditional export of China. Between 1980 and 1986, the annual exports of raw lacquer averaged 300 tonnes. Japan, Hong Kong, Macao and the United Kingdom are the main importing countries. It earns about US\$4 million per year (Kunshan 1994).

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

The potential for annual honey production in China is estimated at 3 to 4 million tonnes.

Other non-edible animal products

In China there is a rich variety of insect and animal resources from which industrial materials are prepared (e.g. lacquer insects, wax insects and Chinese gallnut aphids). There are more than 300 species of host plants for lacquer insects. The annual production of lacquer was 1 482 tonnes in 1988 and 3 019 tonnes in 1996. Half of the total production of lacquer is exported to over 45 countries around the world.

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ANNEX 1. FOREST SERVICES

China has made efforts to develop its national parks and forest recreation services; 874 national parks had been established in China by the end of 1997 with an area of 7.48 million ha accounting for 0.75 percent of the total land area. Of the national parks, 292 were established at the national level with an area of 5.37 million ha.

Within the nature reserves, 13 forest recreation spots, 2 hunting ranges and 11 forest recreation services have been established. According to China Green Times (1999), from 1992 to 1996 over 300 million people visited the national parks contributing ¥180 million, the total income from the tour industry exceeded ¥1 000 million.

In 1997, 52.11 million tourists, of whom 0.68 million came from overseas, visited the national parks; they generated an estimated income of ¥819 million and provided job opportunities for nearly 150 000 people.

QUANTITATIVE NWFP DATA OF CHINA

Product			Resource				Economic value		Remarks	References
Category	Importance 1, 2, 3	Trade name Generic term	Species	Part used	Habitat F, P, O	Source W, C	Destination N, I	Quantity, value		
Plants and plant products										
Food	1	Apple	<i>Malus pumila</i>	fr	P	C	N, I	Annual production of 4.50 million MT	Area of 1.69 million ha	Zhang Anling 1993
	1	Pear	<i>Pyrus bretschneideri</i>	fr	P,O	C	I, N	Annual production of 2.50 million MT	Area of 480 000 ha	Zhang Anling 1993
	2	Orange	<i>Citrus reticulata</i>	fr	P	C	N	Annual production of 4.6 million MT	Area of 1 02 million ha	Zhang Anling 1993
	1	Grape	<i>Vitia</i> spp.	fr	P,O	C	N	Annual production of 870 000 MT	Area of 140 000 ha	Zhang Anling 1993
	2	Banana		fr	P	C	N	Annual production of 1.40 million MT	Area of 110 000 ha	Zhang Anling 1993
	2	Kiwi fruit	<i>Actinidia chinensis</i>	fr	P,O	C	N	Annual production of 347 000 MT According to Kunshan (1994), annual production is 300 000 MT	Area of 670 000 ha	Kunshan 1994
	2	Bamboo shoot	<i>Phyllostachys edulis</i> , <i>Phyllostachy praecox</i> <i>Dendrocalamus latiflorus</i> Ph. <i>vivax</i>	st	F,P	C	N,I	Annual production of dry bamboo shoots is 20 000 MT and fresh bamboo shoots is 1.5 million MT		Li Yucai 1996
	1	Walnut	<i>Juglans regia</i>	nu	P,O	C	I, N	Annual production of 150 000 MT Annual export of 100 000 MT Annual exports: 47 000 MT (US\$30–50 million)	Area of 1 million ha	Zhang Anling, 1993 Kunshan 1994

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
	1	Chestnut	<i>Castanea henryi</i>	nu	P,O	C	I, N	378 183 MT in 1997	Area of 300 000 ha	Kunshan 1994 China Forestry Yearbook 1995– 97
	1	Chinese date Jujube	<i>Ziziphus jujuba</i>	nu	P,O	C	N, I	Annual production of 400 000–500 000 MT Exports of 4 700 MT of dry jujube (US\$5 million) p/a	Area of 550 000 ha	Kunshan 1994.
	2	Blackwood ear	<i>Auricularia auricula</i>	pl	F,O	C	I,N	Exports: about 1 000 MT (US\$8 million) p/a 46 000 MT p/a		Jiang Chunqian 1997
	2	Whitewood ear	<i>Tremella fuciformis</i>	pl	F,O	C	I,N	Annual production of 1 000 MT Exports: 300 MT p/a		Jiang Chunqian 1997; Li Yucai 1996
	2	Shiitake	<i>Lentinus edodes</i>	pl	F,O	C	I,N	Annual production of 120 000 MT (38.3% of total world production). Annual export: 1 000 MT, value US\$2 000/MT	Exported to Southeast Asia and Japan. 90% of shiitake in Hong Kong is from China	Jiang Chunqian 1997; Li Yucai 1996
	2	Wild brake	<i>Pteridium aquilinum</i> (L) kuhn	st	F,P,O	W	I, N	2 000 MT p/a	Production potential of 100 000 MT	Jiang Chunqian 1997
	2	Wild brake	<i>Osmunda cinnamomea</i>	st	F,P,O	W	I, N			
		Wild brake						1980: the price for wild brake was US\$ 400/MT, in 1994 it was US\$1 400/MT		
	1	Camellia tea	<i>Camellia oleifera</i>	fr	P,O	C	N	150 000 MT p/a	Area of 4 million ha	Zhang Anling 1993

	2	Shingleaf yellowhorn	<i>Xanthoceras sorbifolia</i>	fr	P	C	N	300 MT p/a Export: 3 750 MT p/a	Area of 3 000 ha Introduced from Europe in the 1960s, about 5 million individual trees exist. Total area of 50 000 ha	Kunshan 1994
	1	Olive	<i>Olea europaea</i>	fr	P	C	N	200 MT p/a	Area of 13 000 ha	
	1	Green tea, black tea	<i>Cumellia sinensis</i>	le	P,O	C	N,I	1996: 75 822 MT of which 56 603 MT were green tea	1/3 of the production was exported in 1996	
Medicines	2	Eucommia	<i>Eucommia ulmoides</i>	ba,le	P,F	W,C	N ,I	2 000 MT p/a	Area of 80 000 ha	Zhu and Jiang 1998 Anlin Zhang 1993
	2	Officinal magnolia	<i>Magnolia officinalis</i>	ba	P,F	W,C	N, I	1 300 MT p/a	Area of 23 000 ha	
	1	Ginkgo	<i>Ginkgo biloba</i>	nu,le	P	C	I, N	Annual production of kernels: 5 000–6 000 MT. Annual production of leaves: 7 000 MT Annual production of fleshy seed coats: 10 000– 12 000 MT Export earnings of about ¥1 5 000 million Leaf extracts can be sold at US\$30 000/kg	100 kg of leaves produce 1 kg of leaf extract	
	2	Corktree	<i>Phellodendron amurense</i>	ba	P,F	W,C	I, N	2 000 MT p/a	Area of 9 000 ha	
	1	Wolfberry	<i>Lycium chinensis</i>	fr	P,F	C	I, N	4 500 MT p/a	Area of 9 000 ha	
		Pilose antler						Price ¥1 300–1 400/kg		Kunshan 1994
		Pine needle powder						15 000 MT p/a		Kunshan 1994
	1	Chinese prickly ash	<i>Zanthoxylum bungeanum</i>	nu	P,O	C	I, N	31 000 MT p/a	Area of 520 000 ha	Zhang Anling 1993

Plants and plant products										
Perfumes, cosmetics	2		<i>Eucalyptus</i>	fl, le	P	C	I,N	4 500 MT p/a, of which 2 580 MT are exported (the amount of exports equals 80% of the world trade)	The price of this essential oil in the world market depends on the oil extracted from eucalyptus in China	Li Yucai 1996 CAF 1998
Dyeing, tanning	2		<i>Acacia mearnsii</i>	ba	P	C	I,N	50 000 MT in 1987 and 20 000 MT in 1997	Area of 10 000 ha in the subtropical area. Production has declined gradually over the last few years	National Forestry Statistics 1996
Utensils, handicrafts, construction materials	2	Palm	<i>Txachycarpus fortunei</i>	ba	O	C	I, N	40 000 MT p/a		Forestry Yearbook 1996
	2	Bamboo poles	<i>Phyllostachys edulis</i>	st	F,P	C	N,I	6-7 million MT p/a		Li Yucai 1996
	2	Bamboo products	<i>Phyllostachys edulis</i>	st	F,P	C	N,I	Production value of bamboo (1993): ¥5.5 billion, exports of US\$150 million Bamboo manufacture contributed ¥12 000 billion in 1997 and US\$400 million through exports		
	2	Rattan		st	F	C	I,N	4 000-5 000 MT p/a		
Exudates	2	Turpentine	<i>Pinus</i> spp.	le	F, P	C	I,N	47 009-61 627 MT (1991-93)		CAF 1998 National Forestry Statistics 1996
	1	Resin	<i>Pinus massoniana</i> Lamb.	st	F,P	C	I,N	450 000/530 000 MT in 1996 and 1997 respectively	The production is 60% of that in the world	Jiang Chunqian 1999
Others	1	Chinese rose	<i>Rosa chinensis</i>		O	C	N, I	Until 1997 planted area reached 88 000 km ² and 1.94 million bonsai pots were produced. Production value was ¥9.6 billion and value of exports reached ¥0.8 billion	Till 1997, about 11 bases for the production of flowers and plants were established	Forestry Industrial Economy 1997
		Chrysanthemum	<i>Dendranthema morifolium</i>		O	C				
		Azalea	<i>Rhododendron</i>		O	C				
	1	Tung oil	<i>Vernicia</i> spp.	fr	P,O	C	I, N	Annual production of 120 000 MT Annual exports of 20 000 MT	Area 2.07 million ha	Zhang Anling 1993

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
		Tong oil tree seed	<i>Aleurites fordii</i>					1997: 453 355 MT 1989: 105 000 MT Annual export volume, 20 000 MT, foreign exchange for 12 000 MT about US\$15 million		China Forestry Yearbook 1995–1997 Kunshan 1994
	1	Chinese tallow tree	<i>Sapium sebiferum</i>	fr	P,O	C	I, N	Annual production of seeds: 50 000 MT Annual production of oil: 20 000 MT The area is 200 000 ha and the annual production is 85 000 MT. Production of tallow tree seed: 40 912 MT in 1997	Area of 250 000 ha	Kunshan 1994 China Forestry Yearbook 1995–1997
	2	Raw lacquer	<i>Toxicodendron verniciflum</i>	pl	C	C	I,N	Area of 450 000 km ² , annual production: 3 000 MT. Production in 1997 was 4 415 MT	The Chinese exports account for 80% of the total world exports	National Forestry Statistics 1996; China Forestry Yearbook 1995–1997
		Camellia oil seed						1997: 856 868 MT		China Forestry Yearbook 1995–1997
		Chinese gallnut						1997: 11 060 MT		China Forestry Yearbook 1995–1997
		Palm tree bark						1997: 58 158 MT		China Forestry Yearbook 1995–1997
		Pine seed						1997: 702 982 MT		China Forestry Yearbook 1995–1997

Product			Resource				Economic value		Remarks	References
Category	Import-ance	Trade name Generic term	Species	Part used	Habitat	Source	Desti-nation	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
		Dried bamboo shoots						1997: 217 216 MT		China Forestry Yearbook 1995–1997
		Scraped lac						1997: 2 711 MT		China Forestry Yearbook 1995–1997
		Seabuckthorn	<i>Hippophae rhomnoides</i>					Production capacity of 150 seabuckthorn - processing factories of about 150 000 MT in 1990	A variety of products are being produced in various factories	Kunshan 1994
		American ginseng	<i>Panax quinquefollius</i>					Annual production of over 50 MT		Kunshan 1994
Animals and animal products										
Honey, beeswax		Honey						Potential annual honey production of 3–4 million MT	Over 5 000 ha of nectar plants exist	
Other non-edible animal products	2	Chinese gallnut	Chinese gallnut aphid + <i>Rhus</i> spp.		F,P	C	I,N	Annual production is 5 000 MT		Zhu and Jiang 1996
	2	Chinese wax	Chinese wax insect + <i>Ligustrum</i> spp.		F,P	C	I,N	Production of 600 MT	100 million individual host trees	Zhu and Jiang 1996
	2	Lac	Lac insect, <i>Kerria</i> spp.		F,P	C	I,N	Production of 300 000 MT	Area of host trees: 50 000 ha	Jiang Chunqian 1997

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

INDIA

INTRODUCTION

Main non-wood forest products

The most important NWFP of India are edible plants, fibres and flosses, bamboos, exudates (gums, resins and oleoresins), medicinal plants, essential oils, tans and dyes, wrapper leaves and animal products (e.g lac and silk).

General information

All usufruct/utility products of plant, animal and mineral origins except timber obtainable from forests or afforested lands are defined as non-timber forest products (NTFP) or non-wood forest products (NWFP) or minor forest products (MFP). Services for tourism and recreation are also considered to be MFP.

NWFP in India are derived from over 3 000 species. According to the Centre of Minor Forest Products, 325 species producing NWFP are very common, commercial and have a base in major industry – they are exported or imported; 879 species are used locally; 677 species are potentially useful only locally; and 1 343 species can be described as “others lesser known”.

Nearly 60 percent of all the recorded forest revenue in India comes from NWFP. Most of India's 50 million tribal people receive a substantial proportion of their cash and in-kind income from NWFP (NWFP are estimated to generate 70 percent of all employment in the Indian forestry sector), while about 200 to 300 million village people depend on products from forests to varying degrees (Shiva 1995). The forestry sector, with 23 percent of the country's geographical area, provides 2.3 million person-years of employment. Of this total, 1.6 million person-years are related to NWFP. Most NWFP often provide employment during only part of the year because the processing of NWFP is still poorly developed (Gupta 1994).

Commercial NWFP alone are estimated to generate Rs.3 billion (US\$100 million) annually. However, NWFP generate some of the lowest wages of the rural employment sector. While the minimum wage in most states ranges from Rs.30 to 40 per day (US\$1 to US\$1.30), most NWFP collectors earn from Rs.5 to 15 (US\$0.25 to US\$0.50) per day. Low wages reflect the low productivity of the forest arising from poor management, and depressed prices imposed by state trading monopolies and private buyers (Poffenberger 1994).

Most of the NWFP are consumed locally (Shiva 1995). There is no quantitative record of the large numbers of NWFP that are collected by forest inhabitants for their local use and for their subsistence economy. Those commodities, which are exported, generally are stocked in Bombay markets. Data with regard to the quantity of NWFP export are available from the Directorate of Commercial Intelligence and Statistics (Calcutta).

India exports a large number of NWFP to other countries after meeting internal requirements. Foreign exchange earnings total about Rs.10 billion (US\$384 million) annually (Shiva 1995). NWFP are primarily exported as raw materials (Gupta 1994).

Table 1. Value of NWFP exported from India from 1991 to 1997

	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
	Value	Value	Value	Value	Value	Value
Value of NWFP exported from India (in million US\$)	510.96	505.47	786.8	1 033.28	1 248.25	1 311.39

Source: Shiva and Pandey (1998)

Table 2. Percentage contribution of different NWFP groups to the total export value of NWFP from 1991 to 1997

NWFP groups	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97
Edible products	53.5	58.6	52.5	56.4	54.1	48.74
Medicinal products	9.1	9.4	6.8	6.5	6.0	7.4
Spices	6.5	7.0	8.0	7.0	5.2	9.3
Essential oils	3.4	3.1	2.2	1.9	2.0	3.2
Oil seeds/fatty oils	8.3	8.7	10.5	10.1	14.9	11.1
Gums/resins	7.6	9.4	7.4	6.2	7.6	9.2
Tans/dyes	0.7	0.9	0.64	0.4	0.4	0.5
Fibres/flosses	0.4	0.4	0.3	0.25	0.29	0.33
Bamboos/canes	0.01	0.01	0.0004	0.003	0.001	0.007
Miscellaneous	1.25	1.13	1.0	0.9	1.0	0.95
Animal origin including lac and shellac	0.02	0.02	0.03	0.05	0.12	0.08
Mineral origin	9.32	1.36	10.63	10.3	8.4	9.2

Source: Shiva and Pandey (1998)

Property rights have not been well defined until now. The collectors and growers remain ignorant regarding the requirement/demand of any commodity and therefore collection and production are not regulated.

PLANTS AND PLANT PRODUCTS

Food

A number of tree species provide edible plant products. Important fruits come from *Buchanania lanzan* (chironji, achaar or char), *Anacardium occidentale* (cashew nut or kaju), *Pinus gerardiana* (chilgoza or neoza), *Emblia officinalis* (aonla), *Tamarindus indica* (tamarind), *Aegle marmelos* (bel), *Feronia elephantum* (kaitha), *Artocarpus lakoocha* (barhal), *Syzygium cuminii* (jamun), *Annona squamosa* (custard apple) *Carissa opaca* (karaunda), *Juglans regia* (akhrot), *Moringa oleifera* (drum stick) and *Zizyphus jujuba* (ber). Edible flowers come from *Madhuca indica* and *M. longifolia* (mahua). Roots and tubers of *Amorphophalus campanulatum*, *Dioscorca belophylla*, *D. oppositifolia* and *Ipomoea aquatica* are also important.

Table 3. NWFP exports from 1991 to 1997

NWFP	1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)
Edible products	22 842 5.25	114 864.25	264 419.93	124 472.42	291 531.17	173 616.20	312 942.42	244 735.02	374 742.24	283 416.41	348 541.67	268 392.66
Medicinal products	387 44.43	19 485.66	37 405.18	20 030.82	32 948.78	22 391.03	35 953.07	28 280.73	35 493.85	31 301.50	42 592.97	40 814.00
Spices	43 244.27	13 877.38	48 006.14	146 52.73	484 168.75	26 376.91	58 080.28	30 309.44	47 297.81	27 124.31	73 046.25	51 499.04
Essential oils	4 864.78	7 196.62	2 918.71	6 577.77	2 630.69	7 161.31	2 491.78	8 201.50	3 020.33	10 612.59	3 554.43	17 663.80
Oil seeds/fatty oils	89 735.87	17 787.60	295 277.30	18 490.95	379 424.28	34 729.03	168 758.98	43 901.89	374 275.48	78 085.01	264 139.51	61 173.81
Gums/resins	72 626.39	16 294.87	76 088.16	19 880.28	84 179.32	24 521.46	78 590.48	26 829.40	94 220.88	40 042.52	107 158.43	50 493.67
Tans/dyes	10 101.91	1 472.73	9 332.50	1 816.03	10 297.68	2 131.73	5 369.71	1 635.43	6 415.73	2 009.07	8 193.01	2 765.57
Fibres/flosses	4 838.87	869.27	5 283.16	953.26	4 283.92	894.35	5 512.36	1 096.56	5 593.31	1 512.73	5 908.42	1 797.86
Bamboos/canes	91.34	12.42	120.01	31.27	5.55	1.45	113.03	14.45	103.98	7.77	867.71	39.96
Miscellaneous	6 630.36	2 681.81	4 270.87	2 455.56	10 157.08	3 289.88	16 263.56	3 873.13	9 303.04	5 433.17	83 914.60	5 257.18
Animal origin including lac and shellac	98.63	36.82	9.22	38.85	237.94	119.85	205.17	203.77	549.28	677.08	651.22	435.84
Mineral origin	617 698.53	20 026.47	262 977.11	2 893.88	10 054 33.32	35 221.34	12 340 36.01	44 898.07	11 838 99.92	44 044.02	938 083.01	50 450.31
Grand total value of MFPs (in Rs.)	11 171 00.63	2 146 05.90	10 061 08.29	2 122 95.82	2 305 298.48	3 304 54.54	19 183 16.85	4 339 79.39	21 349 15.85	5 242 66.18	18 766 51.23	5 507 83.70
Grand total value of MFPs (in US\$ million)		510.97		505.47		786.80		1 033.28		1 248.25		1 311.39

Source: Shiva and Pandey (1998)

Table 4. Export data of some NWFP with a monopoly in world trade

NWFP	1991-92		1992-93		1993-94		1994-95		1995-96		1996-97	
	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in MT)	Value (in Rs.)	Quantity (in tonnes)	Value (in Rs.)
<i>Sterculia urens</i> (karaya gum) (Indian tragacanth)	573.55	489.45	843.33	724.48	1 443.06	1 110.24	1 467.13	1 074.97	1 224.42	1 159.43	941.11	893.87
Myrobalan fruit extract <i>Terminalia chebula</i> (harra)	540.62	122.02	975.52	242.05	867.91	218.22	1 371.39	324.08	1 110.05	283.90	1 127.59	249.39
Myrobalan amla used in tanning <i>Embllica officinalis</i> (amla)	7.0	0.77	107.2	12.62	102.69	27.34	330.83	73.66	467.02	73.92	248.98	53.44
Myrobalan other (whole or cut) used in tanning	43.4	4.4	370.85	32.51	221.84	32.9	140.79	20.58	121.26	26.72	235.97	51.96
General myrobalans	613.4	134.00	1 453.66	287.44	1 196.44	279.40	1 875.01	425.07	1 745.83	392.05	1 705.25	427.42
(Annatto dye) <i>Bixa orellana</i>	18.94	12.73 (1990-91)	-	-	-	-	-	-	-	-	109.24	97.34
Sandalwood chips and dust, (<i>Santalum album</i>)			0.77	1.04	-	-	-	-	-	-	-	-
Sandalwood oil (<i>Santalum album</i>)	-	-	2.00	4.65	0.03	0.16	0.16	0.86	0.003	0.02	0.50	1.45

Sources: Shiva *et al.* (1996) and Shiva and Pandey (1998)

The kernels of *Buchanania lanzan* are sold at the market at about Rs12/kg. About 140 tonnes of *Pinus gerardiana* nuts are produced every year and they are priced at approximately Rs100/kg (Gupta and Sharma 1975). About 86 different oil-seed producing tree species (e.g. *Shorea robusta* [sal], *Madhuca indica* [mahua], *Mangifera indica* [mango], *Azadirachta indica* [neem], *Pongamia glabra* [karanj oil], *Schleichera trijuga* [kusum], *Salvadora oleoides* [khakan] and *Actinidaphne hookeri* [pisa]) exist in India. Oil seeds are used, for instance, as substitutes for cocoa butter (sal, mango) and in soap making (sal, mahua, karanj oil, kusum, neem, khakan and pisa).

Table 5. Annual seed production of selected tree species in India

Species	Potential production (1 000 MT)	Current production (1 000 MT)	Value of current produce (Million Rs.)
Kusum	200	30	112
Pilu	50	10	NA
Pisa	1	NA	NA
Karanj	110	26	78
Neem	400	100	150
Sal	5 500	100	200
Mahua	1 100	25	17

Source: Gupta (1994)

Other important plants that provide oil seeds and fatty oil are (Latin binomials are followed by trade and local terms): *Anacardium occidentale* (cashew nut tree) – kaju; *Aisandra butyracea* (butter tree) – phulwara; *Aleurites fordii* (tung oil tree) – jangali badam; *Carthamus tinctorius* (saf flower) – kusum; *Garcinia indica* (kokam) – kokam; *Helianthus annuus* (sunflower) soorajmukhi; *Linum usitatissimum* (linseed) tisi or alsii.

Important plants yielding spices are *Alpinia glanga* (greater galangal), *Cinnamomum zeylanicum* (cinnamon or dalchini), *Curcuma* spp. (haldi), *Elettaria cardamomum* (cardamom, choti elachi), *Piper longum* (Indian long pepper, pipili), *Piper nigrum* (black pepper, kali mirch) (Gupta 1994).

Other important plants producing spices and condiments are (Latin binomials are followed by trade and local terms): *Apium graveolens* (celery seeds) – ajmud; *Carum carvi* (caraway) – jira; *Cassia lignea* (tejpat) – tejpat; *Cinnamomum cassia* (cassia) – cinnamon oil; *Crocus sativus* (saffron) – kesar; *Cuminum cyminum* (cumin) – jira; *Elettaria cardamomum* (cardamom) – choti elachi; *Foeniculum vulgare* (fennel) – saunf; *Garcinia indica* (kokam butter tree) – kokam; *Guizotia abyssinica* (niger) – kala-til; *Juniperus communis* (juniper) – aaraar; *Myristica fragrans* (nutmeg tree) – jaiphal; *Pimpinella anisum* (aniseed) – saunf; *Syzygium aromaticum* (cloves) – laung; *Thymus vulgaris* (garden thyme) – thyme.

Fodder

The consumption of fodder was reported to be 229 million tonnes in 1985 (Committee, Government of India). It has been estimated that India needs about 672 million tonnes of fodder to meet its requirements (Jha 1996). Many species have been identified for meeting fodder needs, both in forests and adjoining areas. Overexploitation of forests for fodder may harm other NWFP resources seriously.

Medicines

India's medicinal plant wealth comprises about 1 500 species. Medicinal plants commonly used in pharmaceutical preparations include: *Terminalia chebula*, *T. bellerica*, *Embllica officinalis* (all three yielding myrobalans), *Azadirachta indica*, *Aegle marmelos*, *Saraca ashoka*, *Holarrhena antidysentrica*, *Berberis aristata*, *Tinospora cordifolia*, *Adathoda vasica*, *Ichnocarpus frutescent*, *Glycyrrhiza glabra*, *Rauwolfia serpentina*, *Acorus calamus*, *Boerhaavia diffusa*, *Cyperus rotundas*, *Withania somnifera*, *Piper longum*, *Swertia chirayita* and *Cinchona* sp. (Shiva 1995).

Medicinal plant species are coming under threat increasingly; 15–20 percent of the total vascular flora of India may fall under the IUCN categories of threatened, rare or endangered plants. Due to continuous use, many medicinal plant species have become scarce in the forests and efforts are being made to cultivate them (Gupta 1994).

Other important medicinal plants of about 250 commercially important species are (Latin binomials are followed by trade and local terms): *Aloe barbadensis* (aloe) – girth kumari; *Alpinia galanga* (galangal) – kulanjan; *Atropa belladonna* (Indian belladonna) – belladonna; *Catharanthus roseus* (old maid) – sadabahar; *Curcuma zedoaria* (zedoary) – kachura; *Glycyrrhiza glabra* (liquorice) – mulhatti; *Plantago psyllium* (black psyllium) – kala isabgol; *Panax ginseng* (Chinese gingery) – gingery; *Saussurea lappa* (kuth) – pachak; *Swertia chirayita* (chiretta) – chirayita.

Perfumes and cosmetics

The important essential oils produced in India come from sandalwood, lemon grass, palmarosa, eucalyptus (*E. globulus* and *E. citriodora*), khus and linaloe (Gupta 1994). Some commercially important plants that provide essential oils are (Latin binomials are followed by trade and local terms):

Abelmoschus moschatus (ambrette plant) – musk dana; *Aquilaria agallocha* (agar) – agar; *Artemisia pallens* (davana) – davana oil; *Cananga odorata* (ylang ylang) – apurvachampaka; *Cymbopogon flexuosus* (east Indian lemon grass) – lemon grass; *Cymbopogon martini* (rosha grass) – gandbel; *Cymbopogon winterianus* (citronella) – Java citronella grass; *Eucalyptus globulus* (yields medicinal eucalyptus) – eucalyptus oil; *Eucalyptus citriodora* (yields perfumery oil) – eucalyptus oil; *Jasminum grandiflorum* (jasmine) – chameli; *Lavandula officinalis* (lavender) – lavender; *Mentha arvensis* (menthol) – peppermint; *Mentha piperita* (peppermint) – gainthi phudina; *Mentha spicata* (spearmint) – spearmint oil; *Melaleuca leucadendron* (cajuput) – kayaputi; *Pandanus odoratissimus* (screw pine) – keura; *Polianthes tuberosa* (nutmeg) – anantamul; *Santalum album* (sandal) – chandan; *Syzygium aromaticum* (clove) – laung; *Vetiveria zizanioides* (vetiver) – khus-khus grass; *Zingiber officinale* (ginger) – adrak.

Table 6. Estimated average annual production of essential oils

Essential oils	Production (MT)
Lemon grass oil	1 200
Sandalwood oil	1 300
Palmarosa oil	90
Vetiver oil	50
Eucalyptus oil	50
Cinnamon oil	33
Deodar wood oil	2
Linoloe oil	3
Total	2 830

Source: Gupta (1994)

Dyeing and tanning

Tannins produced in India can be classified as fruit tannins, bark tannins or leaf tannins. Generally, fruit tannins are obtained from *Terminalia chebula* (myrobalan or harra), though pods of *Acacia nilotica* and drupes of *Emblia officinalis* (myrobalan or aonla) and *Zizyphus xylocarpa* are used locally. The main tree species yielding bark tannins are *Acacia nilotica* (babul), *A. mollissima* (wattle), *Cassia auriculata* (avaram) and *Shorea robusta*. The leaves of *Anogeissus latifolia* and *Carissa spinarum* are harvested for tannin production.

Around 78 000 to 100 000 tonnes of myrobalan nuts are estimated to be produced annually, valued at Rs15 to 20 million. Over 23 000 tonnes of wattle bark are harvested every year, valued at Rs38 million. About 22 000 tonnes of babul bark are produced annually, valued at Rs55 million. Annual production of avaram bark is estimated at 23 000 tonnes, valued at about Rs35 million (Gupta 1994).

Some other important plants producing tans and dyes are (Latin binomials are followed by trade and local terms): *Acacia catechu* (cuth) – khair; *Indigofera tinctoria* (natural indigo) – nil; *Lawsonia inermis* (henna) – mehendi; *Petrocarpus santalinus* (red sandalwood) – lal chandan.

Utensils, handicrafts and construction materials

The leaves of *Diospyros melanoxylon* are used as wrappers for tobacco to produce bidi (tendu, abnus, kendu, tembru, kari, tembhurni and bali tupra). Off-cuts of leaves are burned and the ash is used in toothpowder. Around 300 000 tonnes of bidi leaves are produced annually in India. The value of these leaves is based on an average price of Rs15 000/tonne and the annual value of production is about Rs4 515 million (Gupta 1994).

Over 100 species of bamboo occur naturally in India, the most important being *Bambusa arundinacea* (thorny bamboo or bans), *B. tulda*, *B. polymorpha*, *Dendrocalamus strictus* (solid bamboo or lathi bans), *D. hamiltonii*, *Melocanna baccifera* and *Ochlandra travancorica*. *Dendrocalamus strictus* and *Bambusa arundinacea* are the two principal economic species. Bamboo in India is used mainly for pulp (35 percent of total consumption), housing (20 percent), rural uses (20 percent) and fuel (8.5 percent). It is possible that bamboo areas are declining because of gregarious flowering and the consequent dying of clumps. The price of bamboo varies with its end use. Most of the annual cut is used in making paper or rayon, for which producers receive about Rs300/tonne. The value of the potential annual cut is Rs1 367 million (Gupta 1994).

Some other important plants producing bamboos and canes are (Latin binomials are followed by trade and local terms): *Arundinaria falcata* (fishing rod bamboo) – ringal; *Calamus andamanicus* (thickcane) – mota bet; *Daemonorops kurzianus* (east Indian dragon's blood) – aprang; *Melocanna bambusoides* (tarai) – tarai bans; *Ochlandra travancorica* (irul) – irul; *Oxytenanthera nigrociliata* (kalia) – kalia bans; *Phyllostachys spinosa* (sheora) – medicinal bamboo; *Plectocomia himalayana* (basket bamboo) – tokribet.

The following fibre-producing species are used commonly by cottage industries: *Agave sisalana* (sisal), *Abroma augusta*, *Abutilon* spp., *Ananas cosmosus*, *Antiaris toxicaria*, *Boehmeria nivea* (ramie or rhea), *Borassus flabillifer*, *Borassus flabelliformis* (palmyra palm or tar), *Cannabis sativa* (true hemp or bhang), *Cordia dichotoma*, *C. rothii*, *Girardinia heterophylla*, *Grewia glabra*, *G. elastica*, *G. optiva*, *Hibiscus* spp. (e.g. *Hibiscus cannabinus* [kenaf or ambari]), *Malachra capitata*, *Marsdenia tenacissima*, *M. volubilis*, *Phormium tenax*, *Sensiviera roxburghiana*, *Sesbania bispinosa*, *Sida rhombifolia*, *Sterculia foetida*, *S. urens*, *S. villosa*, *Themeda arundinacea*, *Trema orientalis*, *Typha elephantina*, *Urena lobata*, *Oreocnide integrifolia* (Gupta 1994).

It is estimated that around 2 500 tonnes per year of agave fibres are produced in the country, with a present value of Rs45 million (Gupta 1994).

Flosses are obtained from certain wild fruits. Important species are *Bombax ceiba* (silk cotton tree or semul) and *Ceiba pentandra* (kapok or safed semal). The floss from *Bombax ceiba* is obtained from capsules and is known as "Indian kapok." The floss is soft and strong and used in life-saving devices for boats, stuffing for cushions, pillows and mattresses, thermal insulation, and soundproof covers and walls. It is a preferred filling material for padded surgical dressings. Flosses obtained from the fruit of *Ceiba pentandra* (kapok or silk cotton) are elastic and are used in the manufacture of lifebelts and buoys. About 300 tonnes of kapok are produced annually in India, with a value of Rs30 million (Gupta 1994).

Other plants producing fibres and flosses are (Latin binomials are followed by trade and local terms): *Agave americana* (American aloe) – bans keera; *Caryota urens* (kittul) – mari; *Cocos nucifera* (coconut) – nariyal; *Corchorus capsularis* (white jute) – narcha; *Descurainia sophia* (flaxweed) – khubklana; *Gossypium arboreum* (cotton) – kapas; *Pandanus odoratissimus* (screw pine) – keura; *Saccharum munja* (munja) – munj.

Grasses are used for paper making (*Eulaliopsis binata* [sabai grass]), cattle fodder (e.g. *Andropogon*, *Cenchrus ciliaris*, *Bothriochloa ischaemum*, *B. intermedia*, *B. pertusa* and *Bromus* spp.), matting (e.g. *Phragmites* spp., *Arundo* spp., *Saccharum munja*, *Typha elephantina* and *Cyperus corymbosus*), ropes (e.g. *Eulaliopsis binata*, *Desmostachya bipinnata*, *Saccharum munja*, *S. spontaneum* and *Themeda arundinacea*), thatching (e.g. *Imperata cylindrica*, *Saccharum munja*, *S. spontaneum* and *Heteropogon contortus*) and in manufacturing furniture, baskets, and screens (e.g. *Saccharum munja*, *Vetiveria zizanioides* and *Thysanolaena maxima*) (Gupta 1994). Some 0.3 to 0.4 million tonnes of grass could be harvested annually in India (Sharma 1977). Some 60 000 to 80 000 tonnes of sabai grass are purchased each year by paper mills. The price of sabai grass is around Rs300/tonne (Gupta 1994).

Exudates

Madhya Pradesh has the potential to produce as much gum karaya (*Sterculia urens*) as the rest of India combined. However, tapping in the state was banned in 1982 for 10 years. Approximately 1 400 tonnes of gum karaya are collected annually from other states, valued at about Rs60 million (Gupta 1994). No recent production values are available.

Production of gums other than karaya is about 1 900 tonnes, fetching Rs12 million annually. About 46 000 tonnes of oleoresin are obtained from *Pinus roxburghii* each year, valued at approximately Rs2.8 million (Gupta 1994).

Table 7. Classification of Indian resins and gums

Category	Typical product in world trade	Source of typical Indian products
True gums	Gum arabic	<i>Acacia nilotica</i> spp. <i>Indica</i>
	Gum tragacanth	<i>A. catechu</i>
		<i>A. modesta</i>
		<i>A. Senegal</i>
		<i>Anogeissus latifolia</i>
		<i>Bauhinia retusa</i>
		<i>Cochlospermum religiosum</i>
		<i>Lannea coromandelica</i>
		<i>Pterocarpus marsupium</i>
		<i>Sterculia urens</i> and <i>S. villosa</i>
Several minor species		
Hard resins	Copal dammar	<i>Canarium strictum</i>
		<i>Hopea odorata</i>
		<i>Shorea robusta</i>
		<i>Vateria indica</i>
	Amber	
	Lacquer	
Shellac		
Sandarac		
Mastic		
Oleoresins	Turpentine	<i>Pinus roxburghii</i> and three other <i>Pinus</i> species
	Balsams	
	of peru	
	of tolu	
	of styrax or storax	<i>Boswellia serrata</i>
	other oleoresins	<i>Dipterocarpus turbinatus</i>
	Copaiba	<i>Kingiodendron pinnatum</i>
Elemi		
Gum resins	Gamboge	<i>Garcinia morella</i>
	Assafoetida	
	Galbanum	
	Myrrh	
	Olibanum or frankincense	<i>Commiphora mukul</i>

Source: Gupta (1994)

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

Honey forms a natural nutritious food for rural people. Also, it is used widely for medicinal purposes. Two species of bees, *Apis dorsata* (rock bee) and *Apis indica* (Indian bee) produce honey. The former is wild in the montane and submontane regions throughout India. It is a good honey gatherer and a single comb may yield up to 35 kg of honey and 1 kg of wax. The latter is amenable to domestication, but it is not a good honey gatherer. The yield per hive ranges from 3 to 13 kg of honey in the hills and 3 to 8 kg in the plains (Gupta 1994).

