

Non-wood forest products

ABSTRACT

Non-wood forest products (NWFP) are a major source of food and income. However, few countries monitor their NWFP systematically, so an accurate global assessment is difficult. This chapter provides a summary of NWFP for which data have been collected and describes the most important NWFP in each region, with estimates of economic value where available. Some of the major problems associated with collecting and analysing data on NWFP are discussed, and suggestions for improving this situation are advanced.

INTRODUCTION

Non-wood forest products (NWFP)²⁴ play an important role in the daily life and well-being of millions of people worldwide. NWFP include products from forests, from other wooded land and from trees outside the forest. Rural and poor people in particular depend on these products as sources of food, fodder, medicines, gums, resins and construction materials. Traded products contribute to the fulfilment of daily needs and provide employment as well as income, particularly for rural people and especially women. Internationally traded products, such as bamboo, rattan, cork, gums, aromatic oils and medicinal plants, contribute to economic development. However, most NWFP are used for subsistence and in support of small-scale, household-based enterprises.

Despite their real and potential importance, national institutions do not carry out regular monitoring of the resources or evaluation of the socio-economic contribution of NWFP as they do for timber and agricultural products. In the *FAO Yearbook of Forest Products*, for example, statistical data on products such as cork, tannins, bamboo and various oils were covered for the period 1954 to 1971 only. Today, countries that monitor NWFP utilization at the national level remain the exception.

The past decade has witnessed greatly increased interest and activities concerning

There are a variety of definitions for non-wood forest products (NWFP) and the related terms non-timber forest products (NTFP) and non-wood goods and services (NWGS) corresponding to different perceptions and different needs. For the purposes of this paper, the following definition of NWFP is used: "Non-wood forest products are goods of biological origin other than wood, derived from forests, other wooded lands and trees outside the forests" (FAO 1999e).

NWFP, especially with regard to their social and economic role. Numerous ongoing projects promote NWFP use and commercialization as a means of improving the well-being of rural populations and while conserving existing forests. Countries are increasingly encouraged to monitor their forest resources, including attributes such as biological diversity and NWFP and their use. Although significant advances in research on both the socio-economics and the biology of

NWFP have taken place in the last few years, assessment of NWFP and the resources that provide them is still a difficult task. This difficulty is partly attributable to the multitude and variety of products; the many uses at local, national and international levels; the multiplicity of disciplines and interests of different ministries and agencies involved in NWFP assessment and development; the fact that many NWFP are used or marketed outside traditional economic structures; and the lack of common terminology and units of measurement.

METHODS

Monitoring and evaluation of the entire variety of forest resources providing NWFP in a given country are not technically or economically feasible. Thus, the approach used for FRA 2000 was to identify and describe products of national relevance for which monitoring and evaluation are most urgently needed. Highlighted are products widely used on national markets or gathered for export. The selection of relevant products should help countries to focus their first efforts on improved data collection for major NWFP.

In order to evaluate the socio-economic importance of NWFP utilization, available information for each country was reviewed and compiled in a standard format. Key information on products and their resources and economic value was collected and aggregated at the national level. The aim is to assist the national institutions of FAO member countries in collecting, compiling and analysing relevant data and national-level statistics on NWFP for improved policy formulation.

Specific preparatory activities for the collation of country-based data on NWFP were started by FAO as part of FRA 2000. The difficulty of collecting globally comparable information on non-wood goods and forest services, which are often site-specific and highly diverse in their characteristics, was recognized by the Expert Consultation on Forest Resources Assessment 2000 (Kotka III) in 1996. These difficulties were

further confirmed when countries were requested to report on their NWFP; developed and developing countries alike found it very difficult to provide comprehensive and accurate information.

A globally applicable standard classification system for NWFP does not exist. However, NWFP can be classified in many different ways: according to end-use (medicine, food, drinks, utensils, etc.), by the part used (roots, leaves, bark, etc.) or in accordance with major international

classification systems such as the *Harmonized Commodity Description and Coding System* developed under the auspices of the Customs Cooperation Council. For the aims of this project, NWFP were mainly classified according to their end-use (Table 10-1).

A standard reporting format for collecting data by country utilization was developed to cover the following key information requirements:

- the relative importance of selected NWFP and the status of NWFP statistics in the country;
- major uses of NWFP (subsistence, trade and cultural values with production/trade figures);
- the scientific, trade and local names (and part used) of the species;
- resource base, management systems and harvesting methods (e.g. cultivated or gathered from wild origins in natural forest, from plantations or agroforestry systems) and impact of the present utilization on the resource base;
- resource access and property rights;
- recent trends in utilization (decreasing, stable or increasing).

If available, a qualitative assessment of the importance of services from forests (e.g. grazing, recreation, tourism, environmental services) was also sought. Based on the above format, country profiles include a standardized text that provides qualitative and quantitative information on NWFP and a standardized summary table that provides available quantitative information. The format remained rather flexible across countries and regions because of the inherent variability of information available on NWFP. Country profiles also include references to the source documents where the data were found as well as key contact sources in each country. Country profiles are found on the FAO Forestry Internet site (www.fao.org/forestry).

The main sources of data consulted were country reports to regional consultations on NWFP held in Africa, Latin America and Asia; documents in the FAO series of publications on NWFP; country reports to the regional Forestry Commissions; and project reports. In addition, in-country

studies were commissioned in selected countries under the UNECE/FAO Partnership Programme in order to collect data available within the country. Finally, data validation was done in regional workshops by national experts. Eight regional workshops for data validation were held between October 1998 and March 2000 (Table 10-2).

The draft country profiles were discussed with country representatives during these workshops to validate available information and add missing data. No validation workshop was held for countries in Asia, as data validation was done by comparing country results with those from two previous workshops held in Asia (1992, 1994). For Europe, North America, Australia, Japan and New Zealand, the UNECE/FAO Timber Section in Geneva conducted a study on non-wood goods and forest services. Data for this study were collected from officially designated national correspondents by means of a questionnaire. While the UNECE/FAO study for temperate and boreal countries also reports on services provided by forest lands, including aesthetic, cultural, historic, spiritual and scientific values, it was not possible to report on these services for countries in the other regions. Subregional and regional syntheses were compiled based on the country profiles. All documents will eventually become available both on the FAO Web site and as printed working papers.

RESULTS

Africa

The most important NWFP for the different African subregions, i.e. North, West, Central, East, insular East and southern Africa, are medicinal plants, edible products (mainly edible plants, mushrooms, bushmeat and bee products) and fodder (see Table 10-3). Products of relevance for specific subregions are exudates (East and West Africa), cork and aromatic plants (North Africa), ornamental plants and living animals (insular East Africa) and rattan (Central Africa). NWFP are collected in all kinds of habitats, whether in closed or open forests, woodlands (e.g. miombo woodlands in East and southern Africa) or shrublands (mainly in arid zones). Many products (e.g. shea butter) are derived from trees outside the forest located in agricultural fields, fallow areas or home gardens. Plantations have been established for species providing high-value products, mainly traded on the world market, such as *Acacia senegal* or *Cinchona spp.* Medicinal plants are of major importance for all African regions, both for their use in traditional medicine and for trade. In Africa, a