About 250 tonnes of rock bee honey and 98 tonnes of Indian bee honey are produced annually. At a price of Rs40/kg, the total value of honey produced is Rs139 million. Beeswax is used in the manufacture of furniture and floor polishes, dressing and waterproofing of leather goods. It is also an ingredient in shoe polish, cosmetics, lipstick and face cream. About 28 tonnes of wax are produced annually, valued at approximately Rs1.6 million (Gupta 1994).

Other non-edible animal products

Lac from the insect *Laccifer lacca* (commonly known as shellac) is used presently for various purposes in plastics, electrical supplies, adhesives, leather, wood finishing, printing, polish and varnish, ink and other industries. It is also the principal ingredient of sealing wax. Two main strains of the lac insect are recognized: rangeeni and kusumi. The rangeeni crop is raised on several host plants, the most important being *Butea monosperma* and *Zizyphus mauritiana*. The kusumi strain is raised on *Schleichera oleosa*. Both strains produce two crops per year. Lac is collected in two forms, ari and phunki. The former is cut from the host plant and the latter is collected from the brood lac, after being used for inoculation. The lac is then sold as such or freed from the sticks and then sold. The lac removed from the sticks is known commercially as sticklack (Gupta 1994).

The annual production of sticklack is about 14 500 to 20 000 tonnes and the price varies from Rs4 500 to 16 000/tonne (most of the produce sells at around Rs14 000/tonne). The total value of the annual production is Rs203 million to Rs280 million (Gupta 1994).

India produces four kinds of silk: mulberry, tassar, muga and eri. The silkworm *Bombyx mori* is fed on mulberry leaves cultivated in plantations. Silkworms are also found wild on forest trees, e.g. *Antheraea paphia* which produces the tassar silk. *Antheraea paphia* feeds on several trees such as *Anogeissus latifolia*, *Terminalia tomentosa*, *T. arjuna*, *Lagerstroemia parviflora* and *Madhuca indica*. Wild silkworm *Antheraea assamensis* produces muga silk, and another wild silkworm *Philosamia synthia ricini* produces eri silk. The estimated annual production of tassar silk is 130 tonnes. Production of other types of silk exceeds 10 000 tonnes (Gupta 1994).

Other NWFP of animal origin in India include horns, peacock tails and wings, feathers, waste from the bristles and hair of pigs, hogs and boars.

Other NWFP

NWFP of mineral origin in India include garnet, granite, limestone, mica, pumice, sandstone (crude or roughly trimmed) and sandstone merely cut by saw and slate.

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- Directorate General of Commercial Intelligence & Statistics, Ministry of Commerce, Govt. of India, Calcutta

ANNEX 1. FOREST SERVICES

The Government of India encourages ecotourism, recreation and wildlife watching. Hunting has been banned almost totally to conserve the fauna.

Table 8. Protected areas in India

	Number	Area
National parks (NPs)	85	37 436.58 km ²
Wildlife sanctuaries (WLSs)	467	113 691.88 km ²
Protected areas (PAs)	552	151 128.46 km ²

The Wildlife Institute of India has initiated studies and experiments in the high altitude forests in the Garhwal Himalayas to assess tourism impact on habitats and wildlife for sustainable tourism planning. Information is for instance gathered on the tourist flows in Corbett Tiger Reserve and Dhikala in Rajaji National Park. It has been reported that in Corbett Tiger Reserve, 115 km² out of 521 km² is visited annually by 40 000 tourists (of whom 10 percent are foreigners).

Table 9. Wildlife populations in India

Wildlife	Population
Elephant	More than 10 000
Hog deer	More than 10 000
Mouse deer	1 000 to 10 000
Musk deer	Less than 1 000
Nil gai	More than 10 000
Sambar	More than 10 000
Sangai	Less than 1 000
Swamp deer (wet)	1 000 to 10 000
Swamp deer (dry)	1 000 to 10 000
Tiger	4 005 (in 21 states and Union Territories), 1 121 (in 15 reserves) in 1984; 3 000 in 1995
Lion	284 (in Gir National Park) in 1990; 304 in 1995
Panther or leopard	6 763 in 1989; 212 (in Gir National Park) in 1990; 268 in 1995
White black buck	63 in 1994
Sambar	2 262 (in Gir National Park) in 1990
Manipur brow-antlered deer	52 in 1989
Crocodile	39 (in Crocodile Breeding Centre at Tadoba) in 1987
Ghariyal	1 235 (in Nandan Kanan Biological Park, Orissa in 1994)

Sources: *Tiger Paper*, April – June, 1991 Vol. XVIII: No.2; Department of Environment & Forests, Wildlife Government of India (*Tiger Paper*, July – Sept, 1989 pp 4–5); Data Centre of Natural Resources and WWF – *India Newsletter* (1985, 2nd Quarterly); *Tiger Paper*, July – Sept., 1995 Vol. 22: No.3; *Tiger Paper*, January – March, 1992 Vol. XIX: No.1, pp 28; *Tiger Paper*, April – June, 1992 Vol. XIX No.2, pp 31; Singh, H.S. (1995) *The Indian Forester*, Vol. 121. No. 10, pp 876 and 910; *Tiger Paper*, July – Sept., 1996 Vol. 23: No.3.

QUANTITATIVE NWFP DATA OF INDIA

Product			Resource				Economic value		Remarks	References
Category	Import-ance	Trade name Generic term	Species	Part used	Habitat	Source	Desti-nation	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food	1	Edible plant products					N, I	Export of 3 485 41 MT, Rs.2 683 92 (1996-97)		Shiva and Pandey 1998
		Oil seeds/fatty oils					N, I	Export of 2 641 39 MT, lakh Rs.61 173 (1996-97)		Shiva and Pandey 1998
Oil seeds/fatty oils		Kusum	<i>Schleichera trijuga</i>					30 000 MT, Rs.112 million	Production potential 200 000 MT	Gupta 1994
		Pilu						10 000 MT	Production potential 50 000 MT	Gupta 1994
		Pisa							Production potential 1 000 MT	Gupta 1994
		Karanj	<i>Pongmia glabra</i>					26 000 MT, Rs.78 million	Production potential 110 000 MT	Gupta 1994
		Neem	<i>Azadirachta indica</i>					100 000 MT, Rs.150 million	Potential production 400 MT	Gupta 1994
		Sal	<i>Shorea robusta</i>					100 000 MT, Rs.200 million	Potential production 5 500 000 MT	Gupta 1994
		Mahua	<i>Madhuca indica</i>					25 000 MT, Rs.17 million	Potential production 1 100 000 MT	Gupta 1994
		Cashew nuts	<i>Anacardium occidentale</i>	kernel (fr)				60 000 MT p/a Price for raw kernel Rs.30/kg, for processed nuts Rs.80-120/kg		Murthy and Subrahmanuam 1989
Fodder		Fodder						Consumption of 229 million MT (1985)	Estimated that India needs about 672 million MT of fodder for a population of 616 million people	Committee, Government of India

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Medicines		Medicines					N, I	Export of 42 592 MT, lakh Rs.51 499 (1996-97)		Shiva and Pandey 1998
		Spices					N, I	Export of 73 046 MT, lakh Rs.51 499 (1996-97)		Shiva and Pandey 1998
Perfumes, cosmetics		Essential oils					N, I	Export of 3 554 MT, lakh Rs.17 663 (1996-97)		Shiva and Pandey 1998
		Sandalwood oil	<i>Santalum album</i>				N, I	Export of 2.00 MT, lakh Rs. 4.65 (1992-93) Estimated production 1 300 MT		Shiva <i>et al.</i> 1996; Shiva and Pandey 1998; Gupta 1994
		Lemon grass oil						Estimated production 1 200 MT		Gupta 1994
		Palmarosa oil	<i>Cymbopogon martini</i> Roxb. Stapf					Estimated production 90 MT		Gupta 1994
		Vetiver oil	<i>Vetiveria zizanoides</i>					Estimated production 50 MT		Gupta 1994
		Eucalyptus oil	<i>E. globulus</i> <i>E. citriodora</i>					Estimated production 50 MT		Gupta 1994
		Cinnamon oil	<i>Cinnamomum</i> spp.					Estimated production 33 MT		Gupta 1994
		Deodar wood oil						Estimated production 2 MT		Gupta 1994
		Linoloe oil						Estimated production 3 MT		Gupta 1994
		Cinnamon oil						Estimated production 2 MT		Gupta 1994

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Dyeing, tanning		Dyeing, tanning					N, I	Export of 8 193 MT, lakh Rs.2 765 (1996–97)		Shiva and Pandey 1998
		Myrobalan nuts	<i>Terminalia chebula</i>	Fr				78 000–100 000 MT p/a, Rs. 15–20 million		Gupta 1994
		Wattle bark	<i>Acacia mollissima</i>	ba				23 000 MT p/a harvst'd, Rs.38 million		Gupta 1994
		Babul bark	<i>Acacia nilotica</i>	ba				22 000 MT p/a, Rs.55 million		Gupta 1994
		Avaram bark	<i>Cassia auriculata</i>	ba				23 000 MT p/a, Rs.35 million		Gupta 1994
Dyeing, tanning		Myrobalans fruit extract (harra)	<i>Terminalia chebula</i>				N, I	Export of 1 127 MT, lakh Rs.249.39 (1996–97)		Shiva <i>et al.</i> 1996; Shiva and Pandey 1998
		Myrobalans amla	<i>Emblica officinalis</i>				N, I	Export of 248.98 MT, lakh Rs.53.44 (1996–1997)		Shiva <i>et al.</i> 1996; Shiva and Pandey 1998
		Myrobalans other					N, I	Export of 235.97 MT, lakh Rs. (1996–97)		Shiva <i>et al.</i> 1996; Shiva and Pandey 1998
		General myrobalans					N, I	Export of 1 705 MT in 1996–97, lakh Rs.427.42		Shiva <i>et al.</i> 1996; Shiva and Pandey 1998
		Annatto dye	<i>Bixa orellana</i>				N, I	Export of 109.24 MT, lakh Rs.97.34 (1996–97)		Shiva <i>et al.</i> 1996; Shiva and Pandey 1998
Utensils, handicrafts, construction materials		Bamboos and canes					N, I	Export of 867.71 MT, lakh Rs.39.69 (1996–97)		Shiva and Pandey 1998
		Bidi	<i>Diospyros melanoxylon</i>	le				300 000 MT p/a, Rs. 15 000/MT, annual value about Rs.4 515 million		Gupta 1994

	Bamboo	<i>e.g. Bambusa arundinacea, B. tulda, B. polymorpha, Dendrocalamus strictus, D. hamiltonii, Melocanna baccifera, Ochlandra travancorica</i>					When used in paper making or rayon, producers receive about Rs.300/MT Value (potential annual cut): Rs.1 367 million	Price varies with the end-use	Gupta 1994
	Agave fibres	<i>Agacia sisalana</i>					Estimated production of 2 500 MT p/a, Rs.45 million		Gupta 1994
	Kapok	<i>Bombax ceiba</i>					300 MT p/a, Rs.30 million		Gupta 1994
	Grasses						Some 0.3 to 0.4 million MT of grasses could be harvested p/a in India		Sharma 1977; Gupta 1994
	Sabai grass	<i>Eulaliopsis binata</i>					60 000–80 000 MT purchased every year by paper mills, price about Rs.300/MT		Gupta 1994
Exudates	Gums and resins					N, I	Export of 107 1 58 MT, lakh Rs.50 493 (1996–97)		Shiva and Pandey 1998
	Karaya gum; Indian tragacanth	<i>Sterculia urens</i>				N, I	Export of 941 11 MT, lakh Rs.893 87 (1996–97)		Shiva <i>et al.</i> 1996; Shiva and Pandey 1998; Gupta 1994
	Oleoresin	<i>Pinus roxburghii</i>				N, I	Production of 46 000 MT, Rs.2.8 million		Gupta 1994
Others	NWFP of mineral origin					N, I	Export of 9 380 83 MT, lakh Rs.5 045 (1996–97)		Shiva and Pandey 1998

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey, beeswax		Honey	<i>Apis dorsata</i> , <i>Apis indica</i>				N, I	<i>Apis dorsata</i> honey: 250 MT/ p/a, <i>Apis indica</i> honey: 98 MT, Rs.40/kg, total value of honey production: Rs.139 million Wax: 28 MT p/a, Rs.1.6 million	A comb of <i>Apis dorsata</i> may yield up to 35 kg honey and 1 kg of wax A comb of <i>Apis indica</i> yields 3–13 kg honey in the hills and 3–8 kg honey in the plains	Gupta 1994
Other non-edible animal products		Lac, shellac	<i>Laccifer lacca</i>					Sticklac: 14 500–20 000 MT p/a, Rs.4 500–16 000/MT. Total value of annual production Rs.203–280 million		Gupta 1994
		Mulberry, tassar, muga and eri silks	<i>Bombyx mori</i> <i>Antheraea paphia</i> <i>Antheraea assamensis</i> <i>Philosamia synthia ricini</i>				N, I	Estimated annual production of tassar silk: 130 MT Production of other types of silk exceeds 10 000 MT		Gupta 1994

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

INDONESIA

INTRODUCTION

Main non-wood forest products

The most important NWFP in Indonesia are rattan, bamboo, resins (gondorukem and turpentine, jelutung gum, damar, kemenyan, gaharu and kopal), tengkawang seed, sandalwood oil, cayeput oil, honey and shellac. Other important NWFP are fruits and medicinal plants.

General information

According to the Forestry Basic Law No. 5 (1967), NWFP are defined as all biomaterial, except wood, taken from the forest. Soenardi (1980) and Suryamiharja and Buharman (1986) have classified NWFP tentatively into two categories, i.e. plant grouping and animal grouping.

- Plant grouping:
 1. Non-woody plant species: rattan (*Calamus* sp.), bamboo (*Dendrocalamus* sp.), nipah (*Nypa fruticans*), pinang hutan (*Arenga* sp.), sago (*Metroxylon* sp.) and lontar (*Borassus* sp.).
 2. Resin/gum: gondorukem, turpentine, damar (*Dipterocarp* sp.), kopal (*Agathis* sp.), jelutung (*Deyra* sp.), jernang (*Daemonorops draco*), ketiau (*Ganua motleyana*), hangkang (*Palaquium leicocarpum*), perca (*Palaquium gutta*) and kemenyan (*Styrax* sp.).
 3. Seed/nut: tengkawang (*Shorea* sp.), kemiri (*Aleurites mollucana*), asam (*Tamarindus* sp.), pinang (*Arenga* sp.) and jarak (*Ricinus communis*).
 4. Wood bark: saga (*Adenanthra* sp.), mangrove tree (*Cariops candellcana*), kayu manis (*Cinnamomum zeylanicum*), mesoi, kina (*Cinchona officinalis*), gambir (*Uncaria gambir*).
 5. Leaf: nipah, gum camphor (*Cinnamomum camphora*), wintergreen (*Gaultheria fragrantissima*), nilam (*Pogostomon cablin*), kayuputih (*Melaleuca leucadendron*), murbei (*Morus* sp.), sereh (*Andropogon nardus*) and jamu-jamu (herbal medicines).
 6. Other parts of the tree: ijuk (*Nifa* sp.), root-vetiver oil (*Andropogon maricatus*).
- Animal grouping: animal species, parts of the animal or material produced by animals.
 1. Animal: crocodile, monkey, snakes and birds.
 2. Parts of animals: crocodile skin, snake skin, biawak (*Varanus* sp.) skin and deer (*Cervus timorensis*) horn.
 3. Animal products: bird nests, honey, beeswax, silkworm and shellac.

At least 90 Indonesian NWFP are being used and traded either by local people or national and international communities. NWFP play an important role as a source of income, employment and as a source of foreign exchange (Soenardi 1980).

In general the harvesting of NWFP in Indonesia is free. A license is needed to harvest in Perum Perhutani's (state forest enterprise) forest areas. Harvesting is done by local people as a part of their daily activities. As a labour-intensive industry, the NWFP sector is facing various constraints, i.e. minimal capital investment, a low-skilled labour force, a low technological level used in processing, poor quality control and lack of marketing skills. Indonesian NWFP tend to have lower quality standards and fail in competition with the products from neighbouring countries; only some NWFP are managed properly as a business entity. NWFP resources are being threatened by various activities, e.g. commercial logging, illegal logging, forest land conversion for agriculture and transmigration areas, as well as shifting cultivation.

There is no stable management system for NWFP (Soenardi 1980), which results in a general lack of information on NWFP. Many NWFP have not been documented properly and therefore it is difficult to rank their importance.

Table 1. Total revenue of wood and NWFP (1995 to 1999)

Fiscal year	Revenue (Rp. million)			Share of NWFP (%)
	Total	Wood	NWFP	
1995	637 484	563 950	73 534	11.54
1996	706 997	626 606	80 391	11.37
1997	665 942	595 325	70 617	10.66
1998	909 248	823 134	86 114	9.47
1999	1 088 071	985 289	102 782	9.45
Total	4 007 742	3 594 304	413 438	-
Average	801 548	718 861	82 688	11.50

Source: Perum Perhutani (2000 recalculated)

PLANTS AND PLANT PRODUCTS

Food

All tengkawang trees producing oil-bearing seeds of commercial value belong to the meranti group (*Shorea* spp.). Tengkawang oil (Borneo tallow) is obtained from tengkawang tungkul (*Shorea stenoptre*), tengkawang majau (*Shorea lepidota*), tengkawang layar (*Shorea gysbertsiana*) and tengkawang terendak (*Shorea seminis* or *Isoptera boneensis*) (Suryamiharja and Buharman 1986). Tengkawang oil is like cocoanut butter but it has a higher melting point (Soenardi 1980). Tengkawang trees start to bear fruit at the age of eight to nine years. Fruiting occurs every four to five years.

In international markets these seeds are also known as illipe nuts. Tengkawang seed is produced mainly from Kalimantan (East, North and Central Kalimantan) and South Sumatra. Local people use tengkawang oil for frying and medicines. On the industrial scale, tengkawang oil is used for wax, cosmetics, pharmaceuticals, chocolate, soap, margarine and grease making (Suryamiharja and Buharman 1986). Indonesia is the main producer and exporter of tengkawang nuts. Almost all production is exported, mainly to west Europe (the United Kingdom, Netherlands, France, Denmark), Japan, Singapore and Hong Kong (Soewardji and Hutahuruk 1980).

Table 2. Export of black and brown tengkawang seeds in 1992

Product	Quantity (MT)	Value (US\$)	Price (FOB) (US\$/MT)
Black illipe	210	105 000	500.00
Brown illipe	13 361	7 649 035	572.49

Source: Indonesia Foreign Trade Statistics, Biro Pusat Statistik (in Iqbal 1993)

Tengkawang export figures for the last five years (from 1993/1994 to 1997/1998) are recorded at 512 tonnes, 3 979 tonnes, 10 648 tonnes, 984 tonnes and 213 tonnes, respectively. The average export of tengkawang every year is about 3 231 tonnes (Biro Perencanaan 1999).

Medicines

Traditional medicines, locally known as jamu, can be prepared by utilizing dried whole plants or plant organs, locally known as symplicia (in Indonesia, the pharmacological term symplicia refers to unprocessed or dried natural materials that are used for medicinal or health-care purposes) (Hadi 1995). Generally, the collection of medicinal plants is conducted either by specialized collectors who know the plants exactly or herbalists in rural areas who sometimes grow them in their gardens (Menon 1989).

Sidik (1994) identified several jamu characteristics: (i) It relates closely with local society and culture; (ii) it has no a standard for material, formulation, processing and quality control; (iii) it uses plants grown locally; and (iv) it is utilized through touch and sensory perception.

Some scientists are trying to collect and record all of Indonesia's medicinal plants (e.g. Zuhud 1994). Menon (1989) has recorded several plants used for both Indonesian traditional and western medicines such as *Ephedra* sp., *Dioscorea* sp., *Anamirta cocculus*, *Cinnamomum camphora*, *Styrax benzoin* and *Mentha arvensis*. Other examples of plants used in Indonesian traditional medicine are patchouly oil (*Pogostomon cabin*), vetiver oil (*Andropogon maricatus*), wintergreen (*Gaultheria fragrantissima*), cinnamon oil (*Cinnamomum culilawan*), citronella oil (*Andropogon nardus*), castor oil (*Ricinus communis*) and cinchona bark (*Cinchona officinalis*) (Sumadiwangsa 1973; Buharman and Suryamihardja 1986).

Jamu is exported to several countries, including Singapore, Malaysia, the Netherlands, New Zealand, France and Taiwan. In 1991/1992, the export value reached Rp.1.06 billion (US\$530 000) (Directorate General of Food and Drug Administration 1992; Hadi 1995). The industry faces strong market competition with herbal medicines imported from China.

Table 3. Number of people employed by jamu industries, 1990 to 1993

Position	1990	1991	1992	1993
Pharmacist	105	112	104	114
Pharmacy assistant	179	153	126	123
Other univ. graduate	20	86	42	121
Technician	9 039	10 320	7 514	6 490
Total	9 343	10 673	7 786	6 848

Source: Directorate General of Food and Drug Administration (in Hadi 1995)

No records are available of the number of villagers who collect medicinal plants in the forest or who cultivate them in fields outside the forest, nor are there figures on the number of symplicia-collecting traders and jamu gendong vendors. The expansion of jamu industries that produce well-packed, powdered traditional medicines, accompanied by intensive advertising, has resulted in a wider consumption. Traditional medicinal plants are consumed by a wide range of communities (Hadi 1995).

Cayeput oil (locally known as kayu putih) has been appreciated for a long time and it is used widely as medicine for various illnesses (Menon 1989). It is produced by extracting the leaves of the gelam or kayu putih tree (*Melaleuca leucadendron* and *Melaleuca minor*). Cayeput oil is a colourless liquid, which vapourizes at room temperature. Kayu putih trees grow naturally in Maluku and Nusa Tenggara, particularly in Pulau Buru, Seram and Timor. These trees are also planted in West Java, Yogyakarta, Central Java and East Java. Leaf collection is conducted throughout the year by cutting branches and twigs that are more than six months old (Suryamiharja and Buharman 1986). Cayeput oil competes against other essential oils (such as eucalyptus oil) in the market. All cayeput oil production is traded by Perum Perhutani.

Table 4. Production of cayeput oil (1993 to 1999)

Production year	Cayeput oil (litre)
1993/1994	312 831
1994/1995	332 478
1995/1996	235 497
1996/1997	469 948
1997/1998	331 457
1998/1999	357 035
Total	2 039 246
Average	407 849.2

Source: Badan Pusat Statistik (2000)

Table 5. Production and recovery rate and the volume, value and price of cayeput oil traded domestically by Perum Perhutani (1995 to 1999)

Production year	Area of kayu putih trees (ha)	Leaf production (MT)	Cayeput oil production (kg)	Recovery rate (%) of cayeput oil	Volume (kg)	Value (Rp.1 000)
1995	16 093	29 651	233 412	0.79	243 167	3 452 730
1996	11 460	30 806	265 600	0.86	265 583	4 497 725
1997	10 461	33 262	293 885	0.88	248 589	2 980 533
1998	14 677	27 055	200 131	0.74	204 430	4 446 037
1999	17 505	42 560	312 700	0.73	231 134	7 858 362
Total		163 334	1 305 698		1 192 903	23 353 387
Average		32 666.8	261 139.6	0.80	238 580.6	4 647 077.4

Source: Perum Perhutani (2000, recalculated)

Perfumes, cosmetics

There are several species of the genus *Santalum* (family of Santalaceae) that produce sandalwood oil (cendana, sandal and santal). The trees grow naturally in Belu, Timor, North Central Timor, South Central Timor, Kupang, West Sumba and East Sumba (Sarong 2001). The most important species for the production of sandalwood oil is *Santalum album* (Menon 1989). Exploitation of sandalwood is carried out under local regulation. The chief of the village and his staff have the authority to issue the harvesting permit. When trees are scarce, smaller trees are also extracted.

Sandalwood in the eastern part of Flores disappeared a long time ago because of continuous cutting and insufficient effort to maintain its sustainability. People often cut the wood illegally, stole and smuggled it because of its high price (Rp.5 000 to Rp.100 000/kg). A recent local regulation (No 2/1998) states that sandalwood growing naturally in the forests belongs to the government and sandalwood planted by farmers belongs to the farmers (Sarong 2001).

Two sandalwood oil factories were established in Kupang in 1972 and 1974. Both factories have a processing capacity of 1 000 tonnes of wood per year. More than 90 percent of the sandalwood produced in North Timor was sold to the two factories and the remaining wood was processed in the carving industry (Menon 1989).

Table 6. Distribution of sandalwood in North Timor in 1997

Name of district	Number of mother trees	Number of young trees	Total number of trees
West Sumba	822	90 584	91 406
East Sumba	5 127	107 521	112 648
Kupang	10 521	17 069	27 590
South Central Timor	80 655	193 365	274 020
North Central Timor	42 266	85 235	127 501
Belu	43 507	92 334	135 841
Total	182 898	586 108	769 006

Source: BPS-NTT (1999) in Sarong (2001)

Sandalwood oil is used widely in western as well as oriental perfumery. The United States is the largest importer of sandalwood oil (an annual average of 25–30 tonnes). Western Europe is also a significant importer and there are substantial markets in Asia (Iqbal 1993).

Utensils, handicrafts and construction materials

Thirty-five bamboo species are found on almost every island of Indonesia. Dominant bamboo species include *Dendrocalamus asper*, *Phyllostachys aurea*, *Schizostachyum blumei* and *Gigantochloa apus*. Although there are 50 000 ha of bamboo plantations in East Java and South Sulawesi, the bulk of bamboo comes from the rural areas. In 1989, the value of bamboo exports

reached US\$1.2 million. Most bamboo products are consumed in domestic markets. In 1985, the consumption of bamboo totalled 146 million stalks (Silitonga *et al.* 1990; Silitonga 1994).

Rattan is considered to be the most important NWF in Indonesia. In 1986, the Government of Indonesia issued an export ban on raw rattan exports in order to increase the added value of rattan. The ban was overruled in 1997 as one of the commitments between the Government of Indonesia and the International Monetary Fund (IMF).

Rattan is harvested manually by local people. Rattan can be harvested year-round and therefore it can become the main plant for a household in terms of cash flow produced (Purnama and Prahasto 1996). Rattan grows unevenly in clusters and every cluster produces around 20 to 25 kg of cane a year with different harvesting schedules. The harvesting cycle for rattan is generally three to five years for each cluster. Rattan with a bigger diameter (more than 17 mm) can be found in the western part of Indonesia (Sumatra and Kalimantan); the smaller diameter is grown in the eastern part of Indonesia (Suryamiharja and Buharman 1986).

Table 7. Production of rattan (1993 to 1999)

Year	Rattan (MT)
1993/1994	88 149
1994/1995	78 340
1995/1996	36 256
1996/1997	51 564
1997/1998	32 389
1998/1999	62 644
Total	349 342
Average	58 223.7

Source: Badan Pusat Statistik (2000)

Over 380 rattan factories, with small-to-large production capacities, were employing more than 150 000 people at the end of the 1980s (Silitonga 1994).

Inconsistencies arise when comparing the data of rattan export volume with the data of national rattan production. A rattan inventory was conducted by the Ministry of Forestry in 1995. The survey indicated that 1.2 million ha of forests are rich in rattan and estimated rattan production to be at 415 tonnes per year (Soekardi 2000).

Table 8. Exports of rattan (1995 to 1999)

Fiscal year	Finished rattan product export		
	Volume (MT)	Value (US\$)	FOB-price (US\$/kg)
1995	103 669	368 181 825	3.55
1996	86 926	337 074 990	3.88
1997	182 660	153 709 090	0.84
1998	21 285	60 997 880	2.87
1999	112 078	293 959 391	2.62
Total	506 618 000	1 213 923 176	

Source: Asmindo (2000, recalculated)

Restrictive trading policies on raw rattan have not been able to increase foreign exchange earnings significantly as originally planned (Subarudi *et al.* 2000). The policies depressed the domestic prices of rattan, which in turn contributed an adverse impact on the income of rattan farmers and collectors. This depressed price was also considered to be a disincentive for rattan farmers or collectors (forest dwellers) to cultivate rattan in a sustainable manner. The price of rattan at the farm gate in 1981 was Rp.1 800/kg (US\$1.01). In comparison, the rattan price in 1986 was Rp.1 600/kg (US\$0.9) and then it declined to Rp.740/kg (US\$ 0.4). The price of rattan in 1999 was the lowest (Rp. 450/kg or US\$0.2) (Saragih 2000).

The rattan export ban of raw cane had a negative effect on the rattan price at the farm gate. The main reason was the inefficiency of the Indonesian rattan-processing industry. Hence, the industry had to depress domestic prices of rattan in order to compete with China's rattan industry, which has lower prices and better quality rattan products on international markets.

Exudates

Over 20 different resins and gums were exported from Indonesia in 1989 (Central Bureau of Statistics 1990). Resin from pine, jelutung, frankincense and Arabic gums topped the list. Exports of resinous and gum products in 1989, totalled 40 688 tonnes, valued at US\$22 million (Silitonga 1994).

Gondorukem (rosin) and turpentine

Gondorukem (pine resin, rosin, colophony or kucing) is produced through tapping of the resin of *Pinus merkusii*, which grows in Sumatra, Java and Bali (Suryamiharja and Buharman 1986). *Pinus* trees may produce up to 500 kg of resin per hectare. Processed resin yields gondorukem (with a recovery rate of 60 percent) and turpentine oil (a recovery rate of 17 percent).

In 1983, natural and planted pine forests covered 747 000 ha in Indonesia. Some 600 000 ha are grown in Java alone. Since 1983, the pine forests have been expanded at a rate of 15 000 ha per year. The pine stands in Java according to Silitonga (1994) provided work for at least 70 000 people.

There are several classes of gondorukem that are used for different products. The darkest classes of gondorukem (B, C and D) are used for making rosin oil, linoleum and dark varnish. The G and K classes are used as sizing material in soap making. Different quality of soap will use different classes of gondorukem. For instance, good quality soap will use pale gondorukem (W-C and W-W). Gondorukem can also be used as sealing wax, in explosive materials, varnishing of music strings, for paint making, printing ink, wood polish mixture, fireworks, waterproof material for thicker paper and for plastics (Suryamiharja and Buharman 1986).

Table 9. Production of resin, gondorukem and turpentine at Perum Perhutani (1995 to 1999)

Production year	Pine resin production (MT)	Gondorukem production (MT)	Turpentine production (MT)
1995	99 761	66 696	12 247
1996	117 683	77 845	14 372
1997	99 073	69 926	13 680
1998	69 392	47 605	8 496
1999	90 313	62 110	12 306
Total	476 222	324 182	61 101
Average	95 244.4	64 836.4	12 220.2

Source: Perum Perhutani (2000, recalculated)

Table 10. Volume and value of gondorukem and turpentine exported by Perum Perhutani (1995 to 1999)

Year	Gondorukem export			Turpentine export		
	Volume (MT)	Value (US\$)	Price (US\$/MT)	Volume (MT)	Value (US\$)	Price (US\$/MT)
1995	35 270	19 562 870	554.7	8 420	2 265 746	269
1996	34 143	21 732 623	636.5	7 104	3 124 292	439
1997	39 029	27 245 864	698.1	9 432	5 582 754	591
1998	38 362	16 550 573	431.4	8 455	2 665 128	315
1999	39 166	18 400 892	469.8	7 188	2 129 091	296
Total	185 970	103 492 822	2 790.5	40 599	15 767 011	1 912
Avg.	37 194	20 698 564	558.1	8 120	3 153 402	382

Source: Perum Perhutani (2000, recalculated).

Jelutung is the local name for the latex tree from *Dyera* spp. (*Dyera costulata*, *D. Lowii*, *D. Latifolia* and *D. barniensis*), which grows in Central Kalimantan, West Kalimantan, Aceh, North Sumatra, Riau, Jambi, South Sumatra and Central Java (Soenardi 1980). The Jelutung gum is traded as jelutung or pontianak (in the past known also as Dead Borneo). There are three types of Jelutung gum traded in Indonesia, namely; (i) jelutung banjarmasin, (ii) jelutung Palembang and (iii) jelutung pontianak. Jelutung pontianak is the best quality of jelutung.

The trunk of the jelutung tree contains gum that is used to produce bubblegum and as raw material for handicrafts. Other uses of the Jelutung gum are insulation material for cable and electric wire, dental material and as a waterproofing agent (Suryamiharja and Buharman 1986).

Tapping is performed by local people as a part-time job especially when the price of jelutung gum increases (Soetanto 1980). The tapping of 10 to 20 trees can be completed in six working hours and produces 100–200 kg of jelutung gum.

Usually, jelutung gum is exported to Singapore, Japan and Hong Kong. The export figures of jelutung gum for the last five years (from 1993 to 1998) were recorded at 1 192 tonnes, 585 tonnes, 301 tonnes, 2 142 tonnes and 2 785 tonnes, respectively. The average export of jelutung gum every year is about 1 401 tonnes (Biro Perencanaan 1999).

Damar is a gum produced from the Dipterocarpaceae trees *Shorea* spp., *Hopea* spp., *Vatica* spp., and *Dryobalanops* spp., which are found in Lampung, South Sumatra, Aceh, West Sumatra, Riau, North Sumatra, West Kalimantan, Sulawesi and Maluku. Other names for damar are gum damar, resin damar, harsa, damar mata kucing and damar gelap (Suryamiharja and Buharman 1986).

Damar collection is similar to the tapping of jelutung gum and is done by local people as a part-time job. Damar has been used widely as a raw material in the manufacture of rubber, paint, wax, varnish, plastic, matches, insulation material, painting and printing products, medicines and explosives.

Table 11. Production of damar (1993 to 1999)

Year	Damar (MT)
1993/1994	5 149
1994/1995	-
1995/1996	3 869
1996/1997	1 556
1997/1998	6 423
1998/1999	7 887
Total	24 884
Average	4 976.8

Source: Badan Pusat Statistik (2000)

Kemenyan (*Styrax* spp.) is a tree from the family of Styracaceae growing at 1 000 to 1 500 m above sea level (Anonymous 2000). The resin of the tree is called kemenyan resin (benzoin resin); locally it is called kemenyan (incense). North Tapanuli in North Sumatra Province is well known as the production centre for kemenyan resin in Indonesia. The two kinds of kemenyan known by local farmers in North Tapanuli are kemenyan toba (*Styrax sumatrana*) and kemenyan durame (*Styrax benzoin*). Kemenyan toba is preferred because of its better quality and price in local markets (Anonymous 2000).

The total area of kemenyan in North Tapanuli was 22 670 ha in 2000 with production of 2 000 to 3 000 tonnes per year. This figure was lower than the figure in 1990 when the total area of 22 793 ha produced 4 000 to 5 000 tonnes per year. Kemenyan planted on community land as a heritage, is now dominated by old trees (more than 20 years old). Traditionally the kemenyan business is run by local farmers. The harvesting of resin is done conventionally by tapping the tree once a year.

Production of kemenyan has been declining because of the inadequate trading system and unstable prices. The price of kemenyan varies between Rp.25 000 to Rp.50 000/kg and the price at the farm gate is around Rp.5 000 to Rp.12 000/kg. On international markets, kemenyan from Indonesia is sold for US\$4/kg (Anonymous 2000). Kemenyan resin from Sumatra contains 30 to 35 percent of balsamic acids. Kemenyan is marketed in Java and exported to Singapore and Malaysia. There are five classes for the quality of kemenyan traded on domestic markets.

Agarwood, aloewood, eaglewood and gaharu are all names for the resinous, fragrant and extremely valuable heartwood produced by the family Thymeleaceae. Gaharu is the Bahasa Indonesia/Malay term for agarwood (Zich and Compton 2001). Gaharu is a piece of wood or root that has been modified chemically by a fungi-type infection.

There are eight tree species producing gaharu in Indonesia, all coming from the family of Thymeleaceae. They derive from the genera *Aetoxylon* (1 species), *Aquilaria* (2 species), *Enkleia* (1 species), *Gonystylus* (2 species) and *Wikstroemia* (2 species) (Sidiyasa [1986] in Mai and Suripatty [1996]). In West Kalimantan, Misran and Sukendar (1988) found that the angkaras tree (*Aquilaria malaccensis* Lak) is another tree species that produces gaharu. In East Nusa Tenggara (NTT) two trees species that produce gaharu have been identified, i.e. cue or sue (*Wikstroemia adoroaemifolia*) and homa (*Gyrinops cumingia*). Both species are also of the Thymeleaceae family (Universitas Nusa Cendana-UNC 1996). In Irian Jaya, two species of *Wikstroemia* are found in Manokwari, i.e. gaharu sirsak (*Wikstroemia polyantha*) and gaharu cengkeh (*Wikstroemia tenuiramis*) (Mai and Suripatty 1996).