large percentage of the population depends on medicinal plants for health care. The number of species used is not known; in Ethiopia, for example, 600 plant species are documented as being used in traditional medicine. This important role is underlined by the high ratio of traditional healers to Western-trained medical doctors, estimated to be 92:1 in Ghana (Kwahu District) and 149:1 in Nigeria (Benin City). Medicinal plants used in traditional medicine are either collected directly by the user or sold in local markets. In addition, medicinal plants are traded on the world market. The most important African countries exporting medicinal plants (including plants from cultivated sources) are Egypt and Morocco. Important internationally traded species include *Thymus* spp., *Laurus nobilis*, *Rosmarinus officinalis* (North Africa), *Prunus africana* (East, southern and Central Africa), *Warburgia salutaris* (East and southern Africa) and *Harpagophytum procumbens* and *Harpagophytum zeyheri* (southern Africa). NWFP provide important foodstuffs, in particular during the “hungry season” and in marginalized areas. Important edible plants include fruits (e.g. *Irvingia gabonensis*, *Elaeis guineensis*), nuts (e.g. *Vitellaria paradoxa*), seeds (e.g. *Cola acuminata*), vegetables (*Gnetum africanum*), bark (e.g. *Garcinia* sp.), roots (e.g. *Dioscorea* sp.) and spices (e.g. *Piper guineense*). Mushrooms such as *Cantharellus* spp. and *Boletus* spp. are mainly collected in East and southern Africa. Bushmeat is an important edible product, in particular in the humid parts of Central and West Africa. Species hunted include antelopes, gazelles, monkeys, wild boar and porcupines. Honey and beeswax are of major importance in East and southern Africa. Ethiopia, one of the major producing countries in Africa, exported 3 000 tonnes of honey and 270 tonnes of beeswax annually between 1984 and 1994. Fodder is of great importance in the arid and semi-arid zones. Fodder is mainly provided from tree leaves, shrubs and bushes such as *Acacia tortilis* (Zimbabwe), *Khaya senegalensis*, *Faidherbia albida* and *Balanites aegyptiaca* (all West Africa). Forage plays an essential role in animal-based production systems; in the Niger, for example, tree forage contributes 25 percent of the fodder supply for ruminants during the dry season.

Exudates are another group of products of major importance for sub-Saharan Africa. Important products include gum arabic (*Acacia senegal*, *Acacia seyal*) (Table 10-4) as well as resins such as olibanum (*Boswellia papyrifera*), myrrh (*Commiphora myrrha*) and opopanax (*Commiphora* spp.). These products are mainly provided by three East African countries, the Sudan (gum arabic, olibanum), Ethiopia

(olibanum) and Somalia (myrrh, opopanax). In insular East Africa, ornamental plants and living animals are of major importance. Major ornamental plants are *Trochetia boutoniana* in Mauritius and *Cyathea* sp. (fern tree), *Ficus* sp., various orchids and aquatic plants in Madagascar. In 1993, 300 000 individual plants of the aquatic plant *Aponogeton* sp., worth US\$70 000, were exported from Madagascar. The most valuable Malagasy animals in trade are reptiles and amphibians (e.g. *Mantella aurentiaca*); their annual export value reached US\$700 000 in 1990-1995.

Cork and aromatic plants are important in North Africa. Thirty-three percent of the world's cork forests (*Quercus suber*) are located in North Africa, i.e. Algeria, Morocco and Tunisia. However, this region only contributes 9 percent (30 000 tonnes) of the world cork production of 350 000 tonnes. In particular, Algeria has low cork production (2 percent of world production) in spite of its extensive resource, making up some 21 percent of the world's cork forests. Aromatic plants such as *Thymus* sp., *Rosmarinus officinalis*, *Acacia farnesiana* and *Eucalyptus* spp. are important products of Egypt, Morocco and Tunisia. In Tunisia, for example, the export of essential oils reached 230 tonnes worth US\$3.2 million in 1996.

Depletion of habitat and/or overexploitation are the main threats to the resources providing NWFP. Overexploitation has been documented for species such as *Acacia farnesiana*, *Cyathea* spp., *Cycas thouarsii*, *Gnetum africanum*, *Podocarpus* sp., *Prunus africana*, *Warburgia salutaris* and *Xylopiya aethiopicum* as well as for some species of rattans, orchids, reptiles, birds, frogs, lemurs and primates. Some of these species (e.g. *Prunus africana*) are included in the annexes of the Convention on International Trade in Endangered Species (CITES). Non-wood forest products provide an important source of income for women. In Morocco, for example, extraction of edible oils from the argan tree, *Argania spinosa*, is mainly carried out by women.

Asia

Asia is by far the world's largest producer and consumer of NWFP, not only because of its population size but even more because of the traditional use of a vast variety of different products for food, shelter and cultural needs. NWFP have been vitally important 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”.²⁵ 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 and nuts, vegetables and 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-producing 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).

China and India are by far the world’s largest producers and consumers of various 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 closely followed by India and then by 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

²⁵ In China, for example, “all crops obtained from trees, including walnuts, apples and grapes” are by law under the Ministry of Forestry and included in the country’s forest products statistics.

Nardostachys jatamansi, *Dioscorea deltoidea* and *Swertia chirayta*. In the drier regions in continental and south Asia, fodder is the main NWFP.

The rich forests of insular and Southeast Asia have traditionally been a major source of a wide variety of non-wood forest products. Those for which there is significant production and trade include bamboo and rattan, medicines and herbs (*Ephedra* sp., *Anamirta cocculus*, *Cinnamomum camphora*), essential oils (*Styrax* spp., *Pogostomon cablin*, *Cassia* spp., *Citronella* sp.), spices, sandalwood, fruits and resins (naval stores, copal).

Rattan is the most important internationally traded NWFP in the world. At the local level,

it is of critical importance as a primary, supplementary and/or emergency source of income in rural areas. There are approximately 600 species of rattans, of which some 10 percent are commercially used for industrial processing (mainly furniture making). Key genera are *Calamus*, *Daemonorops*, *Korthalsia* and *Plectocomia*. Indonesia hosts the bulk of the world’s 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 habitat. Only Indonesia, the Philippines, Malaysia and, to a lesser extent, the Lao People’s Democratic Republic and Papua New Guinea, still have some significant rattan resources left. In the Philippines, the latest national forest inventory data of 1988 show an available growing stock of approximately 4 500 million linear metres of rattan (all species combined). However, no follow-up rattan inventory has been made and it is presumed that most of the commercial species have been cut. The total area of rattan plantations in the Philippines is estimated at between 6 000 and 11 000 ha.

In the Peninsular Malaysian Permanent Forest Reserves the 1992 National Forest Inventory estimated 32.7 million total rattan plants (irrespective of age) of which the most abundant (about 37 percent) were *Korthalsia* species. Of *Calamus* species, *C. manan* is the most abundant with around 5.9 million clumps. The rattan plantation area is estimated at around 30 000 ha. In 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 the rattan processing industry has been undermined by the depletion of rattan stocks in natural forests. Although some smallholder rattan gardens exist, investment in industrial-scale rattan plantations is presently 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 of lesser importance than trade in rattan or medicinal plants, it has dramatically increased in the last decade. Unlike rattan, bamboo is moving out of the craft 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. Bamboo is increasingly becoming a domesticated crop grown by farmers. Harvesting of bamboo in forests is still important in Myanmar and the Lao People’s Democratic Republic 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 hectares (depending on what “bamboo forest” is defined to include – 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). Average value of world trade in bambooware is on the order of 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 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. Most bamboo shoots are produced on farms.

Since ancient times, forest-gathered medicinal plants have been a key component of the traditional health systems of the region, and they still are 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 of Wild Fauna and Flora (CITES). It is estimated that three-quarters of the total production is still gathered from wild sources. However, domestication and production of medicinals in home gardens is rapidly increasing. Total world trade in medicinal plants in 1992 was of the magnitude of 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 resource for the collection of pine-related products such as resins, seeds and mushrooms. China and Indonesia dominate the world’s production of oleoresins (naval stores) 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 resin, with an annual

production level of nearly 400 000 tonnes. Pine nuts (seeds of *Pinus gerardiana*, *P. pinea*, *P. koraiensis* and *P. cembra*) are an important product with a growing and high-value market, particularly in developed countries. Seeds of chilgoza pine (*Pinus gerardiana*) are produced and exported by India, Afghanistan and Pakistan. China is the world’s largest producer and exporter of *Pinus koraiensis* 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 use, 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 on the order of US\$50 million to US\$60 million. China is 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 mushrooms (*Lentinus edodes*) is about 120 000 tonnes, accounting for 38.3 percent of world production. China is the second largest producer in the world with annual exports of over 1 000 tonnes of dried 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 per year, 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 come 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 and 10 000 tonnes annually. Sri Lanka contributes 80 to 90 percent,

most of the balance coming from Seychelles and Madagascar. The world trade in cassia is on the order of 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. Europe, 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 producing and exporting country. 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 those of cocoa butter. Large quantities of illipe nuts are collected and sold to be used in the manufacture of chocolate, soap and cosmetics. Indonesia dominates world trade in illipe nuts, exporting about 15 000 tonnes annually, worth about US\$8 million.