Gaharu collection is done by local people in groups, each group consisting of three to five people. The group spends three to seven days looking for gaharu in the forest. When gaharu is found in a particular tree, the tree will be cut manually using axes or knives. One tree usually produces about 0.5 to 4 kg of gaharu (UNC 1996). The current estimates indicate that the total number of *Aquilaria* trees harvested in a given year in Indonesia varies from 30 000 to 100 000 trees (Soehartano and Newton 2001).

Table 12. Price of gaharu at the farm gate, and for traders and businessmen in 1995/1996

Gaharu classes	Gaharu seekers (Rp/kg)	Gaharu collectors (Rp/kg)	Gaharu businessmen (Rp/kg)
Super	700 000	1000 000	1 500 000
Kelas II	300 000	400 000	600 000
Teri Hitam	75 000	100 000	150 000
Teri Bunting	40 000	60 000	100 000
Kacangan	25 000	35 000	50 000

Source: Universitas Nusa Cendana (1996).

For the past 20 years, Indonesia has been one of the major gaharu exporting countries (Direktorat Jenderal PHPA 1997, in Soehartano and Newton 2000). Gaharu contributed up to Rp.6.2 billion to foreign exchange earnings in 1995. The present price of gaharu is about Rp.2.3 million/kg for the super class (Kompas 2001).

Due to intensive exploitation, gaharu has been included in Appendix II of the Convention of International Trade of Endangered Species (CITES) since 1994 and therefore the harvesting of gaharu and its exports should be limited (see also Soehartano and Newton 2001). However, gaharu cultivation in Indonesia is being developed by the Biotechnology Laboratory of Agriculture Faculty, University of Mataram (Kompas 2001).

Kopal is the gum collected from trees of the Araucariaceae family, such as *Agathis philippinensis* warb, *A. hamii* MDR, *A. alba* Warb, *A. celebica* KDS, *A. bornensis* Warb, *A. lorentifolia* Salisb, *A. damara*, *A. beccarii* Warb, *A. labillardieri*, *A. robusta*, *A. macropyhlla*, *A. australis* and *A. celebica* (Suryamiharja and Buharman 1986).

The regions that produce kopal in Indonesia are Sumatra, Kalimantan, Sulawesi, Maluku, Irian Jaya and Java. Before World War II, the average production of kopal was 11 000–12 000 tonnes each year. This represented about 80 percent of the world's kopal production and Irian Jaya was the biggest producer. After World War II, kopal production in Indonesia declined to 2 000–4 000 tonnes per year and Sulawesi became the biggest producer (Soenardi 1980).

The export figures of kopal for the last four years (from 1993 to 1997) were recorded at 1 886 tonnes, 2 063 tonnes, 1 168 tonnes and 1 600 tonnes, respectively (Biro Perencanaan 1999). Of these numbers, the total volume of kopal traded by Perum Perhutani is about 542 tonnes.

Table 13. Volume, value and price of kopal exported by Perum Perhutani (1995 to 1999)

Year	Export volume (MT)	Export value (US\$)	Price (US\$/MT)
1995	368	207 167	562.9
1996	294	253 233	861.3
1997	251	173 940	693.0
1998	33	18 239	555.4
1999	162	81 000	500.0
Total	1 108	733 669	3 172.6
Avrg.	222	146 734	634.5

Source: Perum Perhutani (2000, recalculated)

Most of the kopal is exported to the United States, the United Kingdom, France, Italy and Japan and only very little is consumed locally. Domestically, kopal is used as a raw material for the production of paint and varnish. Kopal is also used for enamel making, glue, plastic and other uses such as coating material for textiles, printing inks and adhesives (Suryamiharja and Buharman 1986).

ANIMALS AND ANIMAL PRODUCTS

Wildlife and wildlife-derived products

From 1981 to 1989, wildlife and wildlife-product exports from Indonesia increased from US\$2.4 million to US\$36.4 million. Average earnings from unprotected wildlife sales from Indonesia amounted to US\$11million per year. Breeding centres for monkeys, snakes, crocodiles, turtles, snails and other species are also found in Indonesia (Silitonga 1994). Most of the trade in wildlife does not adhere to the CITES regulations (Silitonga 1994).

Honey and beeswax

Honey, locally known as madu, and beeswax are produced from the dwarf bee (*Apis florea*), the giant or rock bee (*Apis dorsata*), the oriental bee (*Apis cerana*) and the common honey bee (*Apis mellifera*) (Menon 1989). The region in Indonesia that produces the best quality of honey is Sumbawa, thus it is known as madu sumbawa. No figures are available regarding the production of beeswax.

Table 14. Honey production from 1993 to 1998

Year	Production (kg)
1993/94	2 387 350
1994/95	1 800 000
1995/96	1 800 000
1996/97	2 330 348
1997/98	2 615 728
Total	10 933 426
Average	2 186 685

Source: Biro Perencanaan (2000)

As a home industry, beekeeping involves the whole family. The honey that bees provide is a valuable food that may be sold and consumed at home and beeswax can be used also at home and for industry (Menon 1989). The products of commercially managed beekeeping can be classified based on the source flower, i.e. honey from the flowers of kapuk randu (*Ceiba pentandra*), rubber wood (*Hevea brasiliensis*), durian (*Durio zybethinus*), coffee, rambutan (*Nephellium lappaceum*), mango (*Mangifera indica*), kaliandra (*Calliandra* sp.), jambu air (*Eugenia aquaeva*) and mahagony (*Swietenia mahagony*).

An economical analysis on beekeeping conducted by Menon (1989) stated that a minimum of 30 colonies of *Apis mellifera* is required, the cost of a colony being around Rp.200 000, for a business to be profitable. Each colony will then produce 40 kg of honey per annum, valued from Rp.6 000 to Rp.10 000/kg and a profit can be gained of up to 300 percent of the investment. This profit can increase remarkably when it also produces royal jelly at the same time, for which the price per kilogramme was around Rp.122 500 (US\$70) during the time of the analysis.

The price of honey from different flower sources has different prices. The highest price is for honey coming from durian, cengkeh and kaliandra flowers.

Other non-edible animal products

Shellac (shellak, lac or lak [Suryamiharja and Buharman 1986]) is produced from the secretions of the shellac insect (*Tachardia lacca*, family Coccidae). The insect lives in the host trees of kesambi (*Schleichera oleosa*), akasia (*Acacia catechu*) and jamuju (*Cuscuta australis*).

The shellac industry is managed by a forest state enterprise, Perum Perhutani, at Banyukerta, East Java. The potential for shellac production seems to be high and could be increased in future. The volume of granule shellac traded domestically by Perum Perhutani each year is 80 tonnes.

Table 15. Shellac exported by Perum Perhutani, 1998 to 1999

Year	Export volume (MT)	Export value (US\$)	Price (US\$/MT)
1998	72	86 400	1 200

1999	93	130 200	1 400
Total	165	216 600	2,600
Avrg.	82.5	108 300	1 300

Source: Perum Perhutani (2000, recalculated)

Shellac is produced from the host tree kesambi with a density of 189 trees/ha. It has been predicted that each tree produces shellac of about 10 kg with a production cycle of three years resulting in the total production of about 918 526 kg per year.

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ANNEX 1. FOREST SERVICES

Ecotourism is a non-wood service (NWS) and is in high demand at the present time as indicated by the 333 596 people who visited national parks in 1998/1999. Visitors who visited conservation areas exceeded 3 million during the same year. In 1985, 4.4 million tourists entered wildlife sanctuaries, paying the government Rp.17.7 million in entrance fees (Silitonga 1994).

Priasukmana (1999) stated that ecotourism should be prioritized in the national forestry programme because tourism is well known as a green and smokeless industry. Manan (1998) pointed out that forest tourism has physical, mental and spiritual impacts on human life, through such activities as: hunting, fishing, walking, horse riding, picnicking, camping, hiking, boating, swimming and other hobbies (photography, painting, handicrafts and nature watching). Therefore he suggested that the forests located in Java and Sumatra should be used not only for timber production, but also as recreation sources for the local communities. This will be the main task for foresters, ecologists, sociologists and landscape architects in establishing natural recreation and forest tourism.

Most of people who live in big cities enjoy outdoor recreation. Many suitable places for recreation (hills, lakes, rivers, beaches and small islands) are distributed widely in Indonesia. These can be scenic spots, natural monuments, wildlife sanctuaries or historical, geological, archeological and biological sites.

Table 16. Visitors to Perum Perhutani's tourism targets in 1999

Name of target	No. of targets (unit)	No. of visitors (persons)	Revenue (Rp. 1 000)
Forest tourism	86	1 945 358	2 104 472
Natural recreation parks	4	876 083	1 748 946
Camping	14	170 126	199 272
Nature watching	13	85 872	132 730
Total	117	3 007 439	4 185 420

Source: Perum Perhutani (2000)

QUANTITATIVE NWFP DATA OF INDONESIA

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food	2	Illipe nut Tengkawang seed	<i>Shorea stenoptre</i> <i>Shorea lepidota</i> <i>Shorea gysbersiana</i> <i>Shorea seminis</i>	se	F	W	N, I	Export of 213 MT in 1997/1998		Suryamihardja and Buharman 1986; Menon 1989; Biro Perencanaan 1999
Medicines		Jamu medicines			F, P	W, C	N, I	Export value: Rp.1.06 billion (US\$503 000) in 1991/1992	6 848 people employed by jamu industries in 1993	Hadi 1995
		Cayeput oil	<i>Melaleuca leucadendron,</i> <i>Melaieuca minor</i>	le	F, P	W, C	N, I	357 035 litres in 1998/1999 According to Perum Perhutani (2000) in 1999: leaf production of 42 560 MT, oil production of 312 700 kg; value: Rp.7 858 362 000	Domestically all production is traded by Perum Perhutani	Badan Pusat Statistik 2000; Perum Perhutani 2000
Utensils, handicrafts, construction materials	1	Manau rattan Sega rattan Irit rattan	<i>Calamus manan</i> <i>Calamus caesus</i> <i>Calamus trachycoleus</i>	st	F, P	W	N, I	Export of 112 078 MT of rattan-finished products in 1999 (value US\$294 million) Production of 62.664 MT in 1998/1999	Estimations about area and production vary considerably 150 000 employed at the end of the 1980s. Price of rattan at farm gate in 1999: Rp. 450/kg (US\$0.2)	Hamzah 1980; Asmindo 2000; Badan Pusat Statistik 2000; Silitonga 1994; Saragih 2000
		Bamboo	<i>Dendrocalamus asper</i> <i>Phyllostachys aurea</i> <i>Schizostachyum blumei</i> <i>Gigantochloa apus</i>		F, P	W, C	N, I	Export of US\$1.2 million in 1989. In 1985 the consumption of bamboo totalled 146 million stalks	50 000 ha of bamboo plantations in East Java and South Sulawesi	Silitonga 1994

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Exudates	2	Godorukem (rosin, colophonium, and turpentine)	<i>Pinus merkusii</i>	rs, st	P	C	N, I	1999: gondorukem, 62 110 MT; turpentine 12 306 MT Exports: gondorukem, 39 166 MT (value US\$18.5 million) in 1999; turpentine 7 188 MT (value US\$2.13 million) in 1999	The pine stands in Java provide work for at least 70 000 people	Soenardi 1980; Universitas Sebelas Maret 1996; Perum Perhutani 2000; Silitonga 1994; Badan Pusat Statistik 2000
	2	Jelutong Pontianak Jelutung gum	<i>Dyera costulata</i> <i>Dyera lowii</i> <i>Dyera latifolia</i>	re	F	W	N, I	Export of 2 785 MT in 1997/1998		Soetanto 1980; Suryamihardja and Buharman 1986; Biro Perencanaan, 1999
	2	Damar Gum damar Resin damar	<i>Shorea</i> sp. <i>Hopea</i> sp. <i>Vatica</i> sp. <i>Dryobalanops</i> sp.	n	F	W	N, I	Export of 18 609 MT in 1996/1997		Soetanto 1980; Suryamihardja and Buharman 1986 Biro Perencanaan 1999
	2	Benzoin Kemeyan	<i>Styrax benzoin</i> <i>Styrax sumatrana</i>	re	F, P	W, C	N, I	2 000–3 000 MT p/a in North Tapanuli	Price of kemeyan is US\$4.00/kg on the intl. market. 22 670 ha of kemeyan in North Tapanuli in 2000	Wiyono 1985; Anonymous 2000
	2	Gaharu	<i>Aquallaria malaccensis</i> <i>Wilkstroemia adorosaemifolia</i> <i>Gyrinops cumingia</i>	st	F	W	N, I	Export of 309.8 MT at Rp.6.2 billion in 1995 The present price is about Rp.2–3 million/kg for the super class		Sidiyasa and Suharti 1987; Universitas Nusa Cendana 1996; Kompas 2001
	2	Kopal Resin copal	<i>Agathis lorentifolia</i> <i>Aghathis damara</i> <i>Agathis alba</i>	re	P	C	N, I	Export of 1 600 MT in 1996/1997		Soenardi 1980; Suryamihardja and Buharman 1986; Perum Perhutani 2000; Biro Perencanaan, 1999
	2	Sandalwood Oil of sandal Oil of santal	<i>Santalum album</i>	l, st	F/P	W/C	N, I	145 446 MT in 1997	Price of sandalwood varies significantly (Rp. 5 000–100 000/kg)	Menon 1989; Sarong 2001

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey and beeswax	2	Common honey bee Oriental bee	<i>Apis mellifera</i> <i>Apis cerena</i> <i>Apis florea</i> <i>Apis dorsata</i>		P	C	N	2 615 728 MT (1997/98)		Menon 1989; Biro Perencanaan 1999
Other non-edible animal products	2	Shellac Lac Lak	<i>Tachardia lacca</i> (Hosts: <i>Schleichera oleosa</i> <i>Acacia catechu</i> <i>Cuscuta australis</i>)		F, P	W, C	N, I	Export of 93 MT valued at US\$130 200 in 1999		Perum Perhutani, 1980; Suryamihardja and Buharman 1986; Perum Perhutani 2000

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

LAO PEOPLE'S DEMOCRATIC REPUBLIC (PDR)

INTRODUCTION

Main non-wood forest products

The most important NWFP in Lao PDR include medicinal plants (e.g. cardamom), food (nuts, fern roots, fruits), fibres (e.g. paper mulberry) and exudates (damar resin, oleoresin, benzoin). Other important NWFP are spices, stems (bamboo, rattan), perfumes, cosmetics (incense) and orchids.

General information

Lao PDR has a high dependency on forest products due to its low population density combined with a high rate of forest cover (Foppes and Ketphanh 2000). NWFP serve a wide range of subsistence needs and provide opportunities for earning cash income. More than 500 plant and animal products are reported to be used. However, many species have yet to be identified botanically and the names of many species are still inconsistent in different reports. Furthermore, no systematic survey has been conducted on flora. From rural surveys, villagers identified over 757 species of plants and 150 species of animals that are used.

NWFP make a significant contribution to the national economy both directly and indirectly. At the national level, NWFP provide roughly 2.5 percent of annual exports (Ingles *et al.* 1998). According to Foppes and Ketphanh (2000), NWFP provide 50 to 55 percent of the cash income of rural villages, where 80 percent of the population lives and their subsistence use may account for 20 to 30 percent of the gross national product. The reported export value of NWFP was about US\$6.3 million in 1993. Among all the exported products, medicinal plants score highest with about 70 percent of the total export value, followed by fibre products at 15 percent, resin 8 percent, edible products 6 percent and incense 2 percent.

Most NWFP are exported to China, especially medicinal plants (Ingles *et al.* 1998), Viet Nam and Thailand although certain products are also exported to Japan and Europe.

Both animal and plant products are culturally, socially and economically important for Laotians. Everyone can collect NWFP from both plant and animal sources for local use. Through the Land Use Planning and Land Allocation Scheme, some forms of ownership along with community rules on the management and use of resources within the village boundary have been developed. In commercial collection, a quota from the Department of Forestry, Ministry of Agriculture and Forestry for the harvesting of NWFP is needed.

Table 1. Exports of NWFP

Product	Scientific name	1995		1996		1997		1998	
		kg	US\$	kg	US\$	kg	US\$	kg	US\$
Cardamom	<i>Amomum</i> spp.	140 142	630 639	171 453	829 611	571 433	3 333 359	4 243 47	2376343
Damar resin	<i>Shorea</i> spp.	275 591	123 291	301 631	103 787	845 670	267 796	1 525 566	305113
Sugar palm fruit	<i>Arenga pinnata</i>	303 000	119 605	218 000	117 204	288 500	144 250	982 000	320132
Bong bark	<i>Notaphoebe umbellifera</i>	62 800	23137	333 273	107 507	579 569	183 530	286 710	91747
Broom grass	<i>Thysanolaema maxima</i>	10 000	2 632	209 560	56 333	15 000	5 000	825 542	350022
Orchid stems	<i>Dendrobium</i> spp.	Na	Na	Na	Na	Na	Na	68 015	Na
Rattan cane (large)	<i>Calamus</i> spp.	45 500	35 921	91 995	74 190	93 355	73 128	367 196	293757
Paper mulberry	<i>Broussonetia papyrifera</i>	38 000	19 000	57 035	28 518	32 500	16 250	400 000	200000
Dried lizards	<i>Gecko</i> spp.	2 016	22 017	2 114	25 232	Na	Na	Na	Na
Oleoresin	<i>Dipterocarpus alatus</i>	210 883	180 360	505 400	369 540	1 056 800	792 600	274 400	92198
Eaglewood	<i>Aquilaria</i> spp.	Na	Na	Na	Na	Na	Na	26 192	Na
Bamboo shoots	<i>Dendrocalamus</i> spp.	Na	Na	Na	Na	219 000	7 408	10 000	5167
Fern roots	<i>Helminthostachys zeylanica</i>	13 165	43 306	6 601	22 713	816	2 530	Na	Na
Benzoin	<i>Styrax tonkinensis</i>	Na	Na	Na	Na	39 566	131 887	15 500	46500
Bamboo culms	<i>Various bamboo species</i>	Na	Na	Na	Na	111 125	7 408	161 466	5167
Dragon's blood plants	<i>Draceana</i> spp.	Na	Na	35 151	9 260	302 318	125 966	178 000	71200
Rattan fruit	<i>Calamus</i> spp.	Na	Na	Na	Na	57 500	Na	65 882	Na
Meuak bark	<i>Debregeasia hypoleuca</i>	Na	Na	135 000	27 145	279 900	67 643	91 500	18300
Malva nuts	<i>Sterculia lychnophora</i>	1 236 615	2 440 688	17 230	18 527	Na	Na	837 940	1340704
Sisiet bark	<i>Pentace siamensis</i>	Na	Na	Na	Na	8 780	Na	Na	Na
Rattan cane (small)	<i>Calamus</i> spp.	Na	Na	Na	Na	Na	Na	12 000	1200
Vomica nuts	<i>Strychnos nux-vomica</i>	53 300	7 013	14 760	2 143	39 264	5 268	25 130	2010
Berberin vine	<i>Cosciniium usitatum</i>	Na	Na	5 170	56	31 400	Na	23 900	Na
Sticklack	<i>Lacca</i> spp.	Na	Na	8 050	1 298	33 100	108 95	156 500	Na
Yahoa medicine	<i>Smilax glabra</i>	Na	Na	Na	Na	12 000	3 500	33 000	Na

Source: IUCN/DOF NTFP Project (undated)

Table 2. Quota issued for different NWFP

Product	Scientific name	Unit	1995–98	1998–99	1999–00	2000–01
Cardamom	<i>Amomum</i> spp.	MT	3 877	1 318	757	827
Damar resin	<i>Shorea</i> spp.	MT	9 657	4 420	3 645	4 615
Sugar palm fruit	<i>Arenga pinnata</i>	MT	6 020	2 950	1 700	2 155
Bong bark	<i>Notaphoebe umbellifera</i>	MT	1 900	600	600	1 200
Broom grass	<i>Thysanolaema maxima</i>	MT	2 665	1 465	905	1 140
Orchid stems	<i>Dendrobium</i> spp.	MT	Na	Na	Na	33
Rattan cane/large	<i>Calamus</i> spp.	No.	3 563 000	780 000	985 000	1 150 000
Rattan cane/small	Many species together	No.	2 575 000	450 000	565 000	565 000
Paper mulberry	<i>Broussonetia papyrifera</i>	MT	2 795	1 740	420	825
Dried lizards	<i>Gecko</i> spp.	MT	Na	0	0	0
Oleoresin	<i>Dipterocarpus alatus</i>	MT	Na	0	0	0
Bamboo shoots(dry)	<i>Dendrocalamus</i> spp.	MT	Na	Na	Na	187
Fern roots	<i>Helminthostachys zeylanica</i>	MT	101	50	50	50
Benzoin	<i>Styrax tonkinensis</i>	MT	119	33	30	35
Bamboo culms	<i>Dendrocalamus</i> sp.	No.	28 255 000	2 105 000	1 373 000	1 633 000
Dragon's blood	<i>Draceana</i> spp.	MT	375	170	95	105
Rattan fruit	<i>Calamus</i> spp.	MT	Na	20	11	11
Meuak bark	<i>Debregeasia hypoleuca</i>	MT	35	35	Na	70
Malva nuts	<i>Scaphium macropodum</i>	MT	121	300	600	1 700
Sisiet bark	<i>Pentace siamensis</i>	MT	15	5	0	0
Vomica nuts	<i>Strychnos nux-vomica</i>	MT	112	35	30	35
Berberin vine	<i>Coscinium usitatum</i>	MT	3 115	1 280	1 285	1 690
Sticklack	<i>Lacca</i> spp.	MT	4	Na	Na	Na
Yahoa medecine	<i>Smilax glabra</i>	MT	42	10	10	10
Mak khene (spice)	<i>Xanthoxylum retsa</i>	MT	65	35	22	222
Alpinia fruits (spice)	<i>Alpinia</i> spp.	MT	Na	Na	Na	50

Na = not available

Sources: Figures for 1995 to 1998: extracted from NIC database. Figures for 1998/1999: Department of Forestry.

Almost all NWFP are collected from the wild. Generally, the resources have been exploited unsustainably. Efforts at domestication are now expanding to cover more species (e.g. *Styrax tonkinensis* (benzoin), *Pentace burmanica*, rattan and bamboo species, *Debregeasia hypoleuca*, *Sterculia lychnophora* and *Boehmeria malabarica* (bong bark). Currently cardamom, broom grass, rattan shoots, bamboo shoots and culms and paper mulberry are collected from small-scale plantations, agroforests and home gardens.

In addition to forest product gathering in large blocks of state-owned and open-access forests, other types of forest use and management with regard to NWFP are described by Foppes and Ketphanh (2000):

- *Traditional ownership rights over specific types of trees*: Markings of trees as a symbol of ownership (e.g. *Dipterocarpus* spp. for resin tapping and beehives on trees).
- *Spirit forests and hunting taboos*: Small forests honoured as burial grounds or as a refuge for spirits.
- *Village agreements on forest-use rules*: E.g. a fishing and hunting ban during certain seasons between different user groups and sustainable harvesting agreements through improvement activities.
- *Multi-village agreements on forest-use rules*: E.g. the National Bio-diversity Conservation Areas (NBCA), State production forests, protection forests or even in village forests (designated through the land-use and land allocation scheme).
- *Community aquatic resource management*: The establishment of fish conservation zones including the declaration of certain portions of the natural streams/rivers as conservation zones where no fishing or any activity causing disturbance is allowed during the period of peak fishing pressure in the dry season. Other typical management options: bans on stream blocking; bans on various destructive fishing/collection methods; fish fry conservation; frog conservation schemes; regulations for fishing in paddy fields and communal lakes, etc. Fish conservation provides an excellent entry point for integrated development and conservation programmes. Prominent examples are in the south of Lao PDR where over 60 village communities in one district have set successful co-management systems for fish and frog conservation over the last eight years.

PLANTS AND PLANT PRODUCTS

Food

Main products for local use include several species used as food. More than 50 plant species have been recorded as wild vegetables. Many species are available throughout the year. Tubers (*Dioscorea* spp.) are important substitutes for rice and important ingredients for preparing local desserts. Mushrooms are also very popular.

According to Foppes and Ketphanh (1997) some of the common bamboo species for shoots are *Gigantochloa albociliata*, *Bambusa arundianaria*, *Bambusa nana*, *Bambusa tulda* and *Cephalostachyum virgatum* (mai hia). Shoots sell for US\$0.15 to 0.50/kg, depending on the season, and the value of two kilogrammes of bamboo shoots is roughly equal to one kilogramme of rice (Ketphanh 1995).

The two most common rattan species that are eaten for their shoots are *Calamus tenuis* and *Daemonorops schmidtiana* (Foppes and Ketphanh 1997). The fruit and shoots of all these species are edible and some of them are sold on the local market (US\$0.17 for three shoots) (Ketphanh 1995).

Malva nuts (makjong) are fruits collected from *Scaphium macropodum* (sometimes reported to be collected also from *Scaphium lychnophorum* and *Sterculia lychnophora*). The species show a certain degree of endemism and are found only in pockets in the semi-evergreen forests in southern provinces of the country namely, Champasack, Salavan, Sekong and Attapeu. Flowering and fruiting take place irregularly once in every three to four years (Flint 2000).

The gel made from malva nuts is edible and locally malva nuts are used as ingredients in dishes and beverages. Malva nut has cooling agent medicinal properties. It is used to treat dysentery, intestinal infections, coughing and sore throats (Lamxay 2001).

Malva nuts have a fairly limited market locally and they have gained commercial export value only recently. The most significant years for harvesting and trade of malva nuts have been 1995, 1998 and 2001. The main export market is China. The fruit is sold to middlemen at US\$1.00 to 2.00/kg.

With the attractive price of this product, initiatives have been made recently to try out nursery techniques and trial plantations have been started in Champasack Province.

Sugar palm is the fruit of *Arenga westerhoutii*. Sugar palm is distributed naturally in northern provinces such as Luang Nam Tha, Oudomxai, Luang Prabang and Sayabouly.

Harvesting of sugar palm fruits is done usually from January to March. The mature fruits are harvested mainly by climbing trees and cutting down fruit clusters or in some cases by felling the sugar palm tree. According to Lamxay (2001) the yield productivity of sugar palm fruits is approximately 200 to 300 kg/tree in an area with a density of about 120 trees/ha. One tree can produce up to 200 litres of sugar palm juice. Approximately 10 kg of fresh fruits can produce 3 to 3.5 kg of endosperm (seeds).

The sugar palm tree has numerous uses: the shoots can be cooked in a variety of local soups; leaves are used as roofing material; the seeds of the fruit are edible and are used commonly in desserts. Besides, the juice can be harvested from the apex of male flowers to be processed as hard sugar. Currently, sugar palm fruits are sold to a canning factory in Vientiane before being sold to domestic and international markets. The main export market for sugar palm seeds/endosperm has been Thailand. The exported quantity has been about 600 tonnes/year (on average US\$0.33 to 0.54/kg).

Medicines

Cardamom (*Amomum* spp.) (commercial names bastard cardamom, camphor seed or siame cardamom [Ketphanh 1995]) grows abundantly in disturbed natural forests on semishaded sites in all parts of the country. Eight species of cardamom occur throughout the country (Lamxay 2001), the four main species being *Amomum longiligular*, *Amomum ovoideum*, *Amomum villosum* and *Amomum* sp. (locally known as maak naeng hua lohn). The first species is the most popular in the south and the others in the north.

The cardamom fruit is collected mainly from natural forests. Cardamom has been domesticated in home gardens, and is grown with rice in shifting cultivation fields in many areas, notably in parts of Champasack Province where planting started in 1975 (Lamxay 2001) and in Salavan Province. Two native species i.e. *Amomum ovoideum* (green cardamom) and *Amomum villosum* (red cardamom) are used in planting. One exotic species from China, *Amomum xanthioides* was also introduced in Oudomxay Province because of its high price. Harvesting in plantations starts from the fourth year. The yield of cardamom varies from 300 to 600 kg/ha (Lamxay 2001). Cardamom fruits are collected every year from September to October. The harvesting season lasts for 15 to 30 days.

Cardamom is used chiefly for medicinal purposes. The product is collected exclusively for export to China and Korea at varying prices. Among medicinal products, which cover about 70 percent of the total export income, cardamom accounts for 90 percent (Ingles *et al.* 1998). The quantity of exported cardamom has been increasing annually since 1995.

According to Ketphanh (1995) cardamom is used as a spice. In the Middle East it is used to flavour coffee; in northern Europe and the United States in bakery products; and elsewhere it is used in meat seasoning. Ketphanh (1995) reports that the price for seeds in rural areas is about US\$1.00 to 2.50/kg. Cardamom seeds are exported primarily to Thailand and China and the export price is about US\$3.00/kg.

Perfumes and cosmetics

Sapan or peuak meuak, a climber species (*Boemeria malabarica*), is found mainly in the northern provinces of Oudomxai, Luang Prabang, Sayabouly, Luang Nam Tha, Bokeo, Xiang Khouang and Phongsaly.

Bark harvesting has been conducted mainly from the natural forests and has often been very destructive. Actual harvesting practices included extracting the whole plant, including roots. The bark is then removed, cut into sections and sun-dried for almost one week until the moisture content is about 12 to 15 percent. The sun-dried bark is then broken into small pieces to facilitate packing and transporting. Storing in dry, well-ventilated conditions is essential to avoid fungus attacks.

Local villagers report using sapan in traditional medicines for treating digestive and intestinal disorders. There is no processing of the final product in Lao PDR. The dried bark is exported mainly to China where it is used to produce incense, mosquito repellent and glue. Little trade or pricing information is available from local trading agencies that deal with foreign companies. Luang Nam Tha and Bokeo provinces export the largest quantities.

Local villagers have started to plant the species and research to domesticate it is currently ongoing. Future prospects are expected to be good although there will be a decrease of the resource in the natural forests.

Utensils, handicrafts and construction materials

Paper mulberry (*Broussonetia papyrifera*) is a well-known species that produces a strong fibre from its bark. The species is distributed naturally throughout the country.

Paper mulberry has numerous uses: traditional medicine (fruits, sap, leaves bark and roots); as fodder for livestock, pigs, poultry and fish (leaves); soap and waxes (sap from seeds); firewood; fencing materials; and for growing mushrooms (debarked stems) (Lamxay 2001; Forsen *et al.* 2001). The ash from burned stems is used for bleaching pulp by villagers in Luang Prabang in hand-made paper making, and wastewater from this process is later used as fertilizer. Locally the bark of paper mulberry is used mainly for producing pulp for export.

Currently several small private enterprises are dealing with the production of mulberry pulp, hand-made paper and handicraft items. Farmers sell the dry bark (both quality graded and not graded) to collectors in the village. One collector buys around 500 kg of dry bark per year from the farmers and sells to the district collector who again transports it to a provincial trader. The provincial trader does the grading of the bark and sells it to the Thai traders at the border; later they sell it to the businesses that buy various cash crops for subsequent retail to the factories in Thailand. The harvester's price varies seasonally. On average the price at the farm gate was about US\$0.30/kg of dry bark in 1999 and US\$0.23/kg in 2000 (Forsen *et al.* 2001). Official figures show that from 1995 to 1999 Lao PDR exported about 146 tonnes of dry bark per year (Lamxay 2001). The export prices for dry bark vary with grades. Grade A is sold for US\$0.92/kg and grade B for US\$0.85 at the factory in Thailand (Forsen *et al.* 2001). Grade C is sold generally to local paper makers and grade D is a special grade sold at the highest rate.

Forsen *et al.* (2001) revealed that the mulberry paper factory in Luang Prabang Province (presently the only one in operation in the country) produces about 440 tonnes of pulp per year. Out of this total production, 80 percent is exported to Thailand, 10 percent to South Korea and 10 percent to China. Hand-made paper products are produced by several small enterprises and mainly are sold locally.

Paper mulberry bark is collected from natural stands, plantations and intercropping systems (Forsen *et al.* 2001). Collection from natural forests is declining in favour of more management-oriented systems because of resource depletion in the wild and increased prices and numbers of harvesters. Intercropping production systems appear to be more popular compared to monocrop plantations. Two intercropping subsystems are practised: intercropping paper mulberry with annual crops and using paper mulberry as a transition crop to fruit orchards or tree plantations. The amount of bark collected from natural stands is expected to decrease and paper mulberry gardens are expected to expand (Forsen *et al.* 2001). The lack of labour seems to be an important limiting factor for mulberry plantations.

The yields of paper mulberry bark vary greatly. The preferred spacings are 1.5 x 1.5 m (5 067 kg of dry bark/ha) and 2 x 2m (5 440 kg of dry bark/ha) as they give a fairly high yield, good quality bark and trees that are easy to harvest (Forsen *et al.* 2001).

The scientific name as well as the local name of the species yielding bong bark is not clear and there is an ongoing study to identify the species. Two species of bong have been identified to yield bark with a commercial value. These two species are named locally after the colour of the sap, as bong daeng (red bong) (possibly *Persea kuzii*) and bong khao (white bong) (*Persea umbelliflora* or *Notaphoebe umbelliflora*). Bong is found throughout the country both in lowland and mountainous areas.

Bong bark is used in the production of incense/joss sticks, used commonly in Buddhist temples throughout Southeast Asia. Bong bark is also used to make mosquito repellent coils/incense, as glue in carton or particle-board production and timber lacquer. In old traditional practices, bong bark was mixed with soil when used for modelling and moulding to make statues in temples and in household items. The bong bark is harvested from December to April from six-(or more)-year-old trees. Local harvesting methods involve stripping sections of the bark. Stripping all the bark causes tree mortality, but coppices regrow readily from stumps.

Dried bong bark is exported mainly to Viet Nam and Thailand. From 1995 to 1999 an average of 325 tonnes per year were exported, valued at US\$93 578.00 (US\$0.26 to 0.50/kg). The marketing prospects for bong bark are expected to remain stable as incense sticks are used daily in Buddhist ceremonies, in temples and households throughout Southeast Asia. There is a continuous demand as more sticks are used as people become wealthier.

Tiger grass (broom grass) (*Thysanolaena latifolia* or *T. maxima*) is found in all regions although it is more dominant in the northern provinces. Collection is almost entirely from the wild, although a small quantity is also collected from plantations.

The collected flowers are sun-dried and fruits are removed before selling. The dried panicle can be stored for many years. The tiger grass stems/flowers are used to make brooms. Some people eat the young shoots. Leaves are harvested as fodder for livestock.

Tiger grass is sold mainly on local markets (US\$0.25 to 0.6/kg). Dry unprocessed flowers are also exported to Thailand. The NTFP Project surveys on marketing information reveal that from 1995 to 1999, Lao PDR exported an average of 320 tonnes per year, at the price of US\$0.26 to 0.42/kg. Some studies have been conducted recently to support villagers' efforts to domesticate the species.

Bamboo culms and rattan canes are used widely for fencing, house construction, fishing equipment, basketry, tools and implements and furniture. The most commonly used bamboo species for these purposes are *Cephalostachyum virgatum*, *Cephalostachyum virgatum*, mai phang (*Dendrocalamus* sp.), mai phaiban (*Bambusa blumeana*), mai sangphay (*Bambusa nana*), mai kase (*Neuhouzeana mekkhonggensis*), mai bong (*Bambusa tulda*) and mai phaipa (*Bambusa arudinaria*).

Among the rattans, *Calamus javanensis* and *Daemonorops schmidtiana* are the species used most commonly. Rattan grows primarily in the central part of the country (Ketphanh 1995). Each year, the government issues cutting permits for up to 400 000 pieces of large-dimension rattan (one piece measures 4.5 m in length). Actual production varies from 300 000 to 400 000 pieces of large diameter rattan, and from 25 000 to 30 000 tonnes of small diameter rattan, all coming from wild plants. Large diameter rattan is supplied mainly to four large factories, with smaller volumes being directed to home production of furniture and handicrafts. Among the products made from rattan are furniture, baskets, fish traps, hats, walking sticks, tool handles, ropes and mats. Only processed rattan products can be exported (Ketphanh 1995).

Rural people earn income from the harvest of rattan either by retail to traders or to representatives from the main factories. Collectors earn about US\$0.60 per piece of large rattan in the rural areas. Cane delivered to factory sites earns about US\$1.00 per piece. Small diameter rattan is sold for US\$0.35/kg. Cottage industries employ both men and women (Ketphanh 1995).