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 China (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 (as well as on the Pacific islands and in Africa and 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 about 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 an average, about 6 000 tonnes per annum. Shellac is produced from lac, a gummy substance produced as a protective

covering by *Coccus lacca*, a scale insect that feeds on certain trees in India and southern Asia. Viet Nam's annual exports average around 300 tonnes. China produces about 3 000 tonnes.

South America

The most important NWFP in South America are edible products (food and drinks such as Brazil nuts, fruits and palm hearts, palm wines, mushrooms and maté), resins, latexes and essential oils (pine resins, natural rubber and eucalyptus oil), medicinal plants, fibres and construction materials (palm fibres, bamboo), fodder, colourants and tannins (see Table 10-5). In the Amazon region, the most well-known edible products, with a considerable domestic, regional and international market, are Brazil nuts and palm hearts. Brazil nuts are still collected almost entirely from wild sources of *Bertholletia excelsa* in Bolivia, Brazil and Peru and are a major component of the extractive economies of these countries. While they represent only a small percentage of the world edible nut trade, they bring considerable revenue to the producing countries. Bolivia is the largest world exporter of Brazil nuts.

The production of palm hearts is concentrated mainly in the tropical areas of Brazil, Bolivia, Colombia, Venezuela, Guyana and Peru. Palm hearts are extracted from wild stands of *Euterpe oleracea* and *Euterpe precatoria* or from cultivated palm species like *Bactris gasipaes*. In the Amazon region the fruits of these palms also play an important role in food and drink.

Other important palm species (at both the subsistence and commercial level) from which edible seeds and industrial oils are produced include *Orbignya phalerata*, *Mauritia flexuosa* and *Jessenia bataua*. Several tree species such as *Platonia insignis*, *Myrciaria dubia*, *Theobroma grandiflorum* and *Couepia longipendula* also produce edible fruits or nuts of local importance. Seeds of *Araucaria angustifolia* (Argentina and southern Brazil) and *Araucaria araucana* (Argentina and Chile) are commonly used for food.

In Argentina, Uruguay, Paraguay and southern Brazil, the leaves of *Ilex paraguariensis* are used to brew maté, an extremely popular tea-like beverage. This plant has been moved from its natural habitat in forest ecosystems (in the Alto Paraná region, Alto Uruguay region and northeastern Argentina) into large-scale plantations, especially in Argentina and Brazil. Mushrooms (particularly *Boletus luteus* and *Lactarius deliciosus*), growing mainly in plantations of *Pinus radiata*, are a major item in domestic and export markets, for example in Chile.

Rosewood (*Aniba rosaeodora*), andiroba (*Carapa* spp.) and sassafras (*Ocotea pretiosa*) are essential oil-producing species with commercial value. Chile is an important producer and exporter of eucalyptus oil (from *Eucalyptus globulus* and other *Eucalyptus* species). Chilean hazelnut (*Gevuina avellana*) and musk rose (*Rosa moschata* – cultivated) are other oil-producing species. Cumaru (*Dypterix odorata*) is commercially exploited in Brazil as a flavouring agent.

Latex extracted from *Hevea brasiliensis*, indigenous to the Amazon region, is the basis for the production of natural rubber. Other exudates from tropical South America are jatobá (*Hymenaea courbaril*), maçaranduba (*Manilkara huberi*), sorva (*Couma* spp.), balata (*Manilkara bidentata*) and balsamo (*Myroxylon balsamum*). Copaiba (*Copaifera* spp.) and dragon's blood (*Croton dracooides*) are used in medicine. Gum brea (*Cercidium australe*) is used in Argentina for various industrial applications. A hard vegetable wax is obtained from the seeds of the carnaúba palm (*Copernicia prunifera*) in Brazil.