In Vientiane, the total use of bamboo culms is about 1 000 000 culms per year. The price of one culm (5 m) is US\$0.20 to 0.40. Importation of bamboo mat board from Viet Nam averages 80 000 sheets per year according to interviews with traders. The price is US\$2.00 per 1.6 x 4.0 m mat. Many bamboo products (handicrafts, furniture, raw materials) are exported, but quantities are still relatively small and no accurate data on quantities or values are available (Ketphanh 1995). Handicrafts made from bamboo are an important source of income for farmers, following the rice-growing season. In Vientiane, factories processing bamboo provide work for about 1 500 people (Ketphanh 1995).

Exudates

Damar resin (also called damar oil and yang oil by Ketphanh [1995], locally known as khii sii) is a plant exudate obtained from tree species of the family Dipterocarpaceae that mainly occurs in the dry dipterocarp and evergreen forests in the central and southern parts of the country. The species that produce damar resin are *Shorea obtusa*, *Hopea odorata*, *Vatica harmandiana*, *Vatica odorata*,

Anisoptera costata, *Shorea siamensis*, *Shorea guiso*, *Shorea roxburghii* and *Shorea hanryana*. Damar resin produced by *Shorea obtusa* is the best in quality.

Rural people use damar resin to make a lacquer or sealer for local bamboo woven buckets and as a coating to waterproof buckets and local wooden boats. The resin is used in the paint industry, in ink production and for varnishes and lacquers.

The resin is collected both from the ground around the tree and on the tree. According Lamxay (2001) each tree with a diameter of more than 30 cm can produce an average of 15 to 20 kg of damar resin. The collection is done by the villagers, who sell the resin to the collectors or middlemen representing the export companies. Damar resin is exported as raw material mainly to Thailand. The export quantity has increased rapidly over the last few years but the price, however, has decreased every year. Most of the resin used locally is collected directly by the users.

Styrax (benzoin) (*Styrax tonkinensis*) produces an excellent gum called benzoin or gum benjamin. To obtain the gum, trees are scarred or wounded. In an effort to close the wound, new wood forms. This new wood contains cavities filled with a resinous secretion (raw benzoin) (Ketphanh 1995).

Wild styrax grows on fallow land where people practise shifting cultivation. Traditionally people never planted the styrax trees, allowing wild styrax trees to grow unhindered. Trials on plantations have not been successful (Ketphanh 1995).

Since the 1980s the production of benzoin has declined because raw materials are poor in quality and producers lack marketing mechanisms. In 1994, the price of benzoin was US\$2.00 to 2.50/kg and no processing of raw benzoin was done (Ketphanh 1995).

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

Nests of honey bees are found in all forest types. The estimated production of honey is about 5 to 10 tonnes per year. Bee management and beekeeping are still not developed in Lao PDR, but if developed, they could provide a sustainable, long-term means of exploiting the available flora. Honey is collected for household use as a food, as a sweetener and for the production of medicine. Wax is used for polishes, cosmetics and candle making (Ketphanh 1995).

In local markets, honey and wax can be sold quite easily, but export is difficult because the volume of production (10 tonnes per year) is small and producers lack information on quality improvement and marketing. The price paid to collectors is about US\$0.80 to 1.00/litre, but in town markets, the price is about US\$2.00/litre. Solidified wax is sold in local markets for US\$4.00 to 5.00/kg (Ketphanh 1995).

Bushmeat

Several species of fish, frogs, shrimps, soft-shelled fresh water turtles, crabs, and other water animals are probably the most important sources of protein in most areas of Lao PDR. Wildlife is also an important source of protein in most rural areas. Over 1 400 species of wild animals have been identified and about 90 percent probably are used by local people (IUCN 2001). Some 31 mammal species, 24 bird species and 13 reptile species were recorded as being eaten (Foppes and Ketphanh 1997).

No official permit is issued for hunting and people hunt unprotected species. The species under the controlled category can also be hunted during the non-breeding season but only for food and not for sale. However, most animal species have been hunted heavily for subsistence use and local sale. Not only unprotected species, but a number of protected wildlife species like pangolins and several other animals are suffering from heavy illegal hunting.

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Source: Non-Timber Forest Products Information Centre, Forestry Research Centre

QUANTITATIVE NWFP DATA OF LAO PDR

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food	1	Bamboo shoots	<i>Dendrocalamus</i> spp.		F, O	W, C	N, I	Export of 10 000 kg (US\$5 167) in 1998	Quota for dried shoots 2000–01: 187 MT	Foppes and Ketphanh 1997; NIC Database
	1	Rattan fruits	<i>Calamus</i> spp.	fr	F, P	W, C	N, I	Export of rattan fruits: 65 882 kg in 1998		Foppes and Ketphanh 1997; NIC Database; Enfield <i>et al.</i> 1998; IUCN/DOF NTFP Project; Ketphanh 1995
	1	Sugar palm fruit	<i>Arenga westerhoutii</i> <i>Arenga pinnata</i>	fr	F	W	N,I	Export of 982 000 MT in 1998 (US\$320 132)	Quota 1994–98: 6 020 MT. The main market is Thailand	Foppes and Ketphanh 1997; IUCN/DOF NTFP Project
	1	Malva nuts	<i>Scaphium macropodum</i>	fr	F	W	I,N	US\$ 3.00–3.70/kg Export of 837 940 kg in 1998 (US\$1 340 704)	Due to irregular fruiting, production and exports are irregular. Most recent harvesting years: 1995, 1998 & 2001. Main market: China. Quota 2000–01: 1 700 MT	Foppes and Ketphanh 1997; Flint 2000; IUCN/DOF NTFP Project
Medicines	1	Cardamom	<i>Amomum</i> sp.	(f)	F,P,O	W,C	I	Export of 424 347 kg in 1998 (US\$23 763 43) Annual production of at least 200–250 MT of seeds. Export price/kg: US\$5.60	Quota 1994–98: 3 877 MT. 300–600 kg/ha yield. It accounts for 90% of export income	Saydala and Lamxay 2000; IUCN/DOF; Lamxay 2001; Ingles <i>et al.</i> 1998; Ketphanh 1995; NIC Database
		Yahoa medicine	<i>Smilax glabra</i>					Export of 33 000 kg in 1998	Quota 2000–01: 10 MT	IUCN/DOF NTFP Project
Perfumes, cosmetics	1	Eaglewood	<i>Aquilaria</i> spp.	pl	F	W	I	Export of 26 192 kg in 1998		IUCN/DOF NTFP Project; Foppes and Ketphanh 1997

	1	Bong bark	<i>Notaphoebe umbelliflora</i> <i>Persea kuzii</i> <i>Persea umbelliflora</i>	ba	F	W	N, I	Export of 286 710 kg in 1998 (US\$91 747)	Quota: 1 200 MT in 2000–01	Saydala and Lamxay 2001
	1	Sa pan, peuak meuak	<i>Boemeria malabarica</i>	ba	F	W	N	Exports for 1996–98 averaged 168 MT p/a (annually US\$37 800)	Mainly exported to China	Flint 2000
Utensils, handicrafts and construction materials	2	Paper mulberry	<i>Broussonnetia papyrifera</i>	bark	P,O,F	W,C	N,I	Export of 400 000 kg in 1998 (US\$ 200 000)	Quota 2000–01: 825 MT. Farm gate price for dried bark: US\$ 0.23/kg in 2000, export price for Grade A US\$0.92/kg and for Grade B US\$0.85/kg Production of pulp 440 MT p/a of which 80% is exported to Thailand, 10% to South Korea and 10% to China	Jensen <i>et al.</i> 2001; Foppes and Ketphanh 1997; Forsen <i>et al.</i> 2001; IUCN/DOF NTFP Project
	3	Broom grass Tiger grass	<i>Thysanolaema maxima</i> <i>Thysanolaema latifolia</i>	(l)	F,O	W,C	N, I	Price at local markets: US\$0.25–0.60/kg Export: 825 542 kg (US\$350 022)	Quota: 1 140 MT in 2000–01	Lamxay 2001; Foppes and Ketphanh 1997; IUCN/DOF NTFP
	1	Bamboo	<i>Gigantochloa albociliata</i> <i>Bambusa arundianaria</i> <i>Bambusa nana</i> <i>Bambusa tulda</i> <i>Cephalostachyumvirgatum</i> <i>Oxythenanthera parvifolia</i> <i>Bambusa blumeana</i> <i>Neuhouzea mekkhongensis</i> <i>Dendrocalamus sp.</i>	st	F, O	W, C	N	Export of culms 161 466 kg (US\$5 167) in 1998. The use of bamboo culms in Vientiane about 1 000 000 culms p/a; price for 5 m long culm is US\$0.20–0.40	Quota issued 2000–01 for culms: 1 633 000 pieces In Vientiane, bamboo processing factories provide work for about 1 500 people	Foppes and Ketphanh 1997; NIC Database; Ketphanh 1995
	1	Rattan	<i>Calamus tenuis</i> <i>Daemonorops schmidtiana</i> <i>Calamus javanensis</i> <i>Calamus poilanei</i> <i>Calamus palustris</i>	st	F,P	W,C	N, I	Export value 1994–98 was about \$0.5 million Export of rattan fruits 65 882 in 1998 and of rattan canes 12 000 kg (US\$1 200)	Quotas issued: 2000–01: 1 150 000 pieces of big cane, 565 000 pieces of small cane, 11 MT of fruit	Foppes and Ketphanh 1997; NIC Database; Enfield <i>et al.</i> 1998; IUCN/DOF NTFP Project; Ketphanh 1995

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Ornamentals	1	Orchid stems	<i>Dendrobium</i> spp.	st	F	W	N, I	Export of 68 015 kg in 1998	Quota 2000–01: 33 MT	Foppes and Ketphanh 1997 IUCN/DOF NTFP Project
Exudates	1	Damar resin	<i>Shorea</i> spp. (<i>Shorea obtusa</i> <i>Shorea derrii</i> <i>Vatica cinerea</i> <i>Anisoptera costata</i>)		F	W	I	Quota issued 1994-98 96 566 MT. Export of 1 525 566 kg in 1998 (US\$305 113)	Production potential of a tree with a diameter more than 30 cm: 15–20 kg Exports mainly to Thailand	Foppes and Ketphanh 1997; Lamxay 2001; IUCN/DOF NTFP Project; Manivong, 1996; NIC Database
	1	Oleoresin	<i>Dipterocarpus alatus</i>	(e)	F	W	N,I	Export of 274 400 kg (US\$92 198) in 1998		Foppes and Ketphanh 1997; NIC Database; Cleron 1998
	1	Benzoin	<i>Styrax tonkinensis</i>	(e)	F	W	I	Export of 15 500 kg in 1998 (US\$46 500)	Quota: 35 MT in 2000–01	NIC Database; IUCN/DOF NTFP Project
		Meuak bark	<i>Debregaesia hypoleuca</i>				I	Export of 91 500 kg (US\$18 300) in 1998	Quota 2000–01: 70 MT	IUCN/DOF NTFP Project
	1	Fern roots	<i>Helminthostachys zeylanica</i>		F	W	N, I	Export of 816 kg (US\$2 530) in 1997	Quota 1994–98: 50 MT Quota 2000–01: 50 MT	NIC Database; IUCN/DOF NTFP Project
	1	Vomica nuts	<i>Strychnos nux-vomica</i>	nu	F	W	N, I	Export of 25 130 kg (US\$2 010) in 1998	Quota 2000–01: 35 MT	NIC Database; IUCN/DOF NTFP Project
	1	Dragon's blood plants	<i>Draceana</i> spp.	e	F	W	N, I	Export of 178 000 kg in 1998 (US\$71 200)	Quota 2000–01: 105 MT	Foppes and Ketphanh 1997; IUCN/DOF NTFP Project
		Sisiet bark	<i>Pentace siamensis</i>					Export of 8 780 kg in 1997		IUCN/DOF NTFP Project

		Sticklack	<i>Lacca</i> spp.					Export of 156 500 kg in 1998		IUCN/DOF NTFP Project
	1	Berberin vine	<i>Coscitum usitatum</i>	st	F	W	N,I	Export of 23 900 kg in 1998	Quota 2000–01: 1 690 MT	NIC Database; IUCN/DOF NTFP Project

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey, beeswax		Honey and wax			F	W	N	Estimated production p/a: 5–10 MT	In local rural markets the price paid to collectors is US\$0.80–1.00/litre, in town markets US\$2.00/litre Solified wax sold in local markets for US\$4.00–5.00/kg	Ketphanh 1995
Other edible animal products		Dried lizards	<i>Gecko</i> spp.					Export of 2 114 kg (US\$25 232) in 1996		IUCN/DOF NTFP Project

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums;
ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

MALAYSIA

INTRODUCTION

Main non-wood forest products

The most important NWFP of Malaysia are rattan, bamboo, medicinal plants and wild fruits. Other NWFP include palm, resin, tannin, ferns, barks, vegetables and wood-oil.

General information

In Malaysia, minor forest products are defined as all forest products other than logs because of their relatively small contribution to revenue generation. The term "minor forest product" has been replaced recently by the term NWFP recognizing the market and non-market values of these products. NWFP include rattan, bamboo, firewood, charcoal, damar, palm, wood-oil, gums, resins, medicinal plants and others (Poh Lye Yong 1994).

No inventories to quantify non-wood forest resources have been done except for the National Forest Inventory by Forestry Department Peninsular Malaysia (every 10 years) (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

PLANTS AND PLANT PRODUCTS

Food

Wild vegetables are common food for rural people. The consumption of the young fronds of *Diplazion escidentitin* and *Stenochlaena palustris* is very popular in most indigenous communities in Sarawak and both vegetables are sold commonly in the urban markets (Burgers 1993; DoA 1992). Also *Etingera elatior* and *E. punicea* (Zingiberaceae) are consumed in both rural and urban communities of Sarawak, but in smaller quantities. *Coinnielina paludosa* and *Rungia* sp. are popular among certain sections of the rural population. The peeled stem tips of the young shoots are eaten. *R. borneense* and *Rungia* sp. occur relatively rarely, but the soft leaves are valued highly by isolated rural communities. The cultivation of this species is feasible and often for farmers with subsistence-oriented production systems it is a more attractive option than planting annual exotic vegetables (Metz 1998).

Table 1. Major fruit species in Malaysia

Group 1: Non-seasonal fruits, potential for export market	Bananas (<i>Musa sapientum</i> L.) Papaya (<i>Carica sapientum</i> L.) Pineapple (<i>Ananas comosus</i> [L.] Merr.) Starfruit (<i>Averrhoa carambola</i> L.) Watermelon (<i>Citrus lanatus</i> [Thumb.] Mansf.) Muskmelon (<i>Cucumis melo</i> L.)
Group 2: Seasonal fruits, potential for local consumption or export market	Mango (<i>Mangifera indica</i> L.) Durian (<i>Durio zibethinus</i> L.) Jackfruit (<i>Artocarpus heterophyllus</i> Lam.) Rambutan (<i>Nephelium lappaceum</i> L.) Citrus (<i>Citrus</i> spp.)
Group 3: Popular fruits which have not been exploited for commercial cultivation and export	Duku/langsat/duku langsung (<i>Lansium domesticum</i> Jack.) Ciku (<i>Achras sapota</i> L.) Cempedak (<i>Artocarpus cembeden</i> Spreng.) Mangosteen (<i>Garcinia mangostana</i> L.)
Group 4: Fruits for processing	Soursop (<i>Annona muricata</i> L.)

Source: Rukayah Aman (1998)

According to Metz (1998) there is considerable potential for wild vegetables to contribute to the intensification of shifting cultivation systems, particularly in Sarawak and Southeast Asia in general if appropriate cropping practices are developed using existing farming techniques.

Malaysia has a rich diversity of fruit trees, many of which are indigenous and endemic to the country. It has been estimated that about 500 species of fruit trees are found in Malaysia's rain forests of which about 100 are considered edible. Only some 60 species are cultivated and utilized. Sixteen species belong to major fruits (Rukayah Aman 1998).

Additionally, Rukayah Aman (1998) has presented 61 rare and wild edible fruits in Peninsular Malaysia and their potential uses.

Medicines

About 1 200 of the higher plants in Malaysian forests are reported to have medicinal properties. Currently only about 200 are used in preparing various traditional medicines, but plant-based products such as herbal medicines and health foods are gaining more popularity among Malaysians. Based on data obtained from 4 000 Chinese herbal stores, the annual sales value in Malaysia was about \$M500 million in 1994 and the estimated market value of traditional medicine was between \$M1 to 2 billion in 1995 (Azizol Abdul Kadir and Rasadah Mat Ali 1998).

Many aromatic plant species in local rain forests have potential use for the production of essential oils, turpentine, flavours and fragrances. Although many aromatic and medicinal plant resources are available locally for industry, the supply of materials continues to come mainly from China, India and Indonesia, with only a small amount being harvested from Malaysian forests (Azizol Abdul Kadir and Rasadah Mat Ali 1998).

Table 2. Commonly used medicinal and aromatic plants in Malaysia

Latin binomial	Local name	Common use
<i>Eurycoma longifolia</i>	tongkat Ali	health tonic
<i>Labisia pumila</i>	kacip Fatimah	herbal preparation - postpartum
<i>Centella asiatica</i>	pegaga	health tonic, jamu
<i>Cinnamomum</i> spp.	medang	medicinal preparation
<i>Cucurtna xanthorriza</i>	temulawak	medicinal and herbal preparation
<i>Clicurma domestica</i>	kunyit	jamu, cosmetic
<i>Zingiber zerumbet</i>	lempoyang	medicinal preparation
<i>Andrographis paniculata</i>	akar cerita	medicinal preparation
<i>Eugenia aromatica</i>	cengkih	health care/toothpaste
<i>Mentha arvensis</i>	pudina	health care/toothpaste
<i>Cananga odorata</i>	kenanga	hair care/perfumery
<i>Michelia champaca</i>	cempaka	hair care
<i>Aloe barbadensis</i>	lidah buaya	hair care/ facial cleanser
<i>Cymbopogon nardus</i>	serai wangi	perfumery, insect repellent
<i>Citrus</i> spp.	limau	perfumery, cleanser
<i>Cassia alata</i>	gelenguang	medicinal preparation - skin care
<i>Kaempferia galanga</i>	cekur	cosmetic, herbal preparation

Source: Azizol Abdul Kadir and Rasadah Mat Ali (1998)

Medicinal plant species are collected from their natural habitats. Thus the supply of these materials is very uncertain, with product quality being variable. Some examples of common medicinal plant species used as major ingredients in local herbal products are *Eurycoma longifolia*, *Labisia pumila*, *Centella asiatica*, *Cinnamomum* spp., *Curcuma xanthorriza*, *Andrographis paniculata*, *Morinda citrifolia* and *Kaempferia galanga*. Aromatic plants such as *Cymbopogon nardus*, *Cinnamomum zeylanium*, *Michelia champaca* and *Cananga odorata* are

mainly used in food and personal care products and are cultivated commonly (Azizol Abdul Kadir and Rasadah Mat Ali 1998).

Table 3. Import and export of medicinal plants for pharmaceutical uses in Malaysia, 1986 to 1996

Year	Import (\$M)	Export (\$M)
1986	93 426 747	4 171 067
1987	85 219 513	5 227 073
1988	143 862 161	8 192 234
1989	160 250 315	12 263 211
1990	160 426 878	16 777 638
1991	181 474 845	18 725 948
1992	197 678 880	10 053 811
1993	212 619 287	21 925 302
1994	224 971 213	34 951 451
1995	256 673 093	41 241 046
1996	264 756 564	55 871 852

Source: Statistical Department (1996) in Azizol Abdul Kadir and Rasadah Mat Ali (1998)

Respectively, the import value for both medical and aromatic plants increased from \$M141 million in 1986 to \$M431 million in 1996 and the exports increased from \$M5.9 million to \$M63 million over the same time (Ng Lean Teik and Mohd Azmi Muhammed Idris 1997). Detailed trade figures for different medicinal and aromatic plants from 1986 to 1996 are provided by Ng Lean Teik and Mohd Azmi Muhammed Idris (1997).

Utensils, handicrafts and construction materials

Rattan and bamboo are the most important and valuable NWFP of Malaysia. On average (1981 to 1990), rattan contributed about 13.8 percent of the total royalties collected from NWFP, while bamboo accounted for about 71 percent. Foreign exchange earnings from rattan increased from US\$3 million (\$M8 million) in 1981 to US\$26.5 million (\$M71.5 million) in 1990. Respectively earnings from bamboo increased from US\$81 150 (\$M219 106) in 1988 to US\$176 474 (\$M476 480) in 1990. In addition, these two forest industries employ 24 370 individuals, mostly rural people, in 1 685 factories (Poh Lye Yong 1994).

There are about 600 rattan species in the world, of which 106 species are found in Peninsular Malaysia. Based on the National Forest Inventory (1990–1993) the estimated rattan resource was about 825 million sticks (the length of each stick being 3 m) (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

Table 4. Major commercial rattan species in Malaysia

Species	Local name	Uses
<i>Calamus manan</i>	Rotan manau	Furniture
<i>C. caesius</i>	Rotan sega	Binding and weaving basketware
<i>C. scipionum</i>	Rotan semambu	Walking sticks, umbrella handles
<i>C. ornatus</i>	Rotan dok	Cheap furniture
<i>Korthalsia</i> spp.	Rotan dahan	Cheap furniture, broom handles

Source: Department of Forestry, Peninsular Malaysia, Sarawak and Sabah, in Poh Lye Yong, (1994).

Commercial rattan species (about 20 according to FAO [1997]) are located in the northwest of Peninsular Malaysia, while in the south fewer canes are available, probably because of over exploitation. Rattan-processing mills are concentrated in west coast states with bigger forest areas and better infrastructure facilities. The stock of rattan species harvested and the amount of rattan

required by the industry are reported by Tan (1989) and Abd. Latif *et al.* (1990a), respectively (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

The planting of *Calamus manan* is conducted by the government and the private sector. By 1997 more than 31 000 ha had been planted. Out of this, 7 000 ha have been planted in rubber plantations throughout the country (Aminuddin and Salleh 1994; Abd. Latif and Aminuddin 1996). Large plantations in Sabah mainly grow *C. caesilts* and *C. trachycoleus*. So far about 10 000 ha have been established. *C. scipionum* and *C. palustris* are also considered as potential species for plantation (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

There are about 700 rattan mills and 525 are engaged in manufacturing with about 13 percent of the latter being export oriented (Abd. Latif and Aminuddin 1996). The rest are mainly cottage and small-scale industries. Annually, the rattan industry requires about nine million 3 m length sticks of the superior cane, *Calamus manan*, and two million 6 m length sticks of the small diameter cane, *C. caesius* (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

Peninsular Malaysia has an abundant supply of raw rattan. The total gross value collected is about \$M5 million per month. The value can be increased more than twentyfold if the manufacturers concentrate on downstream processing. Increased value-added processing has increased foreign exchange earnings already and the employment opportunities in the rural–urban sectors (the export value of rattan products from Malaysia increased by 200 percent in 1990) (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

Bamboo is next to rattan in terms of economic importance in Malaysia. Bamboo has not, however, been utilized extensively and its use is limited to the production of poultry cages, vegetable baskets, utensil products etc. (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998). There are about 70 known bamboo species in Malaysia: 50 in Peninsular Malaysia, 30 in Sabah and 20 in Sarawak, of which only 12 species are being utilized commercially (FAO 1997).

Table 5. Commercially utilized bamboos in Malaysia

Species	Local names	Uses
<i>Bambusa blumeana</i>	Buluh duri	Toothpicks, furniture, musical instruments, shoots as food
<i>B. heterostachya</i>	Buluh galah	Toothpicks, chopsticks, blinds
<i>B. vulgaris</i>	Buluh minyak	Paper, furniture
<i>Dendrocalamus asper</i>	Buluh belong	Fences, bridges, baskets, shoots as food
<i>Gigantochloa scortechinii</i>	Buluh semantan	Satay sticks, toothpicks, blinds
<i>Schizostachyum brachycladum</i>	Buluh nipis	Chopsticks, handicrafts

Source: Department of Forestry, Peninsular Malaysia, Sarawak and Sahah, in Poh Lye Yong (1994)

There are 1 032 bamboo-based industries of various sizes in Peninsular Malaysia but only 104 mills have appropriate machinery to produce products such as skewers, chopsticks and toothpicks (32 mills), furniture (2 mills) and crafts (70 mills). While these 104 mills are categorized as medium and large scale, the remaining 928 mills are classified as cottage and small-scale enterprises. Cottage industries making handicraft items occur mainly in the west coast states of Peninsular Malaysia, whereas industries making poultry cages and vegetable baskets tend to concentrate plantations around Tapah in Perak (Wong 1989). The local market for bamboo products is worth about \$M3 million annually (Aminuddin and Abd. Latif 1994) (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

Bamboo plantations should be established to ensure a continuous supply of high quality raw material. Commercially usable bamboo species grow mainly in northern Peninsular Malaysia, in logged-over forest and on river banks and hillsides (Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998).

Exudates

Many chemicals, present in various parts of plants, have commercial application (e.g. latex from rubber trees, the bark of certain mangrove trees such as *Rhizophora mucronata* for tanning). The availability of synthetic resins has reduced the trade of natural resins (Abdul Razak Mahd. Ali and Abd. Latif Mohmod 1998).

ANIMALS AND ANIMAL PRODUCTS

Bushmeat

Wildlife is exploited for protein and medicinal sources. Many wildlife habitats have been overexploited causing the displacement or death of several animal populations. The loss of forest by large-scale logging has a significant impact on wildlife. The majority of the forests affected have been the lowland forests below 100 m, which support most of the wildlife (Stevens 1968). The Javan rhinoceros (*Rhinoceros sondaicus*) and the green peafowl that once roamed the lowland region of Peninsular Malaysia are now considered to be extinct. In a recent study conducted by the Department of Wildlife and National Parks (DWNP), in 1986 only 21 species of mammals and birds were threatened while in 1996 a total of 85 species were considered threatened under the IUCN Red List of Threatened Species (DWNP/DANCED 1996) (Sivanathan Elangupillay and Abdullah Mohd 1998).

Over the last 10 years, the DWNP has collected over \$M17 million in revenue from wildlife utilization for the state governments. This revenue is in the form of licenses for game, pets and from import and export taxes (Sivanathan Elangupillay and Abdullah Mohd 1998).

Table 6. Revenue collected by DWNP from wildlife licenses, 1986 to 1995

Year	Licenses amount (\$M)
1986	863 235
1987	852 492
1988	1 193 787
1989	1 125 550
1990	1 741 225
1991	2 074 994
1992	1 965 307
1993	1 921 052
1994	2 024 682
1995	1 916 159
Total	17 138 586

Source: DWNP Annual Reports 1986–1995, in Sivanathan Elangupillay and Abdullah Mohd (1998)

Table 7. Wildlife harvested legally in 1995

Species	Purpose of harvesting	Animals per license	Animals harvested
Wild boar	Consumption	No limit	10 463
Python	Skin	50	52 780
Monitor lizard	Skin	50	138 652
Long-tailed macaque	Pet	5	39
Pig-tailed macaque	Pet	5	275
Flying fox	Consumption	50	6 380
Civet	Consumption	5	84
Mouse deer	Consumption	5	282
Leaf monkey	Pet	5	2
Cobra	Skin	100	3 428
King cobra	Skin	50	39
Barking deer	Consumption	1	0
Sambar deer	Consumption	1	0

Source: DWNP/DANCED (1996), in Sivanathan Elangupillay and Abdullah Mohd (1998)
 There has been no economic evaluation of wildlife consumption in Peninsular Malaysia. A recent estimate for Sarawak showed wildlife consumption values of meat alone at about \$M187 million per year (Sarawak Forest Department 1996). Applying acceptable market values for such consumption, the value of three wildlife species harvested legally would be worth about \$M6.9 million per year for Peninsular Malaysia (Sivanathan Elangupillay and Abdullah Mohd 1998).

Table 8. Value of selected wildlife species consumed per year

Species	Number of animals harvested annually	Value of consumption*
Wild boar	10 000	10 000 x 40 kg x \$M3 = \$M 1.2 million
Python	50 000	50 000 x \$M50 per skin = \$M1.5 million
Monitor lizard	140 000	140 000 x \$M 30 per skin = \$M4.2 million
Total		\$M 6.9 million

Source: DWNP 1996 (* = estimates), in Sivanathan Elangupillay and Abdullah Mohd (1998)

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ANNEX 1. FOREST SERVICES

In Malaysia hunting and wildlife recreation have served as tourist attractions, research subjects and for educational purposes. Malaysia with its abundant wildlife resources could benefit from wildlife conservation and services. The consumptive or commercial and non-consumptive uses of wildlife as NWFPs have been enormous in the areas of game hunting, tourism and nature education (Sivanathan Elangupillay and Abdullah Mohd 1998).

To cater for the increasing demand for outdoor activities and recreation, a total of 85 forest recreation sites have been developed in Peninsular Malaysia. These areas coupled with the more renowned national parks such as the Taman Negara in Peninsular Malaysia, the Kinabalu National Park and Sepilok Orang Utan Rehabilitation Centre in Sabah and the Gunung Mulu National Park in Sarawak have promoted ecotourism tremendously in Malaysia. There is also the growing importance of the forest for nature education and research. Notable examples are the Pasoh Forest Reserve in Peninsular Malaysia, the Danum Valley in Sabah and the Bako National Park in Sarawak which are acclaimed internationally as centres for tropical forest studies (FAO 1997).

Taman Negara is a national park, straddling the states of Kelantan, Terengganu and Pahang; it was established in 1938/1939 with a total area of 4 343 km². About 10 percent of the park is designated for ecotourism development where visitors are provided access to the natural resources of the park (DWNP 1987).

Table 9. Value of Taman Negara as a major wildlife destination using selected indicators

Indicator	Total (\$M)
Government revenue (\$M)+	393 101
Taman Negara resort income (\$M) +	15 000 000
Guides' income (\$M)	640 000
Boat rental	252 000
Tour agencies	500 000
Private chalets	600 000
Restaurant *	360 000
Souvenir shops	480 000
Guide books *	100 000
Fishing equipment	20 000
Camping equipment	100 000
Boat builders	50 000
Total	18 495 1010

Sources: (+) DWNP data, (*) estimates in Sivanathan Elangupillay and Abdullah Mohd (1998)

Amenity forestry and ecotourism are expected to gain greater importance in the future. The Forestry Department, Peninsular Malaysia has already earmarked a few more areas with potential for development as forest recreation areas. The Sabah State Government has already identified future directions in the Sabah Tourism Master Plan (1995–2010). Several key sites in forest reserves such as Borneo Rain Forest Lodge in Danum Valley, Tabin Wildlife Reserves will be promoted to cater to nature tourism activities. In addition, the State Forestry Department has also identified and developed seven other forest recreation areas throughout the state. The situation is quite similar in Sarawak. The state government has acknowledged ecotourism with its growth of 10–15 percent per annum as an important source of foreign exchange (FAO 1997).

QUANTITATIVE NWFP DATA OF MALAYSIA

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Medicines		Medicinal plants					N, I	Annual sales' value in country: \$M500 million in 1994; estimated market value: \$M1–2 billion in 1995. Imports of medicinal plants \$M264 756 564 and exports of \$M55 871 852 in 1996		Azizol Abdul Kadir and Rasadah Mat Ali 1998
Utensils, handicrafts, construction materials		Bamboo			F	W		Export of US\$176 474 in 1990 Local market of bamboo products is worth \$M3 million annually		Poh Lye Yong 1994 Abdul Razak Mohd. Ali and Abd. Latif Mohmod 1998
		Rattan			F, P	W, C		Exports of US\$26.5 million in 1990		Poh Lye Yong 1994
Animals and animal products										
Bushmeat		Wild boar				W	N	Annual harvesting of 10 000, value, \$M1.2 million		Sivanathan Elangupillay and Abdullah Mohd 1998
		Python				W	N	Annual harvesting of 50 000, value, \$M1.5 million		Sivanathan Elangupillay and Abdullah Mohd 1998
		Monitor lizard				W	N	Annual harvesting of 140 000, value, \$M4.2 million		Sivanathan Elangupillay and Abdullah Mohd 1998

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
 Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
 Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
 Source: W – wild, C – cultivated

Destination: N – national; I – international

MYANMAR

INTRODUCTION

Main non-wood forest products

The most important NWFP are bamboo, rattan, edible bird nests and natural rubber. Other NWFP include spices, medicinal plants, straws, tanning barks, perfumes, exudates, honey and beeswax, bushmeat, lac and bat guano.

General information

About half of the total land area of Myanmar (676 777 km²) is covered with forests. These public forests are classified either as Reserved Forests or Unclassed Forests. The Reserved Forests have legal protection but the government allows rural communities to use the products of Unclassed Forests, with the exception of certain protected plant and animal species (Khin Maung Lwin 1995).

In Myanmar, forest products are divided into commercial and minor forest produce. Minor forest produce is defined as "all kinds of forest produce other than timber and firewood", including animals, vegetables and mineral products. For rural communities depending on NWFP for subsistence and for trade, the NWFP are probably more important than timber or other forest products (Khin Maung Lwin 1995).

Myanmar's NWFP can be divided into 13 groups according to their nature and uses: bamboo; cane (rattan); tanning bark; straw (bast); scented wood and bark; gum, resin and oleoresin; spice; roofing material; dyeing material; animal products; medicinal plants; edible products; other miscellaneous products (Khin Maung Lwin 1995).

The Forest Department in Myanmar counts the following NWFP for trade purposes: bamboo, cane (rattan), cutch, tanning bark, straw (bast), karamet, indwe/pwenyet, thanatkha, hpala, kanyin oil, roofing materials, te, honey, beeswax, bat guano, thitsi, edible bird nests, lac, orchids, bomayaza and pine resin (Khin Maung Lwin 1995).

Table 1. Annual production of selected NWFP in Myanmar, 1992 to 1995

Product	Units	1992/93	1993/94	1994/95 (provisional)
Bamboo	Culms	157 283	153 140	153 620
Cane	Pieces	64 997	65 860	62 790
Cutch	kg	271 800	189 750	198 479
Tanning bark	kg	812 250	896 700	903 150
Straw (bast)	kg	73 950	73 350	105 000
Karamet	kg	55 500	22 500	24 000
Indwe-pwenyet	kg	650 030	876 875	929 925
Thanatkha	kg	438 750	439 500	442 050
Hpala	kg	9 225	7 920	7 950
Kanyin oil	kg	7 650	9 150	9 900
Roofing material	Pieces	92 596	95 165	104 884
Te	kg	18 000	18 000	10 500
Honey	kg	35 800	36 400	28 710
Beeswax	kg	2 198	2 018	2 018
Bat guano	kg	232 575	234 300	265 650
Edible bird nests	kg	923	923	1 740
Lac	kg	50 700	227 700	228 900
Orchids	Number	32 500	19 500	30 000
Bomayaza	kg	7 650	7 050	9 000
Thitsi	kg	40 200	34 650	48 000
Pine resin	kg	579 750	522 000	385 800

Source: Forest Department, Myanmar (in Khin Maung Lwin 1995)

Table 2. Production of NWFP 1988 to 1995

Description	Unit	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95
Bamboo	Million nos.	878	933	939	962	940	919	946
Rattan	Million nos.	57	75	75	92	81	81	73
Cutch	MT	241	338	197	86	166	331	184
Bark (for tanning)	MT	307	958	779	970	1 112	2 537	1 050
Straw (fibre)	MT	380	369	418	428	431	388	398
Kalamet	MT	49	62	11	24	85	63	26
Indwe-pwenyet	MT	424	467	1 104	1 133	808	833	899
Thanaka	MT	279	428	521	496	468	493	426
(<i>Limonia accidissima</i>)	MT							
Pine resin	MT	178	411	139	385	179	11	2
Honey	MT	52	23	21	23	29	16	21
Bat guano	MT	276	214	220	279	302	240	271
Lac	MT	45	44	140	277	52	262	254
Edible bird nests	kg	1 665	726	679	390	992	1 523	2 923
Beeswax	kg	628	1 265	834	1 500	924	530	1 134
Thatch roofing sheets	Million nos.	882	1 090	910	933	922	927	920
Orchids	Thousand nos.	17	12	62	496	106	16	15

Sources: Forestry Fact Sheet (1996); Statistical Year Book (1995) in APFSOS/WP/08 (in Qiang Ma 1999)

Table 3. Trade in NWFP from 1992 to 1997

		Export				
		1992-93	1993-94	1994-95	1995-96	1996-97
Lac, natural gums, resins, etc.						
	Quantity (MT)	181	366	295	200	222
	Value(US\$)	110	223	183	126	142
Edible bird nests						
	Quantity (kg)	-	1 477	2 080	1 379	1 197
	Value (US\$)	543	543	760	506	440
Bamboo						
	Quantity (million nos.)	213	371	120	1 128	843
	Value (US\$)	128	234	79	677	582
Rattan						
	Quantity (MT)	4 378	1 398	5 428	4 225	2 804
	Value (US\$)	2 058	690	2 813	2 248	1 601
Natural rubber						
	Quantity (MT)	-	-	20 429	63 285	25 454
	Value (US\$)	-	-	19 407	63 125	26 659

Source: Ministry of Forestry, Myanmar (in Qiang Ma 1999)

Although NWFFP contribute revenue to the country and also provide income-generation opportunities for forest dwellers, they have a low economic profile (Khin Maung Lwin 1995).

Table 4. Export quantities of selected NWFP

Product	Units	1992/93	1993/94	Jan–Aug, 1994
Bamboo	Culms	189 168	37 166	98 500
Bamboo (split)	Bundles	20 200	-	-
Bamboo (peeled)	Bundles	415 000	-	-
Canes	Pieces	2 681 404	856 415	526 033
Thitgyabo	kg	2 570 124	298 450	135 486
Cutch	kg	172 413	217 145	116 582
Nanthaphyu	kg	22 446	5 742	-
Lac	kg	-	23	-
Edible bird nests	kg	-	1 418	608
Ondon bark	kg	-	13 770	22 410
Thitsi	kg	470	2 343	-
Indwe	kg	-	64 500	191 481
Orchid	Number	30	47	-
Taungnangyi	kg	-	474	-
Karamet	kg	7 500	-	-
Pine rosin	kg	-	-	18 375
Kinpwin-thi	kg	-	-	9 000

Source: Forest Department, Yangon Division in Khin Maung Lwin (1995)

PLANTS AND PLANT PRODUCTS

Food

The forests of Myanmar provide many spices for domestic use and also for export. Some important species include: hpala (cardamom) (*Elettaria cardamomum*), ngayok-kaung (black pepper) (*Piper nigrum*), peikchin (long pepper) (*P. longum*) and karawe (*Cinnamomum* spp.) (Khin Maung Lwin 1995).

Most rural dwellers living near forests rely on edible plant products, such as buds, leaves, flowers, fruits, tubers, corms and shoots. Other seasonal foods are edible mushrooms and fungi. Besides nutrients, the forest food provides cash income for rural people (Khin Maung Lwin 1995).

Medicines

Most rural people use traditional indigenous medicines. Recently, the Myanmar Medical Research Department and the pharmaceutical industry upgraded various indigenous medicines, which has resulted in an increase in demand for medicinal plants as raw materials. Some prominent medicinal plants include bomayaza (*Rauwolfia serpentina*), subyu (*Acacia arabica*), hnaw (*Adina cordifolia*), banbwe (*Careya arborea*), zibyu (*Embllica officinalis*), nalingyaw (*Litsaea lancifolia*), ondon (*L. glutinosa*), taw-shauk (*Citrus medica*) and pwegaing (*Cassia angustifolia*) (Khin Maung Lwin 1995).

Utensils, handicrafts and construction materials

Bamboo is the most important NWFP of Myanmar. About 100 species grow in large quantities throughout the country, the most common bamboo species being kyathaung (*Bambusa polymorpha*), tin (*Cephalostachyum pergracile*), myin (*Dendrocalmus strictus*), kayin (*Melocanna bambusoides*), thana (*Thyrsostachys oliveri*), thaik (*Bambusa tulda*), wabo (*Dendrocalmus brandisii*), wabo-myetsangye (*D hamiltoni*), waphyu (*D. membranaceus*) and wagok (*Oxytenanthera albo-ciliata*) (Khin Maung Lwin 1995).

Bamboo is used for utensils, handicrafts and construction materials. In addition pickled bamboo shoots are becoming very popular. As an industrial raw material, in Myanmar bamboo is used

commonly by pulp and paper mills. With the scarcity of raw materials for pulp and paper factories in neighbouring countries, the future of bamboo as a raw material for paper and rayon making is very promising (Khin Maung Lwin 1995).

About 36 species of canes or rattans grow in swampy areas of semi-evergreen and evergreen forests in Myanmar. The commonly used species are kyet-u-kyein (*Calamus platyspathus*), yamata-kyein (*C. latifolius*), kabaung-kyein (*C. longisetus*), ye-kyein (*C. floribundus*), kyein-bok (*C. myrianthus*) and thaing-kyein (*C. erectus*). Canes are used in log-rafting as binding materials, and in small-scale enterprises which produce furniture, baskets, handicrafts, mats, etc. Finished cane products have been exported, supposedly to produce more employment opportunities in collecting, processing and trading cane. Most cane however, is exported unprocessed at lower prices because of the poor processing technology and limited experience in trading (Khin Maung Lwin 1995).

Traditionally, the people of Myanmar have used the straw (bast) of some plants for tying materials. Rural people still use traditional plant fibres while urban people nowadays use synthetic ropes. Plant fibre ropes are essential for domestic and farming activities in rural areas. Traditional mats (thinbyu) are woven with the best of thin (*Clinogyne dichotoma*) and the inner portions can be used as string. The families Sterculiaceae and Tiliaceae include good fibre-yielding plants which grow widely in Myanmar. The most important species for rope-making are shaw-ni (*Sterculia villosa*), shaw-gulu (*S. urens*), letpan-shaw (*S. foetida*), don-straw (*S. ornata*) and tayaw (*Grewia* spp.) (Khin Maung Lwin 1995).

One of the most important NWFP is roofing thatch made from leaves. Common roofing materials include thetke (*Imperata cylindrica*), dani (*Nypa fruticans*), salu (*Licuala peltata*), in (*Dipterocarpus tuberculatus*) and taung-htan (*Livistona* spp.). The collection, processing and trading of roofing materials are income-generating part-time activities for rural people (Khin Maung Lwin 1995).

Dyeing and tanning

Synthetic dyes have been introduced in the textile industry to replace natural dyes while the rural people continue to use natural dyes for certain purposes. The most important dye-yielding plant species are: meyaing (*Indigofera* spp.), pauk (*Butea monosperma*), megyi (*Strobilanthes flaccidifolius*), pein-ne (*Artocarpus heterophyllus*), nibase (*Morinda* spp.), tein-nyet (*Caesalpinia sappan*) and te (*Diospyros burmanica*) (Khin Maung Lwin 1995).

Some of the tree species yielding tanning barks include ngushwe (*Cassia fistula*), tanaung (*Acacia leucophloea*) and some mangrove species of the family Rhizophoraceae. The expansion of the leather industry has had a positive influence on the demand for tanning barks (Khin Maung Lwin 1995).

Cutch is extracted from the heartwood of she (*Acacia caeatechu*) growing in dry areas of Myanmar. It is used as a dye and a preservative for fishing nets and canvas. The people enjoy chewing betel with katha, which is separated from cutch. Cutch also contains tannic acid and can be used as a tannin (Khin Maung Lwin 1995).

Perfumes and cosmetics

Scented woods, including karamet (*Mansonia gagei*), nanthani (*Pterocarpus santalinus*), santagu (*Santalum album*), taungtan-gyi (*Premna integrifolia*) and thit-hmwe (*Aquilaria agallocha*) are used in fragrances, scented sticks and medicines. These species are rare in natural forests and consequently very expensive. The bark and wood of thanatkha (*Hesperethusa caenulata*) are the

most popular traditional cosmetics in Myanmar. Thanatkha is in great demand and its price is high due to the increased manufacturing of cosmetics (Khin Maung Lwin 1995).

Exudates

The most common species yielding gums, resins and oleoresins are thitsi (*Melanorrhoea usitata*), pine (*Pinus* spp.) (for rosin and turpentine), kanyin (*Dipterocarpus alatus* and *D. tubinatus*) (for oleoresin) and subyu (*Acacia arabica*) (for gum) (Khin Maung Lwin 1995).

Others

About 840 species of orchids grow in Myanmar. Some of them are highly valuable and also exported. (Khin Maung Lwin 1995).

ANIMALS AND ANIMAL PRODUCTS

Animals provide many valuable trade products, such as lac, edible bird nests, honey and beeswax, bat guano, hides, bones and horn (Khin Maung Lwin 1995).

Honey and beeswax

Wild honey is preferred to the honey from the hives of beekeepers. Wild honey is used for preparing foodstuffs and in Myanmar's indigenous medicines. Two of the most common honey-bees in Myanmar, *Apis indica* and *A. dorsata*, are found throughout Myanmar (Khin Maung Lwin 1995).

Bushmeat

Rural people hunt birds, mammals, reptiles, amphibians, fish and insects (a major protein supplement) for food and to earn extra cash (Khin Maung Lwin 1995).

Other edible animal products

Edible bird nests are composed of a white gelatinous substance secreted by the salivary glands of the grey rumped swiftlet (*Collocalia inexpectata*). These precious products used in indigenous Chinese tonics are obtained from natural caves in the Myeik Archipelago and on some islands off the Patheingyi coast. Only licensed traders controlled by the Forest Department can collect the nests, which produce good foreign exchange earnings (Khin Maung Lwin 1995).

Other non-edible animal products

Lac is a resinous substance secreted by lac insects (*Kerria lacca*). Host trees are pauk (*Butea monosperma*), gyo (*Schleichera oleosa*), zi (*Zizyphus jujuba*), thinbaw-koko (*Samanea saman*) and ingyin (*Shorea siamensis*). In general the quality of lac depends on the species of the host tree (Khin Maung Lwin 1995).

Bat guano is collected for use as a natural fertilizer, which gives high crop yields at low cost. The bats live in the rocky, mountainous areas of Myanmar (Khin Maung Lwin 1995).

Rural people make good money selling the hides, bones and horns of forest animals. The hides of some animals are in great demand for the leather industry. Bones and horns are used for handicraft production and to decorate living rooms. Some tribes keep and wear some parts of the bones, horns and hides (Khin Maung Lwin 1995).

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QUANTITATIVE DATA OF MYANMAR NWFP

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Dyeing, tanning		Cutch	<i>Acacia caeatechu</i>					184 MT in 1994–95		Qiang Ma 1999
		Bark		ba				1 050 MT in 1994–95		Qiang Ma 1999
Utensils, handicrafts, construction materials		Bamboo						946 million nos. in 1994–95. Export of 843 million nos. (US\$ 582 000) in 1996–97		Qiang Ma 1999
		Rattan						73 million nos. in 1994–95. Export of 2 804 MT (US\$1 601 000) in 1996–97		Qiang Ma 1999
		Shaw fibre	<i>Sterculiaceae</i> spp. <i>Tiliaceae</i> spp.					398 MT in 1994–95		Qiang Ma 1999
		Thatch roofing sheets	<i>Imperata cylindrica</i> <i>Nypa fruticans</i> <i>Licuala peltata</i> <i>Dipterocarpus tuberculatus</i> <i>Livistona</i> spp.					920 million nos. in 1994–95		Qiang Ma 1999
Exudates		Pine resin	<i>Pinus</i> spp.					2 MT in 1994–95		Qiang Ma 1999
Others		Orchids						15 000 MT in 1994–95		Qiang Ma 1999
Animals and animal products										
Honey, beeswax		Honey and beeswax	<i>Apis indica</i> <i>Apis dorsata</i>					21 MT of honey in 1994–95. Production of 1 134 kg of beeswax in 1994–95		Qiang Ma 1999
Other edible animal products		Bird nests						2 923 kg in 1994–95 Export of 1 197 kg (US\$440 000) in 1996–97		Qiang Ma 1999
Other non-edible animal products		Bat guano						271 MT in 1994–95		Qiang Ma 1999
		Lac	<i>Kerria lacca</i>					254 MT in 1994–95		Qiang Ma 1999

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
 Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums;
 ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

NEPAL

INTRODUCTION

Main non-wood forest products

The most important NWFP of Nepal are medicinal and aromatic plants, lokta paper, resin and turpentine. Other important NWFP include sal seed, katha and cutch, sabai grass, bamboo and cane.

General information

In Nepal, NWFP are used for subsistence as well as for trade at national and international levels. Edwards (1996) has summarized a list of 39 of the most important NWFP at national and international levels. These NWFP contribute 4 percent of the total contribution of forestry to the national economy. In Nepal, jaributi refers to a group of NWFP collected from the wild in the mountains and traded in India as raw materials for industries related to pharmaceuticals, food, beverages or perfumes. The trade volume is enormous but for the most part remains invisible (Sharma 1995).

Table 1. Sale of NWFP

Fiscal year	Year				
	1995/96	1996/97	1997/98	1998/99	1999/00
Quantity (MT)	3 233.49	3 748.67	15 084.47	2 690.77	1 550.00*
Revenue (US\$ millions)	0.29	0.35	0.35	0.22	0.16

*only 41 districts

Source: Department of Forests (2000)

FAO (1982) reports that there are more than 700 different species of medicinal and aromatic products in Nepal. The proceedings of the third South and East Asian Countries NTFP Network Workshop on Community Based Non-timber Forest Products Management reported that about 2 000 plants in Nepal have medicinal properties and 1 463 plants are known to be used locally (Shrestha and Shrestha 1999).

The majority of NWFP fall into two contrasting groups: high value products from high altitudes, and low value products from lower altitudes (below 2 000 m). Most NWFP collection in Nepal occurs at high altitudes and in remote Himalayan regions. The primary collectors are women and children near villages and men in remote areas. In general NWFP are collected from forest land. Much of the harvesting takes place between August and September through December. The decision to engage in the collection of NWFP depends on product value, distance and access to collection area, abundance of plants in that area, alternative employment opportunities and the relative wealth of the household. Typically, it is the poorest household that engages in commercial collection of NWFP (Olsen 1998). Income from the collection of medicinal and aromatic plants for rural households varies from 0 to 50 percent of annual household earnings.

Table 2. The volume and value of high- and low-value NWFP traded from 1991 to 1992 (at 1993/1994 prices)

Product	Weight (MT)	Price (NRs*/kg)	Value (NRs)
High-value NWFP:			
<i>Swertia chiraita</i>	140	115	16 100 000
<i>Picrorrhiza scrophularii-flora</i>	24	75	1 800 000
<i>Nardostachys jatamansi</i>	30	58	1 740 000
<i>Aconitum spicatum</i>	10	63	630 000
Other NWFPs	20	33	660 000
Subtotal high-value NWFP	224		20 930 000
Low-value NWFP:			
<i>Cinnamomum tamala</i> bark	100	32	3 200 000
<i>Cinnamomum tamala</i> leaves	400	7	2 800 000
<i>Asparagus racemosus</i>	45	46	2 070 000
<i>Sapindus mukorossi</i>	100	9	900 000
<i>Acacia consinna</i>	50	12	600 000
Subtotal low-value NWFP	695		9 570 000

*US\$1.00 =NR74

Source: Edwards (1996)

Table 3. Quantities of major NWFP at the market (1995 to 1999)

Trade name	Botanical name	Unit	Marketed quantities					Average % change per year
			1995	1996	1997	1998	1999	
Sugandhawal	<i>Velieriana jatamasi</i>	kg	13 637	10 677	8 692	6 671	5 310	-21.0
Kurilo	<i>Asparagus racemosus</i>	kg	59 100	5 750	53 500	38 250	37 150	-10.3
Jhyau	<i>Lichen spp.</i>	kg	65 540	57 810	53 200	48 495	46 310	-8.3
Pakhanved	<i>Bergenia ciliata</i>	kg	6 580	5 592	4 850	5 150	5 550	-3.6
Nundhiki	-	kg	5 470	6 800	6 565	6 965	10 550	19.6
Majhito	<i>Rubia manjith</i>	kg	25 800	21 800	17 600	17 600	9 300	-20.5
Bhyakur	<i>Dioscorea deltoidea</i>	kg	8 900	8 100	6 900	62 00	6 000	-9.3
Chiraito	<i>Swertia chirayta</i>	kg	15 300	13 700	12 200	98 00	7 400	-16.4
Total herbs kg			200 327	182 029	163 507	139 231	127 570	-10.6
Amriso	<i>Thysanolaens maxima</i>	kg	10 250	61 200	61 400	50 900	66 700	127.8
Bamboo		No	19 000	19 000	19 500	20 500	21 100	2.7
Lapsi	<i>Choersonpindus axillaris</i>	Kg	87 500	94 100	88 200	94 500	94 600	2.1

Source: New Era (2001)

Table 4. NWFP exported to India from 1999 to 2000 in NRs

Trade name	1998/99	1999/00	% change in value
Turpentine	40 700	13 000	-68.1
Cinnamomum	1 400	0	-100.0
Cardamom	233 400	207 200	-11.2
Catachue	117 300	199 000	-69.7
Herbs	31 400	43 100	37.3
Ginger	151 700	139 600	-8.0
Dried ginger	41 100	58 800	38.2
Rosin	92 700	173 900	87.6
Broom	51 400	48 800	-5.1

Source: Nepal Rastra Bank (2000)

Table 5. Collectors'/producers' price trends of certain NWFP, from 1995 to 1999 (NRs/kg)

Trade name	Botanical name	Marketed quantities					% change during last five year
		1995	1996	1997	1998	1999	
Sugandhawal	<i>Valeriana jatamansi</i>	39.09	43.68	47.45	51.18	61.21	56.59
Kurilo	<i>Asparagus racemosus</i>	32.16	34.50	36.60	43.50	61.00	89.68
Jhyou	<i>Lichen spp.</i>	9.49	12.55	15.22	16.50	17.64	85.88
Palhanved	<i>Bergenia ciliata</i>	6.00	7.00	7.50	8.60	11.83	97.17
Nundhiki	-	5.50	5.40	7.80	8.50	9.93	80.55
Majhito	<i>Rubia manjith</i>	8.00	9.75	11.25	13.50	17.60	120.00
Bhyakur	<i>Dioscorea deltoidea</i>	2.00	1.75	2.50	4.00	10.33	416.50
Chiraito	<i>Swertia chirayta</i>	53.33	53.00	61.25	71.25	95.00	78.14
Amriso	<i>Thysanolaens maxima</i>	8.92	9.57	10.00	11.63	12.37	38.68
Lapsi	<i>Choerospindus axillaris</i>	3.16	3.66	4.25	5.33	6.91	118.67

Source: New Era (2001)

Various reasons (e.g. illicit collection) have caused a decrease in the NWFP resources of Nepal (Amatya 1995). Recently HPPCL (Herbal Products Processing Company Limited), a governmental organization, and Dabur Nepal initiated the cultivation of some important NWFP. According to Bhattarai and Maharjan (2000), HPPCL has introduced farming, processing and sustainable collection practices for NWFP on its own farms, private land and community forests involving local communities.

Table 6. Sales rates for some NWFP traded by HPPCL from December 2000

Botanical name	Price/kg (NRs)
<i>Artemisia vulagaris</i>	5 155
<i>Rhododendron anthopogan</i>	5 280
<i>Matricaria chamomilla</i>	12 600
<i>Acorus calamus</i>	2 750
<i>Cymbopogon winterianus</i>	400
<i>Ocimum basilicum</i>	3 798
<i>Curcuma zeodaria</i>	3 480
<i>Juniperous recurva</i>	6 500
<i>Nardostachys grandiflora</i>	8 900
<i>Cympobogon</i>	660
<i>Cympobogon martini</i>	895
<i>Cinnamomum glausecens</i>	1 215
<i>Gaultheria fragrantissima</i>	1 015
<i>Zanthoxylum armatum</i>	4 255
<i>Mentha arvenis</i>	710
Shilajit processed	1 100
<i>Lichen resinoids</i>	1 160
Turpentine	30
Rosin	45

Source: HPPCL (2000)

No documentation is available on honey and beeswax, which are faunal-derived NWFP in Nepal. In Nepal fodder is not regarded as a minor forest product, being one of the main products of the forests, and therefore it is not included in descriptions and analyses of NWFP (Khatri 1994).

PLANTS AND PLANT PRODUCTS

Food

Aside from being a major source of building timber, sal (*Shorea robusta*) is a prolific producer of seeds. Sal seed has a high oil content and the oil extracted from it has many industrial and household uses. Sal fat has been used as a partial substitute for cocoa butter in Japan, Germany, Switzerland and Italy. Large quantities of sal fat, either crude, neutralized or dry-fractioned, have been exported to the United Kingdom, Japan and some other countries since 1970. Studies documenting export quantities and their values have not been carried out (Khatri 1994).

Katha is an extract derived from the heartwood of khair (*Acacia catechu*) by boiling. It is a clay-coloured crystalline substance used in the preparation of pan, a chewing material popular in Asia and East Africa. Cutch, a by-product of katha production, is a black reddish gum resin which is used in tanning, dyeing and as a lubricant in oil-well drilling. It is also a traditional component for making medicines (Khatri 1994). Almost all katha and cutch is exported to India (best quality katha at US\$15/kg, kutch at US\$0.80/kg) (Coppen [1994] in Edwards [1996]).

Some important edible fruits are *Aesandra butyracea*, *Choerospondias axillaris*, *Syzygium cumini*, *Terminalia chebula*, *T. bellerica*, *Zizyphus incurva* and *Morus alba*. Edible seeds and nuts include *Castanopsis hystrix*, *C. indica*, *C. tribuloides* and *Juglans regia*.

Medicines

Medicinal plants play an important role in satisfying the health needs of the population because access to modern health facilities in the country is limited. Trade of medicinal plants provides crucial income to rural collectors. A small portion of the plants collected is used locally and about 90 percent is sold as crude herbs, mainly for export (Khatri 1994).

Usually, medicinal plants are harvested from common property resources. Some valuable medicinal plant species are facing the threat of extinction due to indiscriminate collection for swift monetary gains (Rawal 1995). A total ban on collection, use and export has been imposed for *Dactylorhiza hatagirea*, *Juglans regia* (bark) and *Picrorhiza scrophulariiflora* (Nepal Gazette 2001). Nine species are banned for export without processing (*Nardostachys grandiflora*, *Rauwolfia serpentina*, *Cinnamomum glausescens*, *Valeriana walichii*, *Parmelia* sp., *Abies spectabilis*, *Taxus baccata*, *Organic exudate* and *Cordyceps sinensis*). Trading, movement and export has been banned on *Michelia champaca*, *Acacia catechue*, *Shorea robusta*, *Bombax ceiba*, *Pterocarpus marsupium*, *Dalbergia latifolia* and *Juglans regia* (from natural forests).

Table 7. Annual production of selected medicinal plants (tonnes)

Species	Year								
	1987/88	1988/89	1989/90	1990/91	1991/92	1992/93	1993/94	1996/97	1997/98
<i>Swertia chiraita</i>	159.50	131.80	165.10	85.60	159.30	200.80	304.60	137.35	285.53
<i>Nardostachys grandiflora</i>	64.35	111.00	118.10	70.40	203.30	113.30	260.00	106.74	96.59
<i>Picrorhiza scrophulariiflora</i>	24.90	25.80	31.40	30.70	116.40	46.20	25.30	120.90	46.57
<i>Zanthoxylum armatum</i>	227.10	182.90	320.20	371.80	305.40	296.90	260.30	Na	Na
<i>Cinnamomum tamala</i>	11.50	17.00	13.10	31.20	248.10	101.70	259.30	58.03	101.02
<i>Cinnamomum jalinicum</i>	149.60	63.90	90.80	251.10	141.10	361.90	240.10	131.50	86.99

Na = not available

Source: Annual Reports, Department of Forests, HMG/Nepal (1998). Data from 1994 to 1996 are not available.

The leaves and small branches of *Taxus baccata* (lauth salla) produce resin, which can be used as an anticarcinogen. Up to 72 kg of fresh leaves per day can be harvested, equivalent to 36 kg of dried leaves (Paudel and Rosset 1998). According to the Department of Forests the collection of leaves has been increasing (227 tonnes in 1997/1997, 253 tonnes in 1997/1998).

Table 8. Annual collection of *Taxus baccata* leaves

	Fiscal year				
	1995	1996	1997	1998	2000
Collection (kg)	60 417	141 955	302 062	289 421	185 391

Source: DNPL (2001)

Information and knowledge on the cultivation, production and export of different medicinal plants varies. Cultivation practices have been developed for some species. Nepal has some processing facilities but these facilities are quite insignificant relative to the volumes traded in India and most of the value added production is performed in India (Sharma 1995).

The production of atis (*Delphinium himalayai*) was 2 800 tonnes in 1995 (New Era 2001) and the production of ritha (*Sapindus mukuorossi*) 746.16 tonnes in 1996/1997 and 1 042.57 tonnes in 1997/1998.

Table 9. Seedlings of selected medicinal plant species, from 1999 to 2000

Species	Number of seedlings	
	1999	2000
<i>Swertia chiraita</i>	62 400	110 000
<i>Nardostachys grandiflora</i>	4 300	Na
<i>Picrorrhiza scrophulariiflora</i>	3 350	4 000
<i>Taxus baccata</i>	160 953	185 000

Na = not available

Source: DNPL (Dabur Nepal Private Limited)

Nepalese essential oils have been well received in the regional and European markets. The conventional oils such as palmarosa, citronella, lemon grass and tagetes have a growing demand from foreign customers. The case is similar with certain newly introduced unconventional items such as *Rhododendron anthopogon* oil. Jatamansi oil (*Nardostachys jatamansi*) and xanthoxylum (*Zanthoxylum armatum*) oil require greater efforts for successful export. The future of the essential oil industry looks promising, with foreign firms entering Nepal for the manufacture of soaps and detergents (Rawal 1995). It has been estimated that about 39 300 kg of dried jatamansi were marketed whereas its production potential could be more than 100 000 kg (New Era 2001).

Indian traders have estimated that 90 percent of the jatamansi drug in the Indian market originates from Nepal. The figure for the export of jatamansi oil was about 500 kg of oil during the fiscal year 1994/1995.

Utensils, handicrafts and construction materials

Daphne spp., locally known as lokta, is used as raw material for hand-made paper. It is the basis for an expanding cottage industry with an annual turnover of around NR10 million. The industry provides direct employment for about 1 500 families (Khatri 1994).

Lokta paper is used for many purposes, from legal documentation to record-keeping paper, religious scriptures, file folders, envelopes, greeting cards and calendars. The total domestic consumption as office paper comes to about 7.4 million sheets annually, or about 185 tonnes. Other end-users consume the remaining 115 tonnes. Nepali hand-made paper is consumed in local as well as international markets. From 1981 to 1985, UNICEF purchased about 1.6 million sheets

for greeting cards. The value of exports of hand-made paper has varied between NR0.2 million and NR1.2 million between 1982 and 1986 (Khatri 1994).

Table 10. Annual production of lokta paper

Fiscal year				
	1980/81	1981/82	1982/83	1983/84
Collection (kg)	4 766	11 850	21 072	35 000

Source: Acharya (1984)

Sabai grass (*Eulaliopsis binata*) is used traditionally in rope making, paper making and thatching. For paper making, sabai is reputed to be superior to most other available grasses. Small paper mills have been operating since 1986. These paper mills have been designed to take sabai grass and straw as raw material. These mills have a combined capacity of about 70 tonnes per day (Khatri 1994). Although the Indian paper industries have been using Nepal's sabai grass for a long time, after the establishment of paper industries in Nepal the Indian industries have been discouraged from purchasing Nepalese sabai. Thus there is now no significant export of sabai grass (Khatri 1994).

Bamboo is economically important both for rural and urban people as a construction material. Karki and Karki (1997) have listed 15 types of major bamboo species and their traditional uses. The largest bamboo in Nepal is in the genera *Bambusa* and *Dendrocalamus*. The smaller bamboo falls in the genera *Arundinaria* and *Thamnocalamus*.

Bamboo and cane are used extensively by the Nepalese for fodder, to make traditional baskets, mats and furniture, and for building in rural areas. The habitats of commercially exploitable bamboo and cane have been reduced to the brink of disappearance (Kathri 1994). At present there is no significant export of bamboo from Nepal.

Recent studies by Amatya (1997) and Amatya et al. (1998) showed that three types of rattan (*Calamus tenuis*, *Calamus leptospadix* and *Calamus acanthospathus*) are found in Nepal. Among them *Calamus tenuis* is used most widely and economically it is the most important. Rattan is used mainly in furniture. There are a few cottage industries that utilize rattan. The monthly turnover of these industries ranges from US\$35 to US\$107.

Other important fibres used in paper and rope making include *Girardinia diversifolia*, *Edgeworthia gardenieri*, *E. papyrifera* and *Agave* sp.

Exudates

Resin is tapped from pine trees and has great economic significance. It provides raw materials for domestic use and for the rosin and turpentine industries in Nepal. Oleoresin gums are obtained from the native chir pine (*Pinus roxburghii*) and blue pine (*Pinus wallichina*). Only chir pine can be tapped economically, yielding about 3 to 5 kg annually per tree. The estimated potential of pine resin in Nepal is about 21 700 tonnes per year (Khatri 1994).

Local production of rosin and its derivatives has provided much needed income to collectors in rural areas, and has reduced the need to import rosin and turpentine (Khatri 1994). Some rosin is exported to India.

Table 11. Annual production of rosin and turpentine

Year	Rosin production (kg)	Turpentine production (litre)
1996	2 397 017	600 300
1997	861 247	227 800
1998	1 835 248	501 100
1999	1 518 408	341 700

Source: Nepal Rosin and Turpentine Company Limited (2001)

Recently, forest user groups in community forestry have been collecting resins. The figure from Dhankuta District of east Nepal shows that production has been increasing in recent years.

Table 12. Production of resin

	Year	
	1998/1999	1999/2000
Production of resin (MT)	128.00	290.00

Source: Dev and Sizeland (2000)

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ANNEX 1. FOREST SERVICES

According to the report by Dr Swoyambhu Man Amatya, the only important non-wood service is grazing by livestock. Livestock grazing takes place throughout the year but there is no information on livestock types and the extent of the area grazed.

Since some valuable species of medicinal plants are facing the threat of extinction due to indiscriminate collection, national parks and wildlife reserves have been established to protect the natural ecosystem. National parks and wildlife reserves occupy 14 percent of the total land area (Rawal 1995).

QUANTITATIVE NWFP DATA OF NEPAL

Product			Resource				Economic Value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, Value	Remarks	References
	1, 2, 3				F, P, O	W, C				
Plant and plant products										
Food	1	Sal seed	<i>Shorea robusta</i>	se	F	W	N,I	1984–1986: average of 430 000 litres of seed oil and 3 500 MT of de- oiled cake		Jackson 1994
	1	Katha and kutch	<i>Acacia catechu</i>	hw	F	W	N,I	1988: 74 MT US\$15/kg		Edwards 1996
Fodder	1	Badahar	<i>Artocarpus lakoocha</i>	l	P,O	C	N	60–200 kg p/a		Upadhya 1991
	1	Khanyu	<i>Ficus semicordata</i>	l	P,O	C	N			Pandey 1982
	2	Nebharo	<i>Ficus auriculata</i>	l	P,O	C	N	60–80 kg p/a		Amatya 1990
	3	Dhudhilo	<i>Ficus nerifolia</i>	l	P,O	C	N			Jackson 1994
	3	Gogan	<i>Saurauria nepaulensis</i>	l	P,O	C	N			Amatya 1990
	3	Khasru	<i>Quercus semecarpifolia</i>	l	F	W	N			Amatya 1990
	3	Kutmero	<i>Litsea monopetala</i>	l	P,O	C	N			Amatya 1990
Medicinal and aromatic plants	1	Kutki	<i>Picrorhiza scrophulariiflora</i>	ro, st	F, O	W	N, I	47 MT in 1997/98		Dept. of Forests 1998
	1	Chiraitio	<i>Swertia chiraita</i>	pl	F, P, O	W, C	N, I	286 MT in 1997/98		Dept. of Forests 1998
	1	Timur	<i>Zanthoxylum armatum</i>	se	F	W	N,I	260 MT in 1993/94		Dept. of Forests 1995

Product			Resource				Economic Value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, Value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plant and plant products										
	1	Yarsa gumba	<i>Cordyceps sinensis</i>		O	W	N,I	In India sold at NR28 000/kg In remote districts sold at NR3 to 5 per piece		Amatya 2001
	1	Panch aule	<i>Dactylorhiza hatagirea</i>		O	W	N,I	In India sold at US\$12–20/kg		Amatya 2001
		Sarpagandha	<i>Rauwolfia serpentina</i>	ro	F,O	W,C	N,I	50 MT exported in 1996		Edwards 1996
	1	Tejpat	<i>Cinnamomum tamala</i>	le	F	W	N,I	101 MT in 1997/98		Dept. of Forests 1998
	1	Dalchini	<i>Cinnamomum janicum</i>	ba	F	W	N,I	87 MT in 1997/98		Dept. of Forests 1998
	1	Ritha	<i>Sapindus mukuorossi</i>	fr	F,O	W, C	N, I	1 043 MT in 1997/98		Dept. of Forests 1998
	1	Kurilo/ Satawari	<i>Asparagus racemosus</i>	ro	F	W	N,I	27 MT in 1997/98		Dept. of Forests 1998
	1	Nagbeli	<i>Lycopodium clavatum</i>	pd	F	W	N	34 MT in 1997/98		Dept. of Forests 1998
	1	Lauth salla	<i>Taxus baccata</i>	le	F	W	N,I	253 MT in 1997/98		Dept. of Forests 1998
	2	Guche chau	<i>Morchella corina</i>	pl	F	W	N,I	100 MT in 1995		New Era 2001
	3	Atis	<i>Delphinium himalayai</i>	pl	F,O	W	N	2 800 MT in 1995		New Era 2001
	1	Jatamasi	<i>Nardostachys jatamansi</i>	ro	F, O	W	N, I	97 MT in 1997/98		Dept. of Forests 1998

Product			Resource				Economic Value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, Value	Remarks	References
	1, 2, 3				F, P, O	W, C				
Plant and plant products										
	2	Sugandhawal	<i>Valeriana jatamansi</i>	ro	F,O	W	N,I	48 MT in 1997/98 22 MT in 1996/97		Dept. of Forests 1998
Dyeing and tanning	1	Majito	<i>Rubia manjith</i>	p	F	W	N, I	87 MT in 1997/98 105 MT in 1996/97		Dept. of Forests 1998
	1	Padamchal	<i>Rheum emodi</i>	ro	F,O	W	N	18 MT in 1997/98	Plantations: 13 557 seedlings in 1999 17 000 seedlings in 2000	Dept. of Forests 1998
Utensils, handicrafts, construction materials	1	Lokta	<i>Daphne bholua,</i> <i>Daphne papyracea</i>	ba	F	W	N, I	700 000 sheets in 1984, 1983/84: 35 000 kg of paper		Jeanreneud 1984 Acharya 1984
	2	Leyas/ murali	<i>Ampelocalamus patellans</i>	st	F	W	N	Average 3 culms p/a		Karki and Kari 1996
Exudates	1	Khoto	<i>Pinus roxburghii</i>	rn	F,P	W	N,I	1 518 MT of rosin; 3 41 MT of turpentine produced in 1999		Nepal Rosin & Turpentine Co. 2001

Importance:

1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance

Parts used:

an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums;
ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins; heartwood (hw); shoot (sh);
tuber (tub)

Habitat:

F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)

Source:

W – wild, C – cultivated

Destination:

N – national; I – international

PAPUA NEW GUINEA

INTRODUCTION

Main non-wood forest products

The most important NWFP of Papua New Guinea are food from plants (tubers/corms, fruits, nuts and vegetables), mushrooms, medicinal plants, rattan, bamboo and orchids. Other important NWFP include bushmeat, copal gum, vatica, massoy bark, tannins and insects (butterflies).

General information

Papua New Guinea has some of the richest flora and fauna in the world. There are about 9 000 species of higher plants including 1 500 trees. Nearly 90 percent of the population of 3.5 million lives in rural areas, where most basic needs are met through gathering and hunting in forests for food (fruits, roots, wild animals), fibres, medicines and culturally important products such as adornments like feathers of birds (Srivastava 1994). The utilization of NWFP has great potential but is very neglected (Saulei and Aruga 1994).

PLANTS AND PLANT PRODUCTS

Food

The staple food items of Papua New Guineans are mainly carbohydrate-rich sweet potato (*Ipomea batatas*), taro (*Colocasia esculenta*), yams (*Dioscorea* spp.), sago (*Metroxylon* sp.) and bananas (*Musa* sp.). Much of the supplementary food (green vegetables, fruits and nuts) is collected from the wild, like *Hibiscus manilot*, edible grasses (*Setaria palmifolia*, *Saccharum edule*), spinach (*Amaranthus hybridis*, *A. tricolor*, *A. viridis*), *Oceanthe javanica*, *Solonum nigrum*, *Rungi klossii*, sugarcane (*Saccharum officinarum*), breadfruit (*Artocarpus altilis*), coconut (*Cocos nucifera*), *Barringtonia* spp., *Pandanus* spp., *Canarium* spp. and *Terminalia* spp. (Shrivastava 1995).

Powel (1976) (in Saulei and Aruga [1994]) listed some 251 species of food plants in Papua New Guinea of which 157 species (73 percent) were collected from savannahs, forests and grasslands; 51 species (20 percent) were both harvested from the wild and cultivated, and 43 (17 percent) were only cultivated. Seventy-six species were used as supplementary vegetables, the most important being *Gnetum gnemon*, *Amaranthus* spp., *Colocasia esculenta*, *Setaria palmifolia* (Koenig) Stapt., *Cucumis* spp. and ferns (*Asplenium*, *Athyrium*, *Ctenitis*, *Cyathea* and *Dryopteris*).

Shiitake (*Lentinus edodes*) is a mushroom that occurs naturally in Papua New Guinea. It is a very popular food in Southeast Asia, China and Japan and also in some other countries. Shiitake grows on the deadwood of oak and beech trees (both from the family Fagaceae). Cultivation of shiitake is very profitable and can increase the incomes of farmers remarkably. One cubic meter of log can produce five kilogrammes of dried mushroom annually for four to five years after initial inoculation; the annual income obtained ranges from K1 500 to 2 040 (when the export price is K10–12/kg) (Shrivastava 1995).

Sago palm (*Metroxylon* spp.) has very high contents of starch in its trunk and the sago flour is an important staple food for coastal communities. The species *Metroxylon sagu* and *M. rumphii* are the most important species. Riechert (1986) estimated that the annual consumption of sago starch in Papua New Guinea could be 15 000 tonnes (Shrivastava 1995). Sago leaves are used for thatching

house roofs and walls, the fronds for wall cladding, the midribs for fish traps and the pith offers an excellent substrate for mushrooms and sago grubs (Saulei and Aruga 1994).

Powel (1976) (in Saulei and Aruga [1994]) has listed 48 species of plants that serve as fruits in Papua New Guinea. Important fruit plants include breadfruit, *Syzygium malaccense* L., *S. aquem* (Burm.f.) Alston., *Paratocarpus venenosa* (Zoll. & Mor.) Becc., *Berckella* spp., *Diospyros* spp., *Garcinia* spp., *Gnetum gnemon* L., *Magnifera minor* Bl., *Morinda citrifolia* L., *Spondias dulcis* Forst. and *Pangium edule* Reinw. Additionally, *Mangifera indica* L., *Citrus* spp., *Ammona* spp., *Ananas* spp., *Carica papaya* L., *Psidium* spp. and *Cucumis* spp. are cultivated and utilized by local people.

Saulei and Aruga (1994) have listed some 25 plant species that produce edible nuts which are used as seasonal supplementary food.

Medicines

Powel (1976) (in Shrivastava 1995) has provided a list of 22 plant species and their medicinal uses in Papua New Guinea. Moreover, Nick *et al.* (1995) have provided a list of 17 species of medicinal plants used in the traditional medicine. Mebs (1999) studied the traditional use of plants to treat snake bites in northern Papua New Guinea and identified six species. Further, Saulei and Aruga (1994) have listed some 55 medicinal plant species.

Perfumes and cosmetics

The tree species of Massoy (*Cryptocarya massoy*) and Lawag (*Cinnamomum* spp.) yield essential oils (Shrivastava 1995) but there are no records on their production and trade.

Dyeing and tanning

A number of trees (e.g. *Rhizophora*, *Brugueira* and *Acacia* spp.) produce tannin but no tannin production occurs in the country (Shrivastava 1995). Traditionally tannins have been used for body decoration or personal effects (Saulei and Aruga 1994).

Utensils, handicrafts and construction materials

Papua New Guinea is famous for its artifacts. A number of plant species, especially ebony (*Diospyros* sp.) and *Anthocephalus chinensis*, are used for artifacts and musical instruments, which are exported too. Species commonly used for house construction, canoes and artifacts include *Alstonia scholaris*, *Areca catechu*, *Artocarpus* sp., *Breynia racemosa*, *Burkella obovata*, *Capyphyllum inophyllum*, *Cissus* sp., *Duckera taitensis*, *Flagellaria indica*, *Maranthes corymbosa*, *Octomeles sumatrana*, *Pandanus conoideus*, *Pometica pinnata*, *Sterculia ampla*, *Sterculia shillinghawaii*, *Tarena paveta*, *Terminalia megalocarpa* and *Zanthoxylum pluviatile* (Shrivastava 1995).

Nipa palm (*Nypa fructicans*) is used for a variety of end-uses including construction, tying, fuel, drinks and food (Shrivastava 1995).

In 1994 a total of 27 bamboo species (from the genera *Bambusa*, *Nastus*, *Recemobambus*, *Schizostachyum* and *Buergersiochloa*) were reported. Bamboos are used by rural communities for housing, fencing, gardening, agricultural implements, musical instruments, fishing and hunting tools. Because of the lack of information on their properties, for instance, bamboo products have not been commercialized (Shrivastava 1995).

About 60 to 100 rattan species have been estimated to exist in Papua New Guinea. There are vast resources especially in the Sepik and Gulf provinces (Saulei and Aruga 1994). *Calamus hollrungii*, *C. warburgii*, *C. schlechterianus* and *Korthalsia brasii* have been identified as the most common species. Extraction of rattan in the forests is carried out mostly by the landowners. Rattan is used by rural communities for various articles and attempts have been made to develop small-scale industries. From 1985 to 1990 a number of initiatives to develop the rattan-based cottage industry took place (Shrivastava 1995). The boom in rattan exports is largely because of export bans on raw rattans from Indonesia, Malaysia and the Philippines (Saulei and Aruga 1994).

Table 1. Exports of rattan, 1988 to 1992

Year	Volume (MT)	Value(FOB)K'000
1988	98	45.4
1989	Na	Na
1990	65	40.3
1991	394.2	226.2
1992	108.5	75.8

Source: Timber Digest (1988–1992) in Shrivastava (1995)

Exudates

Kauri (*Agathis labillardieri*) is a source of copal (often called Manila copal in the market). Copal has been exported to Europe and Singapore for some time (Shrivastava 1995), but no recent records on production and trade exist.

Vatica papuana is the source of dammar hiru or vatica resin (Shrivastava 1995). No current records are available on its production and trade.

Others

Over 2 746 species of orchids belonging to 148 genera have been reported. According to some estimates Papua New Guinea may have about 65 percent of the world's population of orchids and many of the genera and species still need to be identified. Two of the largest genera include *Dendrobium* and *Bulbophyllum* (Shrivastava 1995).

A total ban on the export of orchids collected from the wild was enforced in 1990 by the Department of Environment and Conservation (DEC); it permitted collection and export of cultivated orchids only. Some village farms were established in the late 1970s to attract tourists. Flowers on these farms were being sold at K2.00 whilst the National Capital District Botanic Garden (NCDBG) was exporting the flowers at K10.00 (Kabaru 1992). Although the village farms have not functioned as envisaged, tourism potential is often associated with orchid cultivation. The value of the domestic cut-flower trade has been evaluated at upwards of K50 000 annually (Shrivastava 1995).

No recent figures on trade on massoy (*Cryptocarya* spp.) bark exist although trade is supposed to exist (Saulei and Aruga 1994). The same applies to trade on sandalwood (*Santalum magregorii* F. Muell.).

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

Shrivastava (1995) reported that beekeeping is becoming popular among smallholder cooperative projects in the highlands and the villagers involved have been provided with training and support.

Bushmeat

Liem and Haines (1977) in Shrivastava (1995) have provided a list of 25 wildlife species utilized by the rural communities. Birds and animals are hunted for their meat. The hides and feathers of many animals are used for clothing and decoration and are valued highly in traditional exchanges. Wildlife has become an important source of cash for many villagers; a live cassowary is valued at US\$1 620 (Saulei and Aruga 1994).

Other edible/non-edible animal products

According to Shrivastava (1995) there are good prospects for developing small village-based projects on insect farming. Papua New Guinea has a very rich insect population; for example, butterflies are amongst the most popular souvenirs from the country (Shrivastava 1995). Butterfly farming was started in 1974 in the Garaina area of Morobe Province and in 1994 there were around 500 farmers engaged in the industry over the whole country. The Insect Farming and Trading Agency, responsible for the exports, pays the collectors a rate of US\$1 to US\$20, depending on the rarity of the species (Saulei and Aruga 1994). Mercer (1989) (in Saulei and Aruga 1994) estimated the annual value of the butterfly trade to be US\$250 000.

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ANNEX 1. FOREST SERVICES

Wildlife has a symbolic significance, and plays an important role in villagers' everyday lives. Different clans have special relationships with particular species which serve as their totems. Wildlife therefore contributes to the cultural identity of the villagers (Saulei Aruga 1994).

QUANTITATIVE NWFP DATA OF PAPUA NEW GUINEA

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food		Shiitake	<i>Lentilus edodes</i>		F, P	W, C	N, I		Household income at K1 500–2 040 p/a when export price is K10–12	Shrivastava 1995
		Sago	<i>Metroxylum</i> spp.	pl					Consumption of sago starch p/a could be 15 000 MT	Shrivastava 1995
Utensils, handicrafts, construction materials		Rattan	<i>Calamus hollrungii</i> <i>C. warburgii</i> <i>C. schlechterianus</i> <i>Korthalsia brasii</i> etc				N, I	Export of 108.5 MT (FOB K758 000) in 1992		Shrivastava 1995
Others		Orchids	<i>Dendrobium</i> spp. <i>Bulbophyllum</i> spp.	fl	F, P	W, C	N, I	Value of cut-flower trade has been evaluated upwards of K50 000 p/a		Shrivastava 1995
Animals and animal products										
Bushmeat		Cassowary						A live cassowary is valued at US\$1 620		Saulei and Aruga 1994
Other edible/non-edible animal products		Butterflies				W, C	I	Estimated value of butterfly trade: US\$250 000		Saulei and Aruga 1994

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
 Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
 Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
 Source: W – wild, C – cultivated
 Destination: N – national; I – international

PHILIPPINES

INTRODUCTION

Main non-wood forest products

The most important NWFP of the Philippines are rattan, bamboo, fibres, vines, palms and exudates. Other NWFP include essential oils, dyes, wild food plants, medicinal plants, honey and butterflies.

General information

In the Philippines, NWFP are classified and referred to as “minor forest products”. They are an important source of food for rural people, the principal source of fibre and forage and a valuable raw material for furniture and handicraft manufacture in the cottage industry. NWFP are also used in the manufacture of pulp and paper, plastic, paint and varnish, soap and shampoo. These products are also important sources of materials for low-cost housing, food and beverages, clothing materials, medicine and other valuable products. NWFP have provided people who live in or near forest lands, especially subsistence upland farmers and the unemployed or underemployed in the lowlands, with sources of income (Neri 1994).

The Philippine Forestry Statistics contains production figures for certain NWFP (trade and market values are not included).

Table 1. Production of selected NWFP from 1990 to 1998 (in thousands of units, kg or by piece)

NWFP	1990	1991	1992	1993	1994	1995	1996	1997	1998
Almaciga resin (1000 kg)	943	780	634	576	1 231	1 059	890	310	261
Anahaw leaves (pc)	2	41	33	42	10	14	10	34	19
Bamboo (pc)	984	892	704	475	360	307	627	183	448
Buri midribs (pc)	58	16	-	-	-	42	15	2	2
Elemi (kg)	-	8	-	-	-	-	13	-	-
Hinggiw (kg)	-	-	-	-	-	2	-	-	-
Nipa shingles (pc)	8 023	14 719	12 634	9 018	6 283	8 332	8 429	4 899	6 745
Diliman and other vines (kg)	89	104	163	84	90	66	381	33	-
Salago bark (kg)	6					-	-	-	-
Split rattan (1000 kg)	10	568	30	1	4	24	17	2	5
Tanbar (kg)	30							-	-
Unsplit rattan (lm)	19 266	25 732	22 693	24 845	19 088	17 457	24 613	19 519	10 463

Source: Philippine Forestry Statistics (1998)

Most NWFP are gathered from the forest although many plants are domesticated and are grown in backyard gardens by indigenous people, upland settlers and also by the urban populace.

While some NWFP are exported in raw form, others are utilized by the gatherers themselves or sold to local processors or manufacturers. Most of the processors are cottage-type or backyard-level industries employing not more than 20 workers. There are about 250 medium to large firms which are involved primarily in the manufacture of rattan and bamboo furniture for export. With the declining importance of wood-based industries, and the prospect of more restrictive logging bans, attention has shifted to the development of NWFP-based industries. Wasteful utilization and the destruction of much of the country's forests have also resulted in the depletion of several NWFP (Neri 1994).

At present, there is a growing export demand for finished and semifinished products such as Philippine rattan furniture, baskets and other native products made of indigenous raw materials such as vines, barks, roots and bast fibres. Other manufactured NWFP exports include buri and pandan placemats, handbags, wallets, purses and similar articles of palm and bamboo, buntal and buri hats. The total export value in 1998 for basketwork (wickerwork), Christmas decorations and other manufactured materials were US\$66 189 066; US\$83 345 578 and US\$14 006 498, respectively (DTI Markets of Philippine Merchandise Exports, January to September 1997/1998). On the other hand the total export values for selected NWFP-based furniture in 1998 were US\$1 436 368; US\$79 475 485 and US\$1 606 138 for bamboo furniture, rattan furniture and buri furniture, respectively (Philippine Forestry Statistics 1998).

The extraction and gathering of NWFP on forest land is regulated legally by the government through the issuance of licences or permits, but an undetermined quantity of NWFP is extracted illegally (Neri 1994).

PLANTS AND PLANT PRODUCTS

Utensils, handicrafts, construction materials

There are about 62 species of rattan found in the Philippines and 12 of these are of commercial value: (palasan (*Calamus merrillii*); limuran (*C. ornatus* var. *philippinensis*); tumalim (*C. mindorensis*); sika (*C. caesius*); panlis (*C. ramulosus*); malacca cane (*C. scipionum*); lambutan (*C. halconensis*); apas or lukuan (*C. reyesianus*); kurakling (*C. microsphaerion*); tagiktik (*C. filispadix*); ditaan (*Daemonorops mollis*) and hiyod (*D. pedicellaris*).

Rattan has played a major role in the economy of the Philippines' flourishing furniture and handicraft industry. The rapid growth and expansion of the rattan industry has caused a heavy drain in the domestic supply of rattan canes. From 1993 to 1997 rattan furniture and handicraft exports earned a total of US\$600 million (Philippine Forestry Statistics 1997) growing at 14 percent annually in the same period. Rattan products were exported to the United States, Japan, Australia, the United Kingdom and France. Similarly within that period, the Philippines imported from China, Hong Kong and Singapore approximately US\$2.8 million of raw rattan poles to supplement the local supply.

Regulations have been applied to rationalize the development of the rattan industry. Separate areas are allocated for large and small entrepreneurs. If the rattan production areas are within lands reserved for or occupied by tribal groups, priority is given to the tribal groups (Neri 1994). However, illegal harvesting of high quality rattan canes still continues.

There are around 32 species of bamboo found in the Philippines. Bamboo species suitable for furniture, handicrafts, and novelty items are: kauayan tinik (*Bambusa blumeana*); kauayan kiling (*B. vulgaris*); giant bamboo (*Dendrocalamus asper*); bayog (*D. merrilianus*); kayali (*Gigantochloa atter*); bolo (*G. levis*) and buho (*Schizostachyum lumampao*) (PCARRD 1991).

Bamboo areas are estimated to range from about 39 000 to 52 000 ha. It is distributed physically as follows: 20 500 to 34 000 ha from forest land; 2 236 ha from government plantations; 3 037 ha from private plantations and 13 434 ha from natural stands. From these bamboo stands, the projected potentially available culm production ranges from 29 million to 52 million poles harvested every year (Virtucio *et al.* 1983; RP-German Forest Resources Inventory Project).

Bamboo export consists mainly of basket/basketware (92.47 percent) and furniture (7.41 percent). Philippine bamboo is exported to 36 countries. The United States is the single biggest market for furniture. Other major buyers are Spain, France, Australia, Italy and the Netherlands (FOSTER-Asia 1998).

Palms, for example buri (*Corypha elata*), nipa (*Nypa fruticans*), kaong (*Arenga pinnata*), anahaw (*Livistonia rotundifolia*) and sago (*Metroxylon sagu*) and vines such as hinggiw (*Ichnocarpus frutescens*), diliman (*Stenochlaena palustris*), lukmoy (*Rhapidophora monticola*) and nito (*Lygodium circinnatum*) are well represented in the Philippines. Palms are as important as bamboo and rattan. There are about 123 native palm species in the Philippines plus other introduced palms classified as either “climbing” or “erect” and about 149 vines and bast fibre species. These are the primary raw materials for the basketry industry. Ninety percent of the total production of the basketry industry is for export (DOST 1996).

Palms have several uses. For instance nipa (*Nypa fruticans*) sap can be used for alcohol, wine, sugar and vinegar; its leaves can be used for bags and hats; its fruits are used as medicine for intestinal worms; leaves are also used to make shingles for roofing and walls for low-cost houses; the midribs are made into brooms and the petioles are used as fuel. The fermented juice is a popular local drink (Neri 1994). In 1998 the production of nipa shingles was 6 746 000 pieces (Philippine Forestry Statistics 1998).

In 1998 exports of buri were 13 708 kg (US\$38 580) (Philippine Forestry Statistics 1998).

Production of anahaw leaves decreased from 48 000 in 1981 to 19 000 pieces in 1998. The trunk of the anahaw is used for handicrafts, utensils and construction materials; the leaves are used for roofing, the buds are eaten and the plant is also used as an ornamental.

Diliman (*Stenochlaena palustris*), nito (*Lygodium* spp.), lukmoy (*Pothos* spp.) and baling-uai (*Flagellaria indica*) are some of the more important climbers. Diliman is used chiefly as tying material in the preparation of fish traps because of its durability in salt water. It is also used for making ropes and baskets. Nito is the name used for different species of *Lygodium*, although the most common and widely used species in the country is *Lygodium circinnatum*. It is used in the manufacture of baskets, hats, bags and other fancy articles. The central cylinders of the roots of *Pothos* are used in baskets. Baling-uai is a vine used in tying, in sewing nipa shingles and in making baskets (Neri 1994).

Salago (*Wikstroemia* spp.) is a shrub with an exceptionally high fibre potential. Fibres extracted from its bark are excellent materials for the manufacture of high grade paper used in bank notes, cheques, paper for legal documents and other specialty papers requiring strength and durability. Four species of this genus are known for their quality fibres, namely: small leaf salago

(*Wikstroemia indica*); lance leaf (*W. lanceolata*); large leaf salago (*W. meyeniana*) and round leaf salago (*W. ovata*) (Brown 1921).

Table 2. Salago plantations areas

Region	Total area (in ha)
Ilocos (Region 1)	1.70
Southern Tagalog (Region IV)	16.44
Bicol (Region V)	199.00
Western Visayas (Region VI)	284.12
Central Visayas (Region VII)	1 153.77
Eastern Visayas (Region VIII)	45.31
Eastern Mindanao (Region IX)	10.05
Northern Mindanao (Region X)	305.25
Southern Mindanao (Region XI)	7.59
Total	2 023.23

Two manufacturers of handmade paper in Cebu City are exporting salago products (i.e. slippers and ladies' bags for export to Germany). The average export price for salago fibre was observed to be increasing steadily from 1986 to 1990. In 1998 a total of 645 840 kg of salago bark valued at US\$443 990 were exported to China, Japan, Korea and Thailand.

In the Philippines, there are 40 known species of pandan (*Pandanus*). Among the most important pandan species in the Philippines are: bariu (*Pandanus copelandii*); taboan (*P. dubius*); alabas (*P. uzonensis*); oyango (*P. radicans*); sabutan (*P. sabotan*); karagomoi (*P. simplex*); common or beach pandan (*P. tectorius*) and pandan layugan (*P. exaltatus*).

The pandan leaves are used for making coarse and fine baskets, bags, hats, mats, picture frames and other novelty items. Pandan leaves are good material for making low-cost cocoon frames for silkworm production. The wood of some pandan species is also used in the manufacture of splints for making baskets.

It is estimated that there are 58.88 billion stems of pandans in the Philippines. Pandan placemats are exported to Canada, French Polynesia, Hong Kong, Singapore, Turkey and the United States. In 1998, the total export of pandan placemats was 56 770 pieces, valued at US\$(FOB)90 934.00 (Philippine Forestry Statistics 1998).

Exudates

Gum- and resin-producing plants, such as: piling liitan (*Canarium luzonicum*); Almaciga/Manila copal (*Agathis philippinensis*); Benguet pine (*Pinus kesiya*); apitong (*Dipterocarpus grandiflorus*) and Manila elemi (*Canarium luzonicu*) are distributed widely in open areas and in second growth forests throughout the Philippines.

Resins and gums (especially Manila copal and Manila elemi) are the main NWFPE exported in raw form. Almost all resins that are produced are exported. In 1998, 355 000 kg of Almaciga resin with an FOB value of US\$254 000 and 221 000 kg of Manila elemi with an FOB value of US\$448 000 were exported. There are insufficient processing factories in the country.

Table 3. Export of Manila copal and Manila elemi from 1990 to 1998

Year	Manila copal		Manila elemi	
	Quantity (1 000 kg)	Value (US\$FOB1000)	Quantity (1 000 kg)	Value (US\$FOB1000)
1998	355	254	221	448
1997	281	365	162	436
1996	326	258	353	947
1995	328	252	259	621
1994	387	249	269	464
1993	382	243	330	686
1992	273	164	176	295
1991	363	242	146	251
1990	288	211	611	1 064

Source: Philippine Forestry Statistics (1998)

Medicines

More than 80 percent of the Philippine population uses herbal remedies. Most original information on drug-producing plants is derived from traditional practitioners, known locally as *herbolario*.

The creation of the National Integrated Research Program on Medicinal Plants (NIRPROMP) has provided scientific groundwork for the development of herbal medicines in the Philippines. Through this programme, four herbal pharmaceutical plants were established in the Philippines (i.e. Tuguegarao and Cagayan in Luzon Island, Tacloban City in Visayas Island and Cotabato City in Mindanao Island). At present, the production of these four Department of Health (DOH) plantations is limited to the following herbal drugs: *lagundi* (*Vitex negundo*), *sambong* (*Blumea balsamifera*), *yerba buena* (*Mentha cordifolia*) and *tsaang gubat* (*Carmona retusa*) (Board of Investment-Department of Trade and Industry 1999).

The exports of herbal products are minimal. Various countries such as China, Romania, Iran and Iraq have shown interest in importing herbal medicines such as *lagundi* and *sambong* from the Philippines.

Perfumes and cosmetics

More than 50 plants have been identified to contain essential oils. Plants that have the potential for commercial extraction include *citronella* (*Andropogon nardus*), *salai/tanglad* (*Cymbopogon citratus*), *moras* (*Vetiveria zizanioides*), *ilang-ilang* (*Cananga odorata*), *kalingag* (*Cinnamomum mercadoi*), *lumbang* (*Aleurites moluccana*) and *baguilumbang* (*Aleurites trisperma*) (DOST 1992; Neri 1994). Due to inefficient manufacturing practices, the essential oil industry of the Philippines has to import more than 90 percent of its raw materials. The cosmetics and pharmaceutical industries imported essential oil products worth US\$96.5 million in 1997 (Bureau of Export Trade Promotion, Department of Trade and Industry 2000).

Herbal soaps and shampoos and other care products are becoming popular too, especially with the urban populace.

Dyeing and tanning

Plant dyes are used for colouring mats, textiles and in food products. For instance, the highlanders of Mindanao use *sikalig* (*Morinda bracteata*), *sibukao* (*Caesalpinia sappan*) and *talisay* (*Terminalia catappa*). *Sappan wood* (*sibukao*) from *Caesalpinia sappan* has been exported.

ANIMALS AND ANIMAL PRODUCTS

Honey

Annually, NATRIPAL (United Tribes of Palawan) is marketing 200 to 300 gallons of honey mostly to local tourist markets and traders in Manila. In 1997 deliveries of honey totalled six tonnes.

Medicine

Demand for monkeys as experimental animals (a source for polio vaccine) and the legal phase-out on the collection and trade of wild monkeys have encouraged commercial companies to engage in the captive breeding of monkeys. Six companies are involved in the trade of animals for experiments.

Other non-edible animal products

Butterflies (e.g. *Graphium agamemnon*) are bred and traded in commercial quantities and exported as pupae and dried adult specimens (DENR-UNEP 1997).

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ANNEX 1. FOREST SERVICES

Mangrove ecosystems and national forest parks provide various benefits. Mangroves provide nursery grounds for fish, prawns and crabs and support for fishery production in coastal waters. They serve as recreational areas for bird watching and wildlife observation. National forest parks have aesthetic, recreational, sociocultural, scientific, educational, spiritual and historical values.

Table 4. Visitors to selected protected areas in the Philippines

Region/name of park/protected area	Number of visitors		Total number of visitors	Income generated (in pesos)
	Local	Foreign		
National Capital Region (NCR) Ninoy Aquino Parks and Wildlife Nature Center	380 689	0	390 689	3 332 088
Region 1 Bessang Pass National Park	12	1	13	2 340
Cordillera Autonomous Region (CAR) Mt Pulag National Park Mt Data National Park	1 237 1 855	0 1 809	1 237 3 664	63 625 0
Region 2 Mt Pulog National Park Penablanca Protected Landscape (formerly Callao Cave National Park)	200 8 957	0 176	200 9 133	11 225 0
Region 3 Angat Game Refuge and Game Sanctuary Mt. Arayat National Park	54 5 225	4 549	58 5 774	0 54 350
Region 4-A Mainland Aurora National Park Mt Palay-palay Mataas na Gulod Mt Banahaw-San Cristobal (Quezon Side) Alibjaban Island Wilderness Area	24 521 0 14	0 0 0 0	24 521 0 14	0 2 367 0 0
Region 4-B Mt Iglit-Baco National Park	62	2	64	0
Region 5 Bicol National Park Mayon Volcano National Park Mt Isarog National Park Libmanan Caves National Park Bongsalay Mangrove Forest Reserve Bulusan National Park	2 490 9 308 6 481 399 224 1 159	0 25 0 1 0 19	2 490 9 333 6 481 400 224 1 178	31 500 13 585 32 975 1 420 0 12 775
Region 6 Bulabog Putian National Park Sampunong Bolo Bird Sanctuary Silay Outdoor Recreation Area (SORA)	11 664 266 9 080	13 0 4	11,677 266 9,084	0 0 0
Region 7 Olango Island Wildlife Sanctuary Apo Island Protected Landscape	2 718 783	185 1 371	2 903 2 154	47 453 68 655
Region 8 Mahagnao Volcano Lake Danao National Park	212 837	21 75	233 912	0 9 023
Region 9 Mt Dajo	0	0	0	0
Region 10 Initao Mt Kitanglad Range	6 062 1 255	4 35	6 066 1 290	41 029 37 225
Region 11 Mt Apo	14	17	31	0
Region 12 Sacred Mountain Mt Apo National Park	0 0	0 0	0 0	0 0
Region 13 Agusan Marsh Wildlife Sanctuary Siargao Is. Prot. Landscape & Seascape	115 2	11 7	126 9	0 930.00

Source: Quarterly Regional Statistical Report 1999 (compiled by: Management Information System and Statistics Unit, Planning Staff, Parks and Wildlife Bureau, DENR)

QUANTITATIVE NWFP DATA OF THE PHILIPPINES

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Utensils, handicrafts, construction material	1	Rattan	<i>Calamus</i> spp. <i>Daemonorops mollis</i> ; <i>D.pedicellaris</i>	st	F	W	N, I	10 463 lm of unsplit rattan and 5 000 kg of split rattan in 1998 Exported less than 1 000 kg valued at US\$ (FOB)3 000 in 1998		PCARRD 1991; Philippine Forestry Statistics 1998; Neri 1994
	1	Bamboo	<i>Bambusa blumeana</i> <i>B.vulgaris</i> <i>Dendrocalamus asper</i> <i>D. merrilliana</i> <i>Nusa</i> <i>Gigantocloa atter</i> <i>G.Levis</i> <i>Schizostachyum lumampao</i>	st	F, P	C	N, I	448 000 pcs in 1998 Exported 12 000 kg valued at US\$ (FOB) 27 000 in 1998		PCARRD 1991; Philippine Forestry Statistics 1998; DENR AO No. 200-63; Neri 1994
Palms	1	Buri (raffia)	<i>Corypha elata</i>	pl	F, P	W, C	N, I	2 000 pcs of buri midrib in 1998 198 298 pcs of buri place mats exported at US\$ (FOB) 101 456 in 1998; 13 708 kg of buri raffia exported at US\$(FOB)38 580 in 1998. Other articles exported at US\$(FOB) 44 032 868		Serrano 1988; Philippine Forestry Statistics 1998; Neri 1994
	1	Nipa	<i>Nypa fruticans</i>	pl	O	W	N, I	6 746 000 nipa shingles in 1998		Serrano 1988; Philippine Forestry Statistics 1998; FAO 1997; Neri 1994

	1	Anahaw	<i>Livistonia rotundifolia</i>	pl	F	W	N, I	Production of anahaw leaves decreased from 48 000 pcs in 1981 to 19 000 pcs in 1998	An estimated 39 million anahaw palms remain	Neri 1994
	2	Pandans	<i>Pandanus</i> spp.	le, st	F,O	W	N,I	56 770 pieces of placemats exported at US\$(FOB) 90 934 in 1998	58.88 million stems of pandan	Neri 1994; Philippine Forestry Statistics 1998; Serrano 1988
	1	Phil. Gampi Salago	<i>Wikstroemia indica</i> <i>W. lanceolata</i> <i>W. meyeniana</i> <i>W. ovata</i>	ba	F	W	N, I	1998: a total of 645 840 kg of salago bark valued at US\$ 443 990 exported to China, Japan, Korea and Thailand.		Asia Pacific Center for Research 1994; Phil. Forestry Stat. 1998; Serrano 1988
		Salago bark						Export of 645 840 kg in 1998 valued at US\$ 443 990		Phil. Forestry Stat. 1998
	1	Hinggiw	<i>Streptocaulon baumii</i>	st	F	W	N,I	2 000 kg in 1995 Exports to Taiwan, USA and European countries	Locally basket tray production has a net income of P290 680 p/a	Gonzales 1995
	1	Diliman	<i>Stenochlaena palustris</i>	st, le	F	W	N, I	33 000 kg of diliman and other vines in 1997		Escobin <i>et al.</i> 1998; Decena 1992
Exudates	1	Manila copal	<i>Agathis philippinensis</i>		F	W, C	N, I	261 000 kg of Almaciga resin in 1998 Exported 355 000 kg valued at US\$(FOB) 254 000 in 1998	Almost all Almaciga resin produced from <i>Agathis philippinensis</i> is exported	Bawagan 1988; Lapis 1988; Neri 1994

	1	Manila elemi	<i>Pinus kesiya</i> <i>Canarium</i> <i>luzonicum</i> <i>C. asperum</i>		F F	W, C W, C	N, I N, I	Exported 221 000 kg of elemi gum valued at US\$ (FOB) 448 000 in 1998	As of 1990, the country's pine forest estimated at 236 400 ha of which 128 300 ha are closed canopy forest and 108 100 ha are open canopy forest Greatest demand for Manila elemi in Europe (France almost 75% of the total exports each year).	Neri 1994
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Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey	1	Honey	<i>Apis dorsata</i> <i>Apis cerana</i>				N	NATRIPAL marketed 200–300 ga p/a (local tourist market, traders in Manila) In 1997 deliveries of honey totalled 6 MT		Guerrero 1999

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums;
ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

SRI LANKA

INTRODUCTION

Main non-wood forest products

The most important NWFP in Sri Lanka are rattan, bamboo, medicinal plants and kitul products. Other important NWFP in Sri Lanka are edible plants, honey and grazing.

General information

According to the Forest Ordinance of Sri Lanka the following materials are declared "non-wood forest produce":

- Leaves, flowers and fruit, seeds, juice, catechu, wood oil, resin, natural varnish, bark, lac, gum and myrabolans.
- Plants that are not trees, including grass, creepers, reed moss and all parts or produce of such plants.
- Tusk horns, shed horns and edible bird nests.
- Peat, surface soil, rocks and minerals, including limestone, laterite, bitumen, bituminous shale, asphalt, mineral oils and all products of mines or quarries (Bharathie 1994).

Due to cultural and socio-economic factors, such as the caste system and poverty, even those people who live at a considerable distance from forests are also engaged in the collection of NWFP (FD/IUCN 1995).

Table 1. Important NWFP in different forest types in Sri Lanka

Forest type	NWFP							Forest services	
	Rattan	Bamboo	Medicinal plants	Kitul produce	Edible plants	Honey	Bushmeat	Ecotourism	Grazing
Montane	-	-	*	-	*	*	*	**	*
Submontane	*	**	**	***	*	*	*	*	*
Lowland rain	**	**	*	***	*	*	*	***	*
Moist monsoon	*	*	*	-	*	*	**	*	**
Dry monsoon	*	-	*	-	*	*	**	***	***
Savannah	*	-	**	-	**	*	**	*	*
Mangroves	-	-	*	-	*	-	*	*	-

*** - Very significant
 ** - Significant
 * - Marginal
 - - Not significant

Generally collection is undertaken by the entire family (Bandaratillake 1995). Few NWFP enter the foreign market, with the exception of handicrafts made from bamboo and rattan. The sales of bamboo and rattan goods were SL Rs2.5 million in 1986. According to Bharathie (1994) sales have declined since then.

Table 2. Average number of NWFP collected by forest type

Forest type	Climatic region	Number of NWFP
Montane forests	Montane zone	1-3
Submontane forests	Wet zone	3-7
Lowland rain forests	Wet zone	3-7
Moist monsoon forests	Intermediate zone	4-6
Dry monsoon forests	Dry zone	4-8

Savannah forests	Dry zone	3–8
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Source: FD/IUCN (1995)

Only little processing is done prior to their sale. Most industries based on NWFP generate only part-time employment, with the exception of the bamboo and rattan industries (Bharathie 1994).

PLANTS AND PLANT PRODUCTS

Food

Kitul (*Caryota urens*) is a multipurpose tree species found in natural forests and home gardens. This species provides a variety of popular products, of which the sap is the most important. Kitul sap is the base for local beer (toddy), treacle and jaggery. Treacle and jaggery are sugary substances which are used in preparing a variety of traditional sweets. Other non-wood kitul products include the sago-like pith, which forms a valuable food, and kitul fibre, which is obtained from the leaves (Bandaratillake 1995).

Kitul tapping has a long history in Sri Lanka. A special cast (hakuru) makes their living from kitul tapping and jaggery making. In general the income generated by villagers from tapping is sufficient for their normal livelihoods. In most of the wet zone forests, kitul products generate over 70 percent of NWFP income for village communities (Bandaratillake 1995). The average value of kitul products from lowland rain forests is around SL Rs.20 000/ha/year (US\$200/ha/year). The average household income from kitul products ranges between SL Rs.15 000–20 000/year.

Table 3. Income from kitul products in wet zone forests (US\$1.00 = SL Rs.50)

Forest	Extent (ha)	Ave. income from forest (SL Rs./ha/y)	Income from kitul (SL Rs./ha/y)	% income from kitul
Dellawa	3 394	13 085	9 260	70.7
Eratne-gilimale	4 920	17 564	15 749	89.6
Kalugala	2 892	10 479	2 399	22.8
Bambarabotuwa	4 540	15 675	13 741	87.6

Source: Bandaratillake (1995)

Although production is localized, there is a high demand for kitul products all over the country in both rural and urban markets. Products are marketed either through middlemen or directly by producers. One of the basic problems in marketing jaggery and treacle is the lack of quality control measures. Kitul toddy marketing has been affected seriously by current legal restrictions. As a result, toddy is either consumed by the tappers or sold secretly in villages. Kitul products are not exported at present (Bandaratillake 1995).

The role of edible plants may not be very important at the national level, but quite a large number of people who live in the vicinity of forest areas still depend on the forests for some of their food needs. In the intermediate and dry zone forests, collection rates are high (65–70 percent of households), while in montane forest zones, far fewer people collect food from the forests (20 percent of households) (Bandaratillake 1995). Common edible plants gathered from Sri Lankan forests are listed in Bandaratillake (1995).

There are two major groups of edible plants: edible higher plants and fungi (mushrooms). Most of the parts of edible higher plants such as roots, tubers, bark, leaves, flowers, fruits and seeds, are used as food (Bandaratillake 1995). Four major types of yams are collected. These are: katuala, gonala, jamburala and hiritala (*Dioscorea* spp.). The katuala yam is the most common. Harvesting yams from the forest for domestic consumption is an island-wide activity (Bandaratillake 1995). Fruits of goraka (*Garcinia cambogia*), madu (*Cycas circinalis*), beraliya (*Monochoria hastata*),

hal (*Jateria copallifera*), gal siyambla (*Dialium ovoideum*) and wood apple (*Feronia limonia*) are consumed as both fruits and vegetables (Bandaratillake 1995). Some other fruits collected by the villagers are palu (*Manilkara hexandra*), weera (*Drypetes sepiaria*), thumba-karawila (*Momordica dioica*), etamba (*Mangifera zeylanica*), mora (*Nephelium*), wira (*Drypetes sepiaria*), madan (*Syzygium cumini*), katuboda (*Culleia ceylanica*), beraliya (*Shorea dyeri*), jack (*Artocarpus heterophyllus*) and beli (*Aegle marmelos*) (Bharathie 1994). Some of these fruits fetch high prices in the local market.

Many other food items collected from the forest are consumed as vegetables or fruits; for instance the dried seeds of mee (*Palaquim grande*) are used for the extraction of edible oil (Bandaratillake 1995). Most foods are used for household consumption, although a limited number of items are sold in markets (Bandaratillake 1995).

Mushroom collection is a country-wide activity in every forest type. Kamalhathu and aturuhatu are found in the lowland rain forests and submontane forests, and indololu and several other types are found in the moist monsoon and dry monsoon forests. The highest mushroom collections have been recorded in the submontane and lowland rain forests. Generally, mushrooms are collected by villagers for domestic consumption only. Collection for sale is very rare (Bandaratillake 1995).

Medicines

Medicinal plants are collected from the forest for both domestic use and sale. The medical system practised in Sri Lanka is called Ayurveda. This science was developed in India and it has spread to almost all Asian and Southeast Asian countries (Pilipitiya 1995). The flowers, roots, bark and leaves of numerous natural forest plants are used to cure a variety of health problems.

About 2 700 plants are mentioned in Ayurvedic books. Bharathie (1994) has listed the most common medicinal plants. Different plant parts are used in medicines (e.g. bark, leaves, seeds and flowers). The largest volume of medicinal plants collected and the highest family income from collection have been recorded from the savannah forests in Bibile (the average family income from collection represents around 70 percent of the total income derived from the collection of all NWFP). Over 60 percent of the villagers are involved in this activity (Bandaratillake 1995).

A new industry has developed to produce local pharmaceutical herbal products and there are about 75 manufacturing units in the country (Pilipitiya 1995). Shops selling indigenous medicines and herbal preparations are common in both rural and urban areas (Bandaratillake 1995).

No systematic large-scale cultivation of medicinal plants exists as yet (Pilipitiya 1995). Many medicinal plants have been overexploited due to the lack of planned management, and as a result, many herbal medicines that could be grown in Sri Lanka are now imported (e.g. kohomba (*Munronia pumila*), weniwel (*Cosciniun feenstratum*). Currently, kohomba is imported from India at a cost of about SL Rs.1 000/kg (Bharathie 1994). Average annual income from the collection of medicinal plants in savannah forests and other forest types ranges from SL Rs.20 000–25 000 and SL Rs.3 000–8 000 respectively (Bandaratillake 1998).

Medicinal plants are exported from Sri Lanka to several countries and the value of exports in 1999 amounted to SL Rs.116 million (US\$1.7 million). The import of medicinal plants to Sri Lanka in 1999 was about SL Rs.66 million (US\$943 000). In 1993 the value of exports was US\$2 million.

Utensils, handicrafts and construction materials

The uses of rattan range from housing construction material (for wattle and daub houses), raw material for furniture and artifacts, small wood needs, house and kitchen utensils and other uses

such as roping material. At present some rattan is imported due to the shortage in raw material from natural forests (Bandaratillake 1998).

In Sri Lanka, rattan comes primarily from the natural forests. The native species include *Calamus zeylanicus* (thambotu wel), *Calamus ovoideus* (sudu wewel), *Calamus thwaitesii*, (ma wewel, wanduru wel), *Calamus pseudotenius* (heen wewel, kola hangala), *Calamus rivalis* (kaha wewel, ela wewel), *Calamus delicatulus* (nara wel), *Calamus rotang* and *Calamus didltatus*, *C. radiatus*, *C. pachystemonus* (kukulu wel) (De Zoysa and Vivekanandan 1991).

According to surveys conducted in formulating the Master Plan for Handicraft Development in Sri Lanka (1987), about 2 100 to 2 200 persons earned their primary family income (over one-third of their income) from the rattan craft industry. Full-time and part-time workers are nearly equal in number.

A study carried out by the Forest Department (Epitawatta 1994) indicates that in almost every village near the wet zone forests, 20 to 60 percent of villagers collect rattan either for commercial purposes or for their own subsistence consumption. Only in some dry zone areas (e.g. Dimbulagala), do more than half of all villagers earn substantial income from rattan collection and cottage industry production. Polonnaruwa, Batticaloa and Ampara districts are the main rattan-producing districts in the dry zone. Average annual income from rattan for people involved in Polonnaruwa District ranges from SL Rs.20 000 to 30 000 per household (Bandaratillake 1998).

The main marketing channels for rattan craft products are handicraft and furniture shops in the major cities of Sri Lanka. Due to small-scale production, craft workers lack capital and very often they depend on middlemen for marketing. Rattan furniture and handicrafts are also manufactured and sold in a rattan craft village called Weweldeniya (land of rattan) (Bandaratillake 1995).

Rattan products are exported to seven countries and the value of exports in 1993 was SL Rs.1.5 million (US\$20 000). The export of rattan products has declined during recent years because of the shortage of raw material and the poor quality of products. However, the value of imports of rattan in 1993 was SL Rs.2.4 million (US\$32 000) which exceeds the value of exports of rattan products. Rattan exports have increased during recent years after the government's decision in 1996 to waive the import duties on timber and rattan as a strategy for the conservation of forest resources in the country.

In addition to its major use as a construction material, bamboo is used in the production of furniture and domestic utensils such as baskets and ornamental items. In the construction industry, bamboo is used for scaffolding and for construction of temporary structures, water lines, and fences. Bamboo is very effective in reducing stream and river bank erosion, and commonly is planted for this purpose. The traditional industry of basketware and bamboo flutes is based almost exclusively on a single native species, bata (*Ochlandra stridula*). *Davidsea attenuata* and *Pseudoxyantherea monadelphae* are two other local species used to produce crude basketware. Four bamboo species, *Ochlandra stridula*, *Davidsea attenuata*, *Bamboosa vulgaris* and *Dendrocalamus giganteus* are used widely in cottage industries (Bharathie 1994).

According to surveys carried out during the formulation of the Master Plan for Handicraft Development in Sri Lanka (1987), the number of workers engaged in bamboo craft production is fewer than those engaged in rattan production (Bandaratillake 1995). According to De Zoysa and and Vevekanandan (1991) 330 workers worked full-time and 364 part-time in the bamboo industry, with varying incomes.

Exudates

There are several tree species in Sri Lankan forests from which gums and resins are collected, e.g. dawn (*Angeissus latifolia*), hik (*Linnea coromandelica*) and gammalu (*Pterocarpus marsupium*).

The resin obtained from the latter is used widely in Sri Lanka to treat diabetes. Gum obtained from kaju (*Anacardium occidentale*) is used locally as an adhesive. Kaju is planted widely as an export crop for its nuts, but few trees occur naturally in the forests. Another gum, locally used as an adhesive, is kohomba gum (*Azadiracta indica*) (Bharathie 1994).

Resin from pine (*Pinus caribaea*) raised in forest plantations is now entering the export market. Except for pine resin, none of the other gums and resins is collected on a large scale. Damar resins are produced by various species of dipterocarps. The best known product, dorana oil, is obtained from the dorana tree (*Dipterocarpus glandulosus*). This oil mixed with other organic substances was used to paint murals in ancient temples in Sri Lanka (Bharathie 1994).

Kekuna (*Canarium zeylaicum*) produces an oleoresin that is collected in small quantities and is used as incense. When distilled, kekuna oleoresin yields phyllandrin which is exported (Bharathie 1994).

Dipterocarpus and *Canarium* species have been exploited heavily for timber in the wet evergreen forests of Sri Lanka. Of the dipterocarps, only about one tree per hectare with a diameter greater than 120 cm can be found in natural forests from which damar resin can be extracted (Bharathie 1994).

Others

Forest tree leaves are used widely in Oriental medical treatment. A few are also used as wrappers and as leaf vegetables.

The most important species and their uses are: bidi leaf (*Diospyros melanoxylon*) to wrap bidi, a cheap cigarette; kenda (*Macaranga peltata*) to wrap jaggery and other sweetmeats; beru (*Agrostistachys hookeri*) for thatching huts; bata leaves (*Ochlandra stridula*) to thatch village houses; madurutala (*Hortonia floribunda*) a mosquito repellent; blue gum (*Eucalyptus globulus*) to distill oil that contains cineole (Bharathie 1994).

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

Three types of beehives are identified by their locations: in the cavities of large trees, in termite mounds and among rocks (FD/IUCN 1995). Generally honey collection is more significant in moist monsoon, dry monsoon and savannah forest types than in other forest types. Only a few people (about 3–4 percent) in a village are involved in this activity.

The average collection in the dry monsoon and savannah forests is about 50 bottles/household/year and the income range is around SL Rs.3 000–5 000 per household/year. Bee honey is sold at village fairs by the collectors or by the members of their families, but sometimes it is accumulated and sold to middlemen.

Bushmeat

According to the current Fauna and Flora Protection Ordinance, hunting of any animal in wildlife reserves and sanctuaries, and hunting of protected animals in other forests, is prohibited. Despite these legal restrictions, villagers in peripheral areas still use bushmeat to supplement their diets. The percentage of villagers who engage in hunting is greater in the dry zone (about 50 to 60 percent) than in the wet zone (about 6 to 10 percent). More than 80 percent of the villagers engaged in hunting, hunt either for family consumption or for sale. Others hunt to protect their

crops from wild animals. Villagers use two methods of hunting game – guns and traditional methods. Hunters use shot guns, muzzle loaders and trap guns. Traditional hunting methods include various types of traps and using hunting dogs. The method varies with the type of animal being hunted (Bandaratillake 1995).

The most common animal hunted in all regions is the wild boar (*Sus scrofa*). Other animals commonly hunted in the dry zone are spotted deer (*Axis axis*), sambhur (*Cervus uricolor*), porcupine (*Hystrix indica*), mouse deer (*Tragulus meminna*), barking deer (*Muntiacus muntjak*), giant squirrel (*Ratufa macroura*) and monkey (*Macaca sinica*). Among the birds most commonly hunted are: Ceylon jungle fowl (*Gallus laffayetii*), Ceylon spurfowl (*Galloperdix bicalarta*) and green pigeon (*Treron pampadour*). In general, small animals such as monkeys, giant squirrels, porcupines and jungle fowl are consumed by villagers. A high proportion of large animals like wild boar, sambhur and deer are sold. Although the sale of bushmeat is prohibited by law, there is a very high demand for this meat in urban areas. As a result, many of the large animals, other than wild boar, are threatened with extinction due to hunting. In some areas, the numbers of monkeys and deer are diminishing rapidly (FD/IUCN 1995). Large areas of forest and forest plantations are also destroyed every year as the result of careless use of fire to trap animals (Bandaratillake 1995).

Although only few people (3 to 4 percent) in villages of peripheral areas are involved in hunting as a livelihood, they receive a high income from this activity. A recent survey in some of the dry zone protected areas showed that their incomes from hunting and sale of bushmeat is around SL Rs.120 000 to 150 000 per year (Bandaratillake 1998).

Other edible animal products

A significant feature in the southern part of the dry zone, is the sale of milk products, particularly curd, which is in high demand in urban areas (Bandaratillake 1995). In the dry zone apart from milk products, the villagers also sell cattle for meat. The average annual family income from cattle rearing on forest lands in this part of the country is about SL Rs.15 000 to 20 000 (US\$150 to 225) whilst this income for large-scale cattle owners is around SL Rs.50 000 to 120 000 (US\$550 to 1 300) per year (Bandaratillake 1998). The average annual family income from cattle rearing in the wet zone is reported to be less than SL Rs.9 000 (US\$100). The production of milk products and meat is not sufficient for consumption in the country and therefore these products are not exported from Sri Lanka.

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Additional information on NWFP in Sri Lanka would be appreciated and duly acknowledged.

ANNEX 1. FOREST SERVICES

Ecotourism activities in Sri Lanka are concentrated mainly in the following areas: national parks (12) managed by the Department of Wild Life Conservation (DWLC), World Heritage Site (National Heritage and Wilderness Area) and conservation forests (2) managed by the Forest Department (FD). Facilities such as ecolodges, camping sites, nature trails, interpretation centres, guided excursions etc. are available in most of these areas. In addition there are nature reserves (3), strict natural reserves (3), sanctuaries (52) and conservation forests (30) in the network of protected areas. Some of these areas have good potential for development to cater to the ecotourism industry.

Currently Sri Lanka is not a popular ecotourism destination for foreign tourists. According to the information available, out of an annual average of 350 000 foreign tourists during the last few years, only about 10 to 12 percent have visited ecotourism facilities.

Table 4. Visitors to the main protected areas in 1997

Protected area	Management agency	Foreign visitors	Local visitors	Total (quantity)	Value (US\$)
Yala National Park (NP)	DWLC	12 921	30 709	43 630	
Udawalawe N.P.	DWLC	3 275	54 006	57 281	
Bundala N.P.*	DWLC	16 448	17 300	33 748	
Wasgamuwa N.P.	DWLC	349	13 443	13 792	
Horton Plains N.P.	DWLD	1 859	152 853	154 712	
Subtotal				303 163	700 000
Sinharaja World Heritage Site	FD	1 287	22 409	23 696	
Knuckles Conservation Forest	FD	-	3 819	3 819	
Udawattakele Conservation Forest	FD	2 274	14 439	16 713	
Subtotal				44 228	17 000
Total		38 413	308 978	347 391	717 000

* Wetland and forest

Forests in Sri Lanka also have religious, cultural and social values for local people. From a home garden or a forest, the villagers gather firewood, leaves, fruits and medicinal plants. The villagers also enjoy watching birds. There are important food items which villagers prepare with plants and leaves as part of the rituals of daily life. These include the taking of herbal gruel in the morning and herbal tea between meals. This traditional habit is said to have ensured the health of Sri Lanka's people in ancient times. Western-qualified doctors are encouraging people to resurrect the ancient practice of having a cup of herbal gruel each day. Many restaurants in Colombo have begun providing herbal gruel for sale on a regular basis (Pilipitiya 1995).

Villagers living in the vicinity of forests still use the forests for grazing their cattle. Despite the introduction of tractors, most of the villagers, particularly those in remote areas, still use buffaloes as traction animals for agriculture and they consider cattle-rearing to be an important domestic activity which benefits them economically (Bandaratillake 1995).

QUANTITATIVE NWFP DATA OF SRI LANKA

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food	1	Kitul	<i>Caryota urens</i>	sa	F, O	W, C	N	Av. value of kitul products from lowland rain forests is around SL Rs.20 000/ha p/a (US\$200/ha p/a)	Av. household income from kitul products is SL Rs.15 000–20 000 p/a	Bandaratillake 1995
Medicines		Medicinal plants						Export of SL Rs.116 million (US\$1.7 million), import of SL Rs.66 million (US\$943 000) in 1999	Av. value of plants p/a: SL Rs.20 000–25 000 (savannah forests) and SL Rs.3 000–8 000 (other forests)	Bandaratillake 1998
Utensils, handicrafts, construction materials	1	Rattan	<i>Calamus</i> spp.	st	F	W	N, I	1993: export of SL Rs.1.5 million (US\$20 000)	Import of rattan in 1993: SL Rs.2.4 million (US\$32 000)	Bandaratillake 1998
		Bamboo						Export of bamboo and bamboo products: SL Rs.80 000 (US\$1 150) and import of SL Rs.55 000 (US\$800) in 1999	Villagers collecting bamboo from state forests for basket making have an annual income of about SL Rs.4 000–8 000/household	Bandaratillake 1998; Sri Lanka Custom Report

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey, beeswax				ho	F	W	N	Average collection in the dry monsoon and savannah forests: 50/bottles/household p/a, which generates an income of SL Rs.3 000 – 5 000 p/a		
Bushmeat				an	F	W	N	Income from the sale of bushmeat in the dry zone: SL Rs.120 000–150 000 p/a		Bandaratillake 1995
Grazing				an		C	N	Household income in the dry zone: SL Rs.15 000–20 000 p/a (US\$150–225); SL Rs.50 000–120 000 p/a(US\$550–1 300) for large- scale cattle owners in the same area. Household income in the wet zone less than SL Rs.9 000 p/a (US\$100)		Bandaratillake 1998

Importance: 1 - high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international

THAILAND INTRODUCTION

Main non-wood forest products

The most important NWFP of Thailand are bamboo, rattan, lac, honey, gums and resins, spices and medicinal plants. Other NWFP include food and bark for tanning and dyeing.

General information

In Thailand, NWFP are defined as all products from the forest, excluding wood and other intangible products (Subansenee 1995). Management of NWFP has its legal framework in the Forest Act B.E. 2484 (1941), the Royal Decree (1987) and the Forest Regulation (1989). NWFP are divided into two categories: protected and non-protected NWFP. Neither category may be collected in conservation forests. Protected NWFP may be collected or harvested in small amounts for subsistence needs.

Protected NWFP include wild orchids; aromatic wood (*Dracaena loureirei* Gaegnep), agarwood (*Aquilaria* sp.), drumm (*Mansonia gagei*) and sappan (*Caesalpinia sappan* Linn.); charcoal; yang oil (gurjan); some barks, including *Castanopsis* spp., *Walsura* spp., *Hopea* spp., *Cotylelobium melanoxylon* Pierre, *Persea* spp., *Litsea* spp, *Shorea* spp., *Artocarpus* spp., *Cinnamomum* spp. and *Platynerium* spp.; gums and resin, including gutta percha, *Pentace* spp., jelutong, lacquer resin, and oleoresin; some palm leaves and some ferns, including *Platynerium* spp. and *Osmunda* spp.; rattans; and talipot (*Corypha umbraculifera*) (Subansenee 1994; 1995).

Timber harvesting in the natural forest has been banned since 1989 and the forest products at present are mainly of the non-wood variety. However, there is no resource management. In particular, bamboo, rattan, gum and resin, edible insects and mushrooms are becoming scarce in the forest.

The Workshop on Promotion of Tropical NWFP in Thailand in 1999 made a decision to concentrate support on four NWFP: bamboo, rattan, sugar palm (*Arenga pinnata*), medicinal plants and spices.

Table 1. NWFP exports from Thailand, 1990 to 1999 (million US\$)

Item	1990		1991		1992		1993		1994	
	kg	US\$	kg	US\$	kg	US\$	kg	US\$	kg	US\$
Lac	4 683 905	2.45	3 606 212	2.23	2 600 388	2.74	2 892 907	4.75	5 559 837	7.84
Bamboo	567 023	0.03	1 076 422	0.03	655 891	0.05	1 030 328	0.07	351 506	0.06
Gum	1 499 628	0.23	1 841 450	0.28	1 391 300	0.22	1 475 334	0.24	1 370 103	0.32
Rattan (raw cane)	289	0.003	6 524	0.02	4 316	0.01	2 537	0.01	724	0.004
Rattan furniture	3 058 014	6.22	2 254 075	4.72	1 634 880	3.76	1 099,785	2.21	901 022	1.95
Natural honey	2 431 646	0.69	1 205 772	0.38	2 406 596	0.72	2 108 249	0.63	1 894 423	0.60
Resins	120	-	-	-	-	-	-	-	24 000	0.01
Spices	30 704	0.09	26 311	0.03	12 649	0.02	23 012	0.03	8 322	0.02
Total	12 271 329	9.71	10 016 766	7.69	8 706 020	7.52	8 632 152	7.94	10 109 937	10.8

Item	1995		1996		1997		1998		1999	
	kg	US\$	kg	US\$	kg	US\$	kg	US\$	kg	US\$
Lac	2 123 753	3.53	2 164 735	2.95	2 588 399	4.16	2 632 055	2.95	3 722 902	4.30
Bamboo	183 060	0.03	248 138	0.01	88 704	0.02	282 209	0.01	122 810	0.05
Gum	1 112 246	0.21	1 019 760	0.21	1 462 435	0.77	1 253 425	0.36	1 837 630	0.94
Rattan (raw cane)	389	0.0042	1 726	0.04	28 018	0.04	-	-	36 011	0.02
Rattan furniture	724 549	1.57	709 846	1.47	534 797	1.13	327 358	0.84	493 852	1.33
Natural honey	1 908 476	0.65	2 655 865	0.98	1 671 963	0.86	1 995 897	0.73	1 053 103	0.61
Resins	7 100	0.0016	2 756	0.03	800	0.001	110 225	0.23	65 025	0.13
Spices	26 712	0.07	103 935	0.21	120 007	0.23	109 071	0.27	83 680	0.20
Total	4 376 285	6.07	6 906 761	5.90	6 407 306	7.21	6 710 240	5.39	7 415 013	7.58

* US\$1.00 = 45 baht

Source: Royal Forest Department (undated)

The uses of NWFP are widespread especially in rural areas of the country and people collect bamboo, rattan, gum and resin, lac and many others for extra income. It is difficult to obtain data on the actual production of NWFP, because most harvesting is done illegally. Since agricultural lands are very limited, many villagers depend on NWFP gathering (e.g. bamboo, mushrooms, edible and medicinal plants and sugar palm). NWFP in Thailand serve as food and as a source of income and also provide rural employment and foreign exchange.

PLANTS AND PLANT PRODUCTS

Food

There are over 500 species of edible forest plants sold in Thai markets. They include fruits, nuts, leaves, bark and shoots. In the rainy season in northeast Thailand, food from forests can account for half of the food consumed by some rural villagers. Edible products also bring extra income (Subansenee 1995). Edible plants include cashew (*Anacardium occidentale*), Madras thorn (*Pithecellobium dulce*), jackfruit (*Artocarpus heterophyllus*) and neem (*Azadirachta indica*).

Mushrooms are found in forests throughout the country. Some favourite mushroom varieties are *Termitomyces* sp. and *Russula delica*, sold for B80 to 120/kg (US\$3.20 to 4.80/kg). Many edible mushrooms also act as an ectomycorrhiza, helping trees to take up phosphorus. Thus, mushrooms can be both a cash crop, and a means of improving tree growth in plantations (Subansenee 1995).

Edible bamboo shoots are popular in both fresh and preserved food (Subansenee 1995). Bamboo species for shoot production include pai tong (*Dendrocalamus asper*), pai bongyai (*D. brandisii*), pai sangdoi (*D. strictus*), pai wan (*Bambusa* sp.), pai seesuk (*B. blumeana*), pai pa (*B. bambos*), pai ruak (*Thyrsostachys siamensis*), pai ruakdam (*T. oliveri*) and pai rai (*Gigantochloa albociliata*). Shoot harvesting occurs from May to October (the rainy season). In bamboo plantations, *Dendrocalamus asper* plants of one to two years can give five or six shoots each year. About 20 percent of the shoot production is consumed fresh, while 80 percent is processed for canning (Subansenee 1995).

Table 2. Area and yields of *Dendrocalamus asper* (pai tong) plantations

Area and yield	1990	1991	1992	1993	1994
Total area (rai)	180 155	236 426	344 296	391 499	424 169
Shoot yield, kg/rai	1 309	1 312	1 338	1 343	1 353
Shoot production, MT	131 490	172 805	206 678	259 614	300 518
Culm yield, kg/rai	3 850	3 855	3 848	3 852	3 858
Culm production, MT	497 840	612 720	767 480	997 310	1 121 071

Source: Pungbun Na Ayudhya (2000)

Table 3. Values of *Dendrocalamus asper* (pai tong) shoot exports (in million baht)

Item	1990	1991	1992	1993	1994
Steamed canned shoots	693.1	1 421.2	956.0	1 124.7	1 110.9
Dried shoots	3.6	4.2	4.7	7.5	6.2
Fresh shoots	3.1	3.0	3.0	1.6	2.0
Total	699.8	1 428.4	961.6	1 133.8	1 119.1

Source: Pungbun Na Ayudhya (2000)

In northeast Thailand, people in some provinces eat rattan fruits and shoots. Normally, they collect the rattan from the wild but farmers are now starting to plant rattan for shoots. The most popular species is vaiyai (*Calamus siamensis*) (Subansenee 1995).

Calamus viminalis also produces edible shoots. Consumption of rattan shoots is the best alternative utilization of rattan in Thailand. Edible rattan shoots increase farmers' incentives to establish rattan plantations. Instead of waiting for cane production for over six to seven years,

farmers can manage early utilization of rattan shoots within the second year of cultivation. Rattan shoots have now become a popular dish in Thailand, especially in the north and northeast, as well as in Lao PDR and Viet Nam.

Sugar palm (*Arenga pinnata*) is a multipurpose species. It is known mainly for its sap for sugar making and as a provider of edible starch from the trunk. The fruit cooked in syrup is a favourite Thai dessert. Sugar palm fruit is one of the most important edible plants but is becoming very rare due to unsustainable harvesting. Thailand has to import the products from other countries.

Medicines

Over 800 species of medicinal plants are described in Thai traditional recipes. About 400 species are available in traditional drug stores and about 51 species are used in the traditional medicine industry. Some medicinal plants with commercial potential that are used in traditional medicine are *Rauvolfia serpentina*, *Gloriosa superba*, *Cassia angustifolia*, *Amomum krervanh*, *Dioscorea* spp., *Cartharanthus roscus*, *Strychnos nux-vomica*, *Diospyros mollis*, *Costus speciosus*, *Derris elliptica*, *Hydrocarpus anthelmintica*, *Calophyllum inopyllum* and *Stemona tuberosa*. (Subansenee 1995). Some other medicinal plants are faa thalai chone (*Andrographis paniculata*), *Carpinus viminea*, *Arcangelisia flava* and *Tinospora crispa*.

Table 4. Exports of medicinal plant products

Year	Export quantity (MT)	Export value (baht)
1988	1 393	66 383 000
1989	3 072	133 369 000
1990	2 210	74 419 000
1991	2 009	103 097 000
1992	3 379	173 394 000

Source: Subansenee (1995)

Some important forest spices are *Amomum krervanh* (best cardamom), *Cinnamomum iners* and *C. bejolghota*. Some cultivated spice trees in the country include *Eugenia caryophyllus* (clove), *Apium graveolens*, *Cinnamomum verum* and *Myristica fragrans* (nutmeg) (Subansenee 1995).

Table 5. Exports of spices (cinnamon and cinnamon-tree flavours, cloves, nutmeg, mace and cardamom)

Year	Export quantity (MT)	Export value (baht)
1987	183	18 380 000
1988	378	38 347 000
1989	772	54 827 000
1990	846	51 124 000
1991	524	35 378 000
1992	312	34 567 000
1993 (Jan–Nov)	289	35 774 000

Source: Subansenee (1995)

Perfumes and cosmetics

Agarwood (*Aquilaria* spp.) is a protected NWFP in Thailand. Low-grade material is used to distil the volatile agar attar oil used in the perfume and tobacco industries. High-grade material is exported to Arabian countries where it is used as incense and, when powdered, in the manufacture of joss sticks. The ground wood is also used as a stimulant, a tonic and a sedative. It is an ingredient in several medicinal preparations against rheumatism, body pains and heart palpitations. The price of agarwood can reach almost US\$200/kg depending on the wood grade (Subansenee 1995).

Kobuak powder is obtained by grinding the bark of *Persea* spp. and all parts (except the leaves) of *Cinnamomum inners* (Sial 1995). Kobuak is used for making joss sticks (Subansenee 1995).

Table 6. Exports of kobuak powder

Year	Export quantity (MT)	Export value (baht)
1988	5 003	47 891 000
1989	4 190	41 134 000
1990	342	3 737 000
1991	4 087	45 059 000
1992	3 882	46 609 000

Source: Subansenee (1995)

Dyeing and tanning

Bark is a source of tannin and natural dye. Some bark is used in medicines or in spices. Permits are required for harvesting some species such as *Artocarpus lakoocha*, *Broussonetia papyrifera*, *Cinnamomum bejolghota*, *Shorea floribunda* and *Pentace burmanica*. Subansenee (1995) reports further that permits are required for harvesting the species *Castanopsis* spp., *Lithocarpus* spp., *Quercus* spp., *Walsura* spp., *Hopea* spp., *Cotylelobium melanoxylon* Pierre, *Persea* spp., *Litsea* spp., *Artocarpus* spp., *Cinnamomum* spp., *Shorea* spp. and *Pentace* spp.

The most important natural dyes used in cottage industries in Thailand are annatto tree (*Bixa orella* L., family Bixaceae) (kum sad, kum fad, kum ngo, sead, or chad); sappan wood or false sandalwood (*Caesalpinia sappan* Linn., family Caesalpinaceae) (fang, ngai, or fang som); ebony (*Diospyros mollis* Griff., family Ebenaceae) (kleu or ma-kleu); gambodge tree (*Garcinia hanburyi* Hook. F., family Guttiferae) (rong); catechu or cutch tree (*Acacia catechu* Willd., family Leguminosae) (bae, si-siad khean, si siad leung, or si siad); jack tree (*Artocarpus heterophyllus* Lamk. A. *integrifolia* Linn. F. syn., family Moraceae) (ka nun, ma ka nun, mak mea, nun, ka noo, payoisa, or nako); mai luang (*Cudrania javanensis* Trecul *Macrula cochinchinensis* Lour syn., family Moraceae) (kae lae, luang, kae kong, kae, nam kae, or chang ga tog); indigo (*Indigofera tinctoria* Linn. *I. arrecta* Hochst syn., *I. suffrutiosa* Mill, *I. sumatrana* Gaertn., family Papilionaceae) (kram, kam, or kram yom) (Subansenee 1995).

Utensils, handicrafts and construction materials

Thailand has 60 species of bamboo in 13 genera (i.e. *Arundinaria*, *Bambusa*, *Cephalostachyum*, *Dendrocalamus*, *Dinochloa*, *Gigantochloa*, *Melocalamus*, *Melocanna*, *Neohouzeaua*, *Pseudosasa*, *Schizostachyum*, *Teinostachyum* and *Thyrsostachys*). Wild bamboo mostly appears in mixed deciduous forests (Subansenee 1995).

There has not been any particular inventory of bamboo resources in Thailand. In 1988, bamboo covered about 5.5 percent (8 100 000 ha) of the forest area (148 600 000 ha) of Thailand (Subansenee 1995). More recent satellite imagery (LANDSAT TM taken in January/February 1991) combined with field mapping revealed that bamboos were found over an area of 32.83 million rai (5 525 800 ha)³.

The important commercial bamboos in Thailand for construction work and supporting poles include pai liang (*B. nana*), *B. bambos*, *B. blumeana*, *D. asper*, *D. strictus*, pai sangnuan (*D. membranaceus*), *T. oliveri* and pai phak (*G. hasskariana*); important species for basketry and handicrafts include *B. nana*, *B. blumeana*, *D. membranaceus*, *T. siamensis*, *T. oliveri*, *G. albociliata*, *G. hasskariana*, pai griab (*Schizostachyum humilis*), pai kaolaam (*Cephalostachyum pergracile*) and pai hiae (*C. virgatum*) (Pattanavibool 2000).

³ 1 hectare = 6.25 rai

Thyrsostachys siamensis, *Bambusa blumeana* Schult, *Bambusa nana* and *Dendrocalamus asper* are also cultivated. The area of bamboo plantations expanded rapidly during the first half of the 1990s (Pungbun Na Ayudhya 2000).

According to Subansenee (1995) all rattans were brought under protection in 1987 because overexploitation had depleted the resource. Permits from the Royal Forest Department (RFD) are required for harvesting.

There are more than 60 species of rattan in Thailand occurring in swamp, evergreen, dry evergreen and mixed deciduous forests at elevations up to 1 000 m asl. The most important large stem rattans in Thailand used for furniture are kordam (*Calamus manan*), kampuan (*C. longisetus*), namphung (*Calamus* sp.), keesean (*C. rudentum*), nguay (*C. peregrinus*) and the most important small stem rattans are takathong (*C. caesius*), keephung (*C. blumei*), lek (*C. javensis*), horm (*C. pandanosmus*) and keereh (*C. densiflorus*). Besides cane production, some species of rattan produce edible shoots.

Exudates

Thailand has about 27 plants which produce gums and resins. They are used mostly to satisfy the subsistence needs of rural people. Two important Thai resins are gum oleoresin (*Pinus merkusii*) and yang oil or gurjan (*Dipterocarpus alatus* Roxb. and other dipterocarps). Besides these, Thailand produces gambodge from *Garcinia hanburyi* Hook.f., Chinese lacquer (natural lacquer) from *Melanorrhoea usitata* Wall (syn. *Gluta usitata*), benzoin from *Styrax benzoin* Dry, gutta percha from *Palagium obovatum* Engler, jelutong from *Dyera costulata* Hook.f and gum dammar from dipterocarps (Subansenee 1995).

Table 7. Exports of gum and resin from 1988 to 1993

Year	Export quantity (MT)	Export value (baht)
1988	2 210	21 308 000
1989	2 378	20 767 000
1990	1 534	15 318 000
1991	1 874	18 271 000
1992	1 398	10 928 000
1993 (Jan–Nov)	11	1 028 000

Source: Subansenee (1995)

ANIMALS AND ANIMAL PRODUCTS

Honey and beeswax

There are four species of bees in Thailand, of which the rock bee (*Apis dorsata*), the hive bee (*A. cerana*) and the dwarf bee (*A. florea*) are found in natural forests. In addition, *A. mellifera* has been introduced for beekeeping (Subansenee 1995). Other products than honey obtained from bees are wax, pollen, royal jelly, propolis, venom and bees themselves. The current production, prices and demand are difficult to estimate. Beekeeping became more popular in Thailand during the 1980s. In 1990, there were about 77 000 hives in Thailand. It is estimated that annual national honey production from beekeeping is about 2 000 tonnes (Subansenee 1995). In 1994, honey exports were 1 94.4 tonnes (26.9 million baht).

Table 8. Exports of natural honey, 1987 to 1993

Year	Export quantity (MT)	Export value (baht)
1987	745	11 111 000
1988	1 750	24 548 000
1989	704	9 290 000
1990	2 432	31 114 000
1991	1 206	16 966 000
1992	2 407	32 392 000
1993 (Jan–Nov)	2 108	28 233 000

Source: Subansenee (1995)

Bushmeat

Oecophylla smaragdina (weaver red ant), *Omphisa* sp. (bamboo borer) and *Vespa* sp. (wasp larvae) are edible insects found in all forests and important foods at the national level (Nutchanart and Prachoen 1999; Yanyong and Pannee 1999; Prachoen and Nutchanart 1999).

Other non-edible animal products

Thailand is the second largest lac-producing country after India. The world production of lac is about 30 000 tonnes of which Thailand's proportion is 40 percent. The production of lac fluctuates depending on weather conditions and the world market price. From 1984 to 1994 production has averaged 6 000 tonnes annually (Subansenee 1995).

The largest lac-producing areas are in the north and northeast. There are many trees and shrubs that can host the lac insect (*Laccifer lacca*). The major lac host tree in Thailand is the raintree (*Samanea saman* Merr). Other highly productive host trees are *Zizyphus mauritiana*, *Albizia lucida*, *Combretum quadrangulare* and *Acacia glauca*. Although lac can be cropped twice a year, in practice it is done only once, from November to January (Subansenee 1995).

Table 9. Exports of lac, 1987 to 1992

Year	Export quantity (MT)	Export values (baht)
1987	7 685	287 184 000
1988	3 483	121 616 000
1989	6 505	151 760 000
1990	4 740	115 907 000
1991	3 692	106 627 000
1992	2 650	124 753 000

Source: Subansenee (1995)

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QUANTITATIVE NWFP DATA OF THAILAND

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food	3	Mushrooms	<i>Termitomyces filiginosus</i> <i>Lentinus edodes</i>	fl	F, P	W, C	N		<i>Termitomyces</i> sp. and <i>Russula delica</i> sold for B80–120/kg (US\$3.20–4.80/kg) Price for <i>Termitomyces filiginosus</i> B100/kg; for <i>Lentinus edodes</i> B150/kg and for <i>Astraeus hygronetricus</i> B70/kg	Panee and Yanyong 1999; Subansenee 1995
		Sugar palm	<i>Arenga pinnata</i>	w	F	W	N, I	B15–20/kg		Panee and Yanyong 1999
	1	Bamboo	<i>Dendrocalamus asper</i> <i>Bamboo nana</i> <i>B. bambos</i> <i>Thyrsostachys siamensis</i>	sh cl	F, P	W, C	N, I	1999: 122 810 kg (US\$ 0.05 million) 1994: <i>Dendrocalamus asper</i> shoot exports (MT) – steamed canned shoots 1 110; dried shoots 6.2; fresh shoots 2.0; total 1 119	1994: <i>Dendrocalamus asper</i> shoot production: 300 518 MT. The total production figure includes the export of utensils, handicrafts and construction materials	RFD (undated); Pungbun Na Ayudhya 2000; Subansenee 1995
Medicines		Medicinal plants						1992: export of medicinal plants – 3 379 MT (B173 394 000)		Subansenee 1995
		Spices	<i>Cinnamomum bigolghota</i> <i>C. inners</i> <i>Amomum krevan</i>	w l, r s	F	W	N, I	1999: export of 83 680 kg (US\$0.20 million)		RFD (undated)

Product			Resource				Economic value			
Category	Import-ance	Trade name Generic term	Species	Part used	Habitat	Source	Desti- nation	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Perfumes and cosmetics		Agarwood	<i>Aquilaria</i> spp.						The price can reach US\$200/kg, the price of agarwood oil can be as high as US\$200 per 10 mm	Subansenee 1995
		Kobuak powder	<i>Persea</i> spp. <i>Cinnamomum inners</i>					1992: export of 3 882 MT (B46 609 000)		Subansenee 1995
Utensils, handicrafts and construction materials	1	Rattan	<i>Calamus manan</i> <i>C. longisetus</i> <i>Calamus</i> sp. <i>C. rudentum</i> <i>C. caesius</i> <i>C. siamensis</i>					1999: export of raw cane – 36 011 kg (US\$0.02 million) 1999: export of furniture – 493 852 kg (US\$1.33 million)		Subansenee 1995; RFD (undated)
	1	Bamboo		st sh	F, P	W, C	N, I	1999: export of 122 810 kg (US\$ 0.05 million) 1994: culm production – 1 121 071 MT	The export figure also includes the export of bamboo shoots	RFD (undated); Pungbun Na Ayudhya 2000

Product			Resource				Economic value		Remarks	References
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey and beeswax			<i>Apis dorsata</i> <i>A. cerana</i> <i>A. florea</i> <i>A. mellifera</i>		F, O	W, C	N, I	1999 export: 1 053 103 kg (US\$0.61 million)	About 77 000 hives in 1990	RFD (undated); Subansenee 1995
Others	1	Lac	<i>Laccifer lacca</i>				N, I	1984–1994: 6 000 MT p/a (average) 1999: export of 3 722 902 kg (US\$4.30 million)	Thailand is the second largest lac producer in the world. World production of lac is about 30 000 MT of which Thailand's proportion is 40%	Subansenee 1995 RFD (undated)

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums;
Habitat: ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Source: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Destination: W – wild, C – cultivated
N – national; I – international

VIET NAM

INTRODUCTION

Main non-wood forest products

The important NWFP in Viet Nam are handicrafts (from rattan and bamboo), resin, essential oils, medicines, spices, mushrooms and honey.

General information

Besides timber, the forests in Viet Nam provide a wide range of NWFP which are commonly referred to as “Special Forest Products” (Lauong Van Tien 1994). NWFP play an important subsistence role for rural households, particularly of the ethnic minorities living in upland areas where about 54 ethnic groups with around 150 subgroups have been found (Smithsonian 1991). NWFP can yield higher economic returns than the upland agriculture or the forest products of this area.

The NWFP sector (collection, cultivation, trade and processing) in Viet Nam affords employment to hundreds of thousands of people, including the inhabitants of urban areas (Lauong Van Tien 1991). NWFP exports reached US\$40 million annually between 1986 and 1990 (NTFP Project Document 2000). People moving from the rural areas tend to maintain their consumption patterns in the cities and the urbanization of the population has increased the demand for NWFP.

The trade is in the hands of various state and provincial companies and a number of small private traders (NTFP Project 1999). Before 1995, the State Enterprises controlled all the marketing chains of NWFP. Currently, deregulation and more free market access for NWFP is taking place.

The lack of value-added processing reduces the incomes from NWFP. Many harvesters sell NWFP unprocessed because they either need money immediately or because of insufficient knowledge of processing techniques (NTFP Project 2000).

NWFP are domesticated by households in home gardens and agroforestry systems. Some NWFP plantations (production forest and protection forest) have been developed under the management of the State Forest Enterprises (STEs) but there is no systematic management of NWFP development in Viet Nam. Forest decline and other factors are leading in many locations to overexploitation of NWFP resources. According to the Biodiversity Action Plan (1995) about 28 percent of animal species, 10 percent of bird species and 21 percent of reptiles and amphibians, are facing extinction, while some 350 plant species are among the endangered species.

Table 1. Available NWFP species in Viet Nam in 1997 and 2000

NWFP	Number of species 1997*	Number of species 2000**
1. Fibres	242	242
2. Resins	113	113
3. Essential oils	458	458
4. Fatty oils	473	473
5. Tannin	800	800
6. Medicine	557	1863
7. Dyeing agents	Na	200
8. Wicker (bamboo and rattan, other)	Na	93
9. Starch	27	27

Na= not available

Sources: *) VFFSCP (1997) and **) Chu (2000)

According to Viet Nam's Five Million Hectare Reforestation Program (5MHRP), the Ministry of Agriculture and Rural Development (MARD) has prioritized the development of certain NWFP, grouped as follows: handicrafts (rattan, bamboo); resin and gum (pine resin, also lac); essential oils (production from cinnamon, citronella, *Ocimum basilicum*, peppermint, anise star, cajeput, *Litsea cubeba*, saffras); medicinal plants, fruits and nuts (cashew nut, canarium, chestnut).

According to the 5MHRP plans, in 2010 Viet Nam could have more than one million hectares of NWFP plantations and other types of NWFP forests. The forest cover has been increased from 23.6 percent in 1983 to 33.2 percent in 2000 (MARD 2000). This is a result of the new reforms, which have opened opportunities for local communities to improve their forest resources and which have given them new possibilities to generate more income from NWFP. According to the Forest Strategy Group (December 2000), it has been forecast that from 2001 to 2010 Viet Nam will need 300–350 000 tonnes of rattan and bamboo; 40 000 tonnes of pine resin; 30 000 tonnes of anise flower; 5 000 tonnes of shellac; 1 000 tonnes of dipterocarpus sap and 1.5 000 tonnes of medicinal plants.

PLANTS AND PLANT PRODUCTS

Food

Canarium (*Canarium pimelea*) and chestnut (*Castanea mollissima*) grow mainly in Cao Bang and Bac Giang provinces. In Cao Bang Province there are 2 000 ha of intensively cultivated chestnut trees that can provide cash income for farmers (Huy 1996).

In the mountain areas, mushrooms (e.g. nam huong (*Lentinus edodes*), Jew's ear (*Auricularia auricula*) and nam linh chi (*Ganoderma lucidum*)) are used mostly as subsistence for other food. Mushroom cultivation has become more popular both in uplands and lowlands as it has provided many farmers with new ways for income generation. There were around 100 000 households cultivating straw mushrooms (*Volvariella volvacea*) in Viet Nam, employing 300 000 people on a permanent basis, mainly in South Viet Nam (VFFSCP 1997). Annually more than 100 000 tonnes of mushrooms can be produced and this has attracted about 1 million households to become involved in this new profession (Thu Hanh 2001).

Table 2. Exports of mushrooms in 1995

Importing country/area	Products	Quantity (kg)	Value (US\$)	Product code
Japan	Mushrooms, prepared or preserved, with sugar	23 004	169 680	2003.10.100
	"French" mushrooms, prepared or preserved, in containers, no sugar	98 141	211 887	2003.10.211
	Mushrooms, prepared or preserved, in containers, no sugar	640 047	1 049 917	2003.10.219
EU	Mushrooms and truffles	135 000	450 479	0712.30.000
Total		896 192	1 881 963	

Source: VFFSCP (1997)

The domestic demand for mushrooms is very high. For instance Ha Noi City needs 300 tonnes of fresh mushrooms annually. The whole country needs about 160 000 tonnes per year (Le Vo Dinh Tuong 2001). More than 40 per cent of the Vietnamese mushrooms are exported to the United States, Japan, Taiwan, China, the European Union, Hong Kong, Singapore, Australia and Canada (Hien Anh 2001).

Bamboo shoots are used as food. Production of bamboo shoots reached 32 500 tonnes in 1995, 30 887 tonnes in 1996 and 13 789 tonnes in 1997 (Ministry of Agricultural Rural Development Vietnam [MARD] 2000); Chu 2001).

Medicines

Around 4 000 different types of medicines ranging from traditional herbal cures to modern remedies introduced from the west are produced in Viet Nam. The low productivity and obsolete technology of the Vietnamese pharmaceutical industries can currently meet only 30 percent of the total demand, while 70 percent of the domestic demand has to be supplied by imports (VFFSCP 1997).

A study by the Medicinal Institute found that more than 2 000 trees species (238 plant families) are famed for their medicinal properties; they are common in folk medicines and should be protected. Some species under the threat of extinction are *Coptis chinensis* and *C. quiquesecta* (hoang lien), *Berberis julianae* and *B. wallichiana* (hoang lien gai), *Thalictrum* spp. (tho hoang lien) *Mahonia bealei*, *M. nepalensis*, *M. japonica* (hoang lien o ro), *Asarum* spp. (te tan), *Aristolochia* spp. (phong ky), *Anoectochilus* spp. (co nhung), *Nervilia* spp. (cay mot la), *Panax* spp. (tam that) (Nguyen Tap 2001).

About 300 species are harvested for domestic and commercial purposes (including domesticated medicinal trees). Valuable plants include *Acatopanax* spp. (ngu gia bi gai), *Schefflera* spp. (ngu gia bi chan chim), *Polygonum multiflorum* (ha thu o do), *Lonicera* spp. (kim ngan), *Polygonatum* and *Disporopsis* (hoang tinh), *Strychnos wallichiana* (hoang nan), *Draceana* spp. (huyet giac), *Codonopsis* spp. (dang sam), *Artemisia annua* (thanh hao hoa vang), *Stephanis rotunda* (binh voi) and *Cibotium barometz* (cau tich) (Nguyen Tap 2001). It has been estimated that 80–90 percent of the medicinal plants produced in northern Viet Nam are exported in the form of dried plants or extracts and that only 10–20 percent of the medicinal plants are consumed or processed domestically (Lecup 1996).

Table 3. Exports of medicinal plants in 1995

Importing country	Products	Quantity (kg)	Value (US\$)	Product code
Japan	Plants for perfumery, pharmacy	372 895	259 172	1211.90.990
China, Hong Kong and Taiwan	<i>Rhizoma coptidis</i> , used in pharmacy	105 272	852 000	1211.90.14
	<i>Rhizoma pinellia</i> , used in pharmacy	2 000		1211.90.19
	Rhubarb, used in pharmacy	3 100		1211.90.24
	Bantaroi seeds, used in pharmacy	61 400	34 000	1211.90.32
	Plants and parts of plants, used in pharmacy	276 429	55 000	1211.90.49
	Plants and parts of plants, used in perfumery	34 650	12 000	1211.90.50
EU	Plants and parts of plants used primarily in perfumery, pharmacy	166	521 795	1211
Total		855 912	1 733 967	

Source: VFFSCP (1997)

Spices (e.g. mackhen, cinnamon, anise star, *Cardamom villosum*, *Cardamom tsaoko*) are used for traditional food and some are exported to China and the overseas markets.

In Viet Nam there are three important species of cardamom (local name sa nhan, trade name wild cardamom): *Amomum villosum* Lour (local name sa nhan do); *Amomum xanthioides* Wall (local name sa nhan xanh) and *Amomum longiligulare* T.L.Wu (local name sa nhan tim).

More than 80 percent of the cardamom production is gathered from the wild with the remainder being cultivated (Tu 1990). The quality of the products is, however, higher in the plantation forests since in the wild the fruits are often collected too early as the collectors are afraid that other collectors will harvest the products before them. The harvesting season is in June and July.

Cardamom is exported mainly to Asian countries (China, Japan and Hong Kong). In 1999 to 2000, Viet Nam exported about 8 000 kg of cardamom to China (Kham 2001). In 1995, 17 800 kg (US\$143 880) were exported to Japan (VFFSCP 1997). In the domestic market, the fresh fruits are sold at D5 000–6 000/kg (US\$0.3–0.4/kg). The price for dried fruits can be 10 times higher since 10 kg of fresh fruits is equal to 1 kg of dried fruits (ratio 1/10), from US\$3.5–4.0/kg (Tu 2000).

Anise star tree (*Illicium verum* Hook) (trade name anise, local name hoi huong) grows mainly in Lang Son Province but is also found in other provinces such as Bac Kan, Thai Nguyen, Cao Bang, Quang Ninh. In Lang Son Province, anise has been planted in the districts of Van Lang, Van Quang, Tay Bac, Cao Loc, Binh Gia, Nam Truong Dinh and Bac Son. The area of plantations in Lang Son Province is more than 9 000 ha, the majority being in Van Quan District (7 021 ha). The district of Van Quan produced 3 000 tonnes (more than D70 billion [US\$5 million]) in 2000 (Vietnam News 2001). In the past, anise plantations mostly belonged to the collectives and the SFEs. From the 1990s onwards, the collectives and the SFEs were disestablished and the anise plantations were allocated for management by households. Within the framework of the 5MHRP, some 20 000 ha of new plantations are planned.

Table 4. Production of anise, 1995 to 1999

Item	Unit	1995	1996	1997	1998	1999
Anise (<i>Illicium verum</i>)	t	1 870	6 672	9 896	9 500	5 000

Source: MARD (2000) and Chu (2001)

Anise flowers twice a year: from February to April (fruit from May to October) and from May to September (fruit from November and December). Harvesting fruit during the summer season provides bigger yields (Tan 1996). Due to the high quality of Vietnamese anise seeds, the Chinese producers buy Vietnamese anise in order to upgrade their quality and then re-export the blended anise to international markets.

Table 5. Exports of anise seeds in 1995

Country/area	Products	Quantity (kg)	Value (US\$)	Product code
China, Hong Kong, Taiwan	Anise seeds	400	Na	0909.10.10
EU	Anise seeds	42	128 369	0909

Na = not available

Source: VFFSCP (1997)

Perfumes and cosmetics

Essential oils are exported mainly to destinations in western Europe (France, the Netherlands) and Japan. There is not much domestic consumption in Viet Nam.

The average annual export of essential oils to overseas markets is around 1 600 tonnes, comprised by: cassia oil (*Cinnamomum cassia*): 10–15 tonnes; citronella oil (*Cymbopogon citratus*): 200–350 tonnes; *Ocimum basilicum* oil (*Ocimum basilicum*): 10 tonnes; peppermint oil (*Mentha piperita*): 15–20 tonnes; star anise seed oil (*Illicium verum*): 200–300 tonnes; cajeput oil (*Melaleuca leucadendron*): 10–12 tonnes; *Litsea cubeba* oil (*Litsea cubeba*): 10–15 tonnes; pemou oil (*Fokienia hodginsii*): 10–15 tonnes; sassafras oil (*Cinnamomum* sp.): 1 000–1 200 tonnes.

Table 6. Exports of some essential oils

Importing country	Products	Quantity (kg)	Value (US\$)	Product code	Year
Japan	Peppermint oil from <i>Mentha arvensis</i>	4 940	59 006	3301.25.019	1995
	Other essential oils	101 560	507 338	3301.29.239	1995
USA	Essential oils, sassafras (incl. <i>Ocotea cymbarum</i>)	5 720	20 184	3301.29.5041	1994
Total		112 220	586 528		

Source: VFFSCP (1997)

All parts (bark, leaves, flowers, wood, roots) of *Cinnamomum cassia* (local name que) can be used for cassia oil production. The bark has an oil content of 4 to 5 percent (Hoang Cau 2000) and 100 kg of bark can produce 2 kg of oil and 1 000 kg leaves and branches can produce 1 kg of oil (Hoang Cau 2001).

Table 7. Production of cinnamon, 1995 to 1999

Item	Unit	1995	1996	1997	1998	1999
Cinnamon (<i>C. cassia</i>)	t	7 790.0	3 658.0	3 954.2.0	2 100.0	2 900.0

Source: MARD (2000) and Chu (2001)

Table 8. Exports of selected cinnamon products

Importing country	Products	Quantity (kg)	Value (US\$)	Product code	Year
Japan	Cinnamon	242 087	643 900	0906.10.000	1995
	Cinnamon (crushed or ground)	148 399	389 786	0906.20.000	1995
China, Hong Kong, Taiwan	Cinnamon	9 120	4 000	0906.10.000	1995
USA	Cinnamon	59 551	129 161	0906.10.000	1994
	Cinnamon (crushed or ground)	28 907	74 915	0906.20.000	1994
EU	Cinnamon	480	584 791	0906.10.000	1995
Total		487 544	1 826 553		

Source: VFFSCP (1997)

Table 9. Markets for cinnamon (averages from 1994 to 1996)

Importing countries	Volume (MT)	Value (1 000 US\$)	Share of market(%)
Taiwan		4 672	26.1
Korea	2 819	3 947	22.0
Japan	1 803	2 114	11.8
USA	2 536	1 475	8.2
The Netherlands	454	1 052	5.9
Singapore	923	1 187	6.6
Germany	799	336	1.9
Hong Kong	324	685	3.8
France	238	893	5.0
Hungary	413	412	2.3
Thailand	180	211	1.2
Poland	115	191	1.1
China	231	73	0.4
UK	54	22	0.1
Total	10 889	17 270	

Source: Statistic Department of Vietnam (1998)

The planting of *Cinnamomum cassia* has become more common; its management has improved since property rights have been re-established and now households are better involved in its planting. Cinnamon has been introduced to a number of provinces such as Phu Tho, Tuyen Quang, Lao Cai, Bac Kan, Ha Tinh, Quang Binh, Binh Dinh and Khanh Hoa. Cinnamon has high potential in the provinces of Cao Bang, Thanh Hoa and Quang Nam. Currently the area is 16 000 ha, which can provide more than 3 000 tonnes of bark per year (Hoang Cau 2000); 65 000 ha of cinnamon should be planted from 2000 to 2010 according to the 5MHRP.

The incense made from eaglewood (*Lignum aquilariae*, local name tram huong) is produced from *Aquilaria crassna*. Partly due to the extinction of the species in natural forests, more than 700 ha of *Aquilaria crassna* have been planted by farmers. Most planting areas are in Huong Khe District, Ha Tinh Province; Dong Hoi District, Quang Binh Province; Tra My and Tien Phuoc districts, Quang Nam Province; Dong Xoai District, Binh Phuoc Province.

In 1995, the export of eaglewood to Japan was 34 071 kg (US\$6 046 091) (VFFSCP 1997). In 1999 and 2000 Viet Nam exported 2 000 kg of eaglewood to Japan and China (Kham 2001). The quality of Vietnamese eaglewood is acknowledged widely in world markets (Tissari 1997).

In the near future, 155 000 ha of the tung oil tree (*Aleurites montana*) will be planted in new areas following the 5MHRP. Currently tung oil trees have been planted mostly in Lai Chau, Hoa Binh, Quang Nam Da Nang, Lang Son and Quang Ninh provinces (Viet 1996).

Utensils, handicrafts and construction materials

Rattan and bamboo are important raw materials for the handicraft industry, which employs at least 2 to 3 million people in Viet Nam (VFFSCP 1997). According to Lan Anh (2001) the handicraft business has employed around one million unskilled workers. Each US\$1 million earned from handicraft exports can generate jobs for roughly 3 000 to 4 000 workers in the handicraft villages (Thu Hanh 2001). The main destinations for finished handicraft products made from bamboo and rattan are Japan, China, Hong Kong, Taiwan, the United States and the European Union. In 1998, the value of the total forest production was US\$59.0 million and of this amount the value of handicraft exports was US\$37.7 million (Huan 2000).

Table 10. Value of handicraft exports, 1990 to 1995

Product	Unit	1990	1991	1992	1993	1994	1995
Handicrafts	US\$ M	36	12.6	20.7	28.6	19.5	18.7

Source: VFFSCP (1997)

The most important rattan species in Viet Nam are: *Calamus tetradactylus* Hance (small diameter) in the north; *Calamus tonkinensis* Becc (small diameter) and *Calamus rudentum* Warb (small diameter) nationwide; song mat (*Calamus platyacanthus* Warb) (large diameter) in the north and *Calamus poilanei* Lour (song bot) (large diameter) in the south. Species like *Calamus tetradactylus* Hance (may nep), *Calamus tonkinensis* Becc (may dang) and *Calamus amarus* Roxb (cay mai) have been domesticated in home gardens (Dung 1996).

Table 11. Rattan production, 1995 to 1999

Item	Unit	1995	1996	1997	1998	1999
Rattan	MT	28 500	25 975	25 639	80 097	65 700

Source: MARD (2000) and Chu (2001)

The value of rattan production in Viet Nam increased rapidly in the late 1980s, reaching D10 billion (US\$1 million) in 1990. This favourable economic development is supposed to continue. Viet Nam is the third largest exporter of rattan in the world after Malaysia and Indonesia (around

14 percent of the world rattan trade in 1992). The value of exports ranges between US\$36 million (1990) and US\$12.6 million (1995). However, up to 60 percent of the raw rattan cane in Viet Nam is imported.

Table 12. Exports of selected rattan products

Importing country	Year	Products	Quantity (kg)	Value (US\$)	Product code
China, Hong Kong and Taiwan	1995	Rattan	4 447	2 541	1401.20.00
	1995	Plaited articles	1 688	2 202	4602.10.00
USA	1994	Luggage, handbags, etc	1 633	5 880	4602.10.2500
EU	1995	Rattan	16 000	48 733	1401.20

Source: VFFSCP (1997)

Data from the Ministry of Trade (MOT 1991) showed that 50 542 tonnes of rattan had been exported (value: US\$26 352 805), mostly in the form of raw material and semi-processed products (Doan Bong 1995).

Uncontrolled rattan harvesting for many years has led to the extinction of rattan resources. In order to support the growing handicraft industry, the government is encouraging the cultivation of rattan. In Thai Binh, Hai Duong, Ha Tinh and Nam Ha provinces rattan has been planted in home gardens for centuries as a multipurpose tree. Annually farmers can produce some 1 500 to 2 000 tonnes from their home gardens.

Nowadays rattan markets have been liberalized and are operated by private traders, primary processing factories and exporters along with state-controlled export companies. Few secondary processing activities are conducted in Viet Nam for the local market and in general most of the exported products are in the primary processed form. The secondary processing in furniture and other home appliances is done usually by the importing countries (Lecup 1996). Annually some 20 000 to 40 000 people are involved in rattan exploitation and processing, which makes the industry an important contributor to employment (Dung 2001).

According to the Forest Inventory Planning Institute (FIPI) (1993), the area of both bamboo plantations and natural bamboo forests in Viet Nam is 896 391 ha and more than 200 000 ha should be planted in the near future following the 5MHRP guidelines.

Important bamboo species in Viet Nam include *inter alia*, *Arundinaria spathiflora*, *Neohouzeaua dullooa* and *Dendrocalamus membranaceus*. *Neohouzeaua dullooa*, *Indosasa augustata*, *Phyllosiachys pubeacens*, *Dendrocalamus sericeus* and *Dendrocalamus latifolius* are harvested mostly for their shoots.

Table 13. Exports of selected bamboo products

Importing country/area	Products	Quantity (kg)	Value (US\$)	Product code	Year
Japan	Bamboo	20 401	27 228	1401.10.00	1995
	Bamboo shoots	373 770	437 746	2005.90.210	1995
China, Hong Kong and Taiwan	Bamboo	1 224 733	109 000	1401.10.00	1995
	Bamboo shoots	1 000	3 000	0709.90.10	1995
USA	Baskets and bags made from bamboo	6 953	15 169	4602.10.1100	1994
EU	Bamboo	166	521 795	1401.10	1995
Total		1 628 656	1 119 818		

Source: VFFSCP (1997)

Currently products made from *Dendrocalamus membranaceus* are exported as handicrafts to Japan, France, Argentina, Brazil and Taiwan (Salter 2000). The volume of bamboo supplied to the pulp industry is as high as 100 000 tonnes per year. Bamboo processing developed rapidly from 1990 to 1995. Nationwide, some 20 mill firms have been established (Chu 2000).

Exudates

Pine resin (*Pinus merkusii*) (local name thong nhua) grows in natural forest and has been planted over large areas in the provinces of Quang Ninh, Bac Kan, Thanh Hoa, Nghe An, Ha Tinh, Quang Binh, Quang Tri and Lam Dong. According to data from MARD (1992) Viet Nam has 120 000 ha of pine resin plantations. According to 5MHRP, from 2000 to 2010, some 140 000 ha of *Pinus merkussi* should be planted (MARD 2000).

Table 14. Volume of pine resin exploitation in Viet Nam from 1995 to 1999

Year	1995	1996	1997	1998	1999
Volume (MT)	5 350	1 348	6 387	6 776.8	7 182

Source: MARD and Chu (2001)

ANIMAL PRODUCTS

Honey and beeswax

Forest honey in Viet Nam is produced mainly by *Apis dorsata*. Some quantities are produced by *Apis cerana*, *Apis florea* and *Apis trigona*. About 200 to 400 tonnes of forest honey per year are marketed and pure forest honey has a much better price on the domestic market because of its good taste and the medicinal qualities that are ascribed to it (de Beer 1993). Some honey has been produced by raising the European honey bee (*Apis mellifera*).

According to Viet Nam's Central Bee Company (VCBC), Viet Nam has around 350 000 bee hives, mainly in the Central Highlands and also in a number of northern and southern provinces. They yield around 8 000 tonnes of honey and hundreds of tonnes of wax annually. During the first half of 2001 the VCBC exported more than 4 000 tonnes of honey (an increase of 1 000 tonnes compared to the previous year). The price for the honey exported is 10 percent higher than during 2000. Exports of honey have increased compared to the export levels of 1995. Viet Nam's honey is exported to the European Union, Japan, the United States, ASEAN countries and Taiwan (Vietnam News 2001).

Table 15. Exports of honey

Importing country	Volume (kg)	Value (US\$)	Product code	Year
Japan	534 860	340 290	0409. 00	1995
USA	20 400	12 036	0409.00.0064	1994
European Union	389	323 299	0409.00.00	1995
Total	55 649	675 625		

Source: VFFSCP (1997)

Living animals/bushmeat

The value of trade in wildlife in Viet Nam from 1992 to 1993 was estimated to have been approximately US\$24 million. It is remarkable that 11 of the 79 species of birds and 10 of 77

species of mammals traded in Viet Nam have been declared rare or endangered (Le Dien Duc 1997). The hunting and poaching of any animal without a permit has been banned since 1973 and species threatened with extinction have been recommended to be banned from commercial trade (Ministry of Science, Technology and Environment [MOSTE] 1992). Another law was passed in 1992 prohibiting the sales and export of 45 species and restricting the trade in another 15 species (Donovan 1998).

Medicines

In the central coastal province of Ha Tinh, farmers have for many decades raised spotted deer *Cervus nippon* (local name huong sao) to sell its antlers for Chinese medicine. The antlers, which can be harvested annually, earn D2.5 million (US\$250) per set. Keeping a male deer is therefore as profitable as cultivating one hectare of rice. Deer breeding can generate more profits but requires a heavy initial investment (a three-month-old deer costs D25 million (US\$2 500).

Other non-edible animal products

Lac (trade name shellac or sticklac, local name canh kien do) is the resinous secretion obtained from the body of the insect, *Laccifer lacca*. Before the 1990s, lac resin had the potential to generate income for minorities in the northwest of Viet Nam. The amount of lac exported annually is about 350 tonnes (Chu 1996).

There are two seasons for harvesting lac resin: autumn (March to September) and spring (September to March). The host trees can be found in the wild, in home gardens and in plantations. Host trees suitable for lac cultivation in Viet Nam include co phen (*Protium ceratum*), cay sung (*Ficus glomerata*), cay coi (*Pterocarya tonkinsis*), cay ban xe (*Albizia lucida*), cay dau thieu (*Cajanus cajan*) and *Dalbergia hupeana*.

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ANNEX 1. FOREST SERVICES

Special-Use Forests play an important role in forest protection and biodiversity conservation of Viet Nam, and cover an area of more than 1 million ha. The system extends protection to a variety of different ecosystems, and endangered plant and animal species (Nguyen Huy Phon 2000). The Vietnamese Red Data Book has been published by the Government of Viet Nam in two volumes. The first is devoted to presenting 347 endangered animal species and the second to some 350 rare and endangered plant species.

Annually these areas receive more than 80 000 visitors. Popular tourist destinations include:

- Cuc Phuong National Park in Ninh Binh Province receives around 40 000 visitors per year, most of whom are domestic tourists. Cuc Phuong National Park is an important site for biological research and for training scientists. Many undergraduate and graduate students visit the national park on field courses.
- Hoang Lien Son-Sa Pa Nature Reserve in Lao Cai Province contains many species of plants that are used as medicines, ornaments, food or for timber.
- Dao Cat Ba Proposed Marine Protected Area and Cat Ba National Park in Quang Ninh Province.
- Muong Phang Cultural and Historical Site belongs Lai Chau Province. The site currently attracts about 50 visitors per month, including both domestic and foreign tourists.
- Ba Vi National Park in Ha Tay Province is an import source of forest products for local communities. Medicinal plant collection is among the major economic activities in the area. In 1997/1998, around 250 tonnes of medicinal plants were extracted from the national park.
- Bach Ma National Park in Hua Thien Hue Province.
- Cat Tien National Park in Dong Nai, Lam Dong Province receives a growing number of domestic tourists. The national park has gained popularity among foreign birdwatchers (BirdLife International 2001).

QUANTITATIVE NWFP DATA OF VIET NAM

Product			Resource				Economic value		Remarks	References
Category	Import-ance	Trade name Generic term	Species	Part used	Habitat	Source	Desti-nation	Quantity, value		
	1, 2, 3				F, P, O	W, C	N, I			
Plants and plant products										
Food	1	Mushrooms	<i>Ganoderma lucidum</i> <i>Auricularia auricula</i> <i>Lentinus edodes</i> <i>Ganoderm lucidim</i>	pl	F, P	W, C	N, I	1995: export of 896 192 kg (US\$1 881 963) Export of 40 000 MT + p/a 2000: value of mushroom exports: US\$8 million	Demand in Ha Noi City p/a: 300 MT of fresh mushrooms Domestic demand for mushrooms p/a: 160 000 MT	Bach 2000; Hung 1999; VFFSCP 1997; Tuong 2001
	2	Chestnut	<i>Castanea mollissima</i>	fr	F, P	W, C	N, I	Production of 70–134 MT p/a	Cao Bang Province has 2 000 ha of chestnut trees	Huy 1996; de Beer 1993
Medicines	1	Anise star	<i>Illicium verum</i>	fr, fl	F, P	W, C	N, I	2000: export of 3 000 MT (D70 billion –US\$5 million)	Plantations of more than 9 000 ha in Lang Son Province	Tan 1999; Vietnam News 2001
	2	Cardamom	<i>Amomum xanthioides</i> <i>Anomum villosum</i> <i>Anomum longiligulare</i>	fr	F, P	W, C	N, I	Export of 10 MT at US\$7/kg 1995: export of 17 800 kg (US\$143 880)	More than 80% is gathered from the wild. Price for fruits at domestic markets: D5 000–6 000 (US\$ 0.3–0.4/kg)	FAO 1993; VFFSCP 1997; Tu 2000; Tu 1990; VFFSCP 1997; de Beer 1993
	1	Medicinal plants			F, P	W, C	N, I	30–114 MT p/a 1995: export of 855 912 kg (US\$1 733 967)	Estimated: registr'd production accounts for only 30% of the actual production	Tinh 1999; Lecup 1996; VFFSCP 1997; Chi 1995; NAFORIMEX 1998; Medicinal Institute 2000; Tap 2001
	1		<i>Cynara scolymus</i> L.	le	P	C	N, I	Lao Cai Province: export of 100 MT (US\$13 700) in 2000	Exported to Japan	Medicinal Institute 1998

	2	Camphor	<i>Cinnamomum camphora</i>	ro	F, P	W, C	N	100 MT p/a (US\$5/kg)		Medicinal Institute 2000; Tap 2001; de Beer 1993
	2		<i>Zanthoxylum rhetsa</i>	ro	F, P	W, C	N	Price: US\$1 500 p/a		Medicinal Institute 2000; Tap 2001; de Beer 1993
	2	A. tsao kwa	<i>Amomum costatum</i> Roxb.	fr	F, P	W, C	N, I	153 MT in 1986 and 19 MT in 1988 (US\$1–2.5/kg)		FAO 1993; Canh 1999; de Beer 1993
Perfumes, cosmetics	2	Tung oil	<i>Aleurites montana</i> Wils.	fr	F, P	W, C	N	1 000 MT p/a, US\$1 700/MT		FAO 1993; Viet 1996; de Beer 1993
	1	Citral <i>Litsea cubeba</i> oil	<i>Litsea cubeba</i> Pers.	fr	F, P	W	N, I	Export of 30 MT p/a		Chi 1995
	1	Cassia oil	<i>Cinnamomum cassia</i>	pl	F, P	W, C	N, I	Export of 10 MT in the 1980s at US\$27/kg Export of 10 889 MT from 1994–96 (US\$17 270 000)	Current plantation area: 16 000 ha	FAO 1993; Hoang 1996 and 1999; Hoang Cau 2000; Statistic Department of Vietnam 1998
	1	Pemou oil	<i>Fokienia hodginsii</i>	pl	F, P	W, C	N, I	Export of 50 MT p/a at US\$350/MT		FAO 1993; Canh 1999; Kham 2000; de Beer 1993
	1	Cajeput oil	<i>Melaleuca leucadendron</i>	pl	F, P	W, C	N, I	Export of 50 MT		Oil Company Ha Noi 1998; Kham 2000; de Beer 1993
	1	Star anise seed oil	<i>Illicium verum</i> Hook	fr	F, P	W, C	N, I	Export of 200–250 MT at US\$7.50–15/kg		Oil Company Ha Noi 1998; Kham 2000; de Beer 1993
	1	Sassafras	<i>Cinnamomum</i> sp.	ro	F	W	N, I	Export of a few dozen MT p/a at US\$7.00/kg		Oil Company Ha Noi 1998; Kham 2000; de Beer 1993

	1	Eaglewood	<i>Aquilaria crassna</i>	pl	F, P	W, C	N, I	Export of 100 MT + at US\$2 000/kg 1997: export of 34 071 kg (US\$6 046 091)		FAO 1993; VFFSCP 1997; Hien 1996; Kham 2001; de Beer 1993
Utensils, handicrafts, construction materials	1	Rattan	<i>Calamus platyacanthus</i> Warb. <i>Calamus rudentum</i> Lour. <i>Calamus poilanei</i> Lour. <i>Calamus tetradactylus hance</i> <i>C. tonkinensis</i> Becc.	st	F, P	W, C	N, I	1991: export of 50 542 MT (US\$26.3 million) Production of 25 000 MT p/a	Up to 60% of rattan material is imported	Rale 1993; Dung 1998; Chu 2000; Hau 1985; Can 1985; Doan Bong 1995; Saigon Times Daily 2001
Exudates	2	Cham resin	<i>Canarium copaliferum</i>	fr	F, P	W, C	N	Export of 60–150 MT p/a		FAO 1993; de Beer 1993
	1	Pine resin	<i>Pinus merkusii</i> Jungh and Vierse	ba	F, P	W, C	N, I	1999: 7 182 MT		Bieu 1981; Bao 1981; Bach 1995; FAO 1993; Chu 2001

Product			Resource				Economic value			
Category	Importance	Trade name Generic term	Species	Part used	Habitat	Source	Destination	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
Animals and animal products										
Honey and beeswax	1	Honey	<i>Apis dorsata</i> <i>Apis mellifera</i> <i>Apis cerana</i> <i>Apis trigona</i>	ho, bw	F, P, D	D, W	N, I	About 8 000 MT of honey p/a 200 MT+ of wax p/a Export of 4 000 MT + during the first half of 2001	Around 350 000 bee hives exist	Chinh 1993;
Medicines	2	Spotted deer	<i>Cervus nippon</i>		P	C	N	5 000–7 000 head raised	Used parts: antlers and meat	Thanh 1999; Phong 1995
Other non-edible animal products	3	Sticklack, Shellac	<i>Laccifer lacca</i>		W, P	W, C	N, I	89–143 MT p/a in the 1980s Exports declined from 350 MT in 1984 to only 1.5 MT in 2000		FAO 1993; Kham 1981; Phi 1996; Chu 1996; Bay 2000

Importance: 1 – high importance at the national level; 2 – high importance at the local/regional level; 3 – low importance
Parts used: an – whole animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – whole plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins
Habitat: F – natural forest or other wooded lands; P – plantation; O – trees outside forests (e.g. agroforestry, home gardens)
Source: W – wild, C – cultivated
Destination: N – national; I – international