Pine resin is extracted from various *Pinus* species. The main products derived from pine resin are rosin and turpentine used in the manufacture of adhesives, paper sizing agents, printing inks, as a solvent for paints and varnishes, as a cleaning agent and for other purposes. Brazil, Argentina (*Pinus elliottii*) and Venezuela (*Pinus caribaea*) are commercial producers and exporter of pine resin. Brazil is the biggest producer of gum naval stores in South America.

The region has a long tradition of medicine based on plants. One of the legacies of the South American people is the bark of *Cinchona* species, the source of the antimalarial drug quinine. World production of quinine bark is approximately 8 000 to 10 000 tonnes per year. Important producer countries in South America are Brazil, Bolivia and Colombia. Cat's claw (the bark of *Uncaria tomentosa*) contains alkaloids and acid glycosides, several of which have immunostimulatory, anti-inflammatory and antimutagenic properties. Quillay (*Quillaja saponaria*) is used for the extraction of saponine (mainly from the bark), which has many applications in the drug and cosmetic industries. Chile is the most important producer of quillay in South America. Boldo (*Peumus boldus* or *Boldoa fragrans*) is an endemic tree that grows in the semi-arid regions of Chile. Boldine, the active substance extracted from the leaves, is used in medicine for its analgesic, diuretic and antirheumatic properties.

Annatto (obtained from dried seeds of *Bixa orellana*) and cochineal (from the insect *Dactilopius coccus*, feeding on certain cactus

species) are sources of natural colourants. Peru is the main producer of both. A red colourant (carmines) is produced from the extract of cochineal. In Peru, production of annatto is export oriented and is very heavily dependent upon the harvesting of wild trees. By contrast, Brazil produces annatto to meet local demand of several thousand tonnes annually. Supplies are mainly dependent upon small farmers. Peru is the world's largest producer of tara

fruits (*Caesalpinia spinosa*) for the extraction of tannins (80 percent of world production).

Production is mainly from natural stands but in part from agroforestry systems. Peru is the Andean country with the largest *Caesalpinia* forests, followed by Bolivia and to a lesser extent Chile, Ecuador and Colombia. Quebracho colorado (*Schinopsis* spp.) is a source of tannin in Argentina and Paraguay.

Fibres include the leaves of the palm *Carludovica palmata*, used for the production of Panama hats in Ecuador. *Attalea funifera* and *Leopoldina piassaba* are sources of fibre in Brazil. *L. piassaba* is also harvested on a small scale in Venezuela and Colombia. *Heteropsis* spp. are exploited for their aerial roots in the Brazilian Amazon. In non-tropical South America (particularly Chile), the young branches of *Salix viminalis* are split and woven for the production of furniture, baskets and other household items. Bamboos are largely used in construction, furniture and handicrafts in Ecuador, Colombia and Venezuela, with *Guadua angustifolia* and *Chusquea* spp. used in the Andean regions of Ecuador and Chile.

In South America, large areas are under a cover of shrubs and low tree species – for example, the campo cerrado and caatinga of central-eastern and northeastern Brazil, the chaco in Argentina, Paraguay and Bolivia, and the arid coastal areas of Peru and Chile. In these areas the most important economic activity is often livestock raising, with livestock feeding almost exclusively on the fruits and leaves of these plants. In the arid zones of Chile large areas are under the cover of trees of *Prosopis tamarugo* and *Prosopis chilensis*. In Peru there are approximately 1.4 million hectares of dry woodlands, predominantly covered with *Prosopis pallida*, used for fodder and for the extraction of algarobina (a cocoa substitute) from the pods. The nuts of the tagua palm (*Phytelephas* spp.) in northern South America produce a kind of vegetable ivory which is carved for handicrafts and made into buttons. The production of other forest seeds is also important.

In terms of forest management, there is very little experience in South America with management of NWFP or with integrated management of forests for timber and NWFP.

Trials have been conducted for some species, (for example, *Uncaria tomentosa* and palm hearts in Peru). For some species subject to high extraction pressure, governments have set up regulations to reduce the ecological impact (for example, guidelines for use of *Araucaria araucana* in Argentina, measures to regulate felling of *Ocotea pretiosa* trees in Brazil and a ban on export of raw bark of *Uncaria tomentosa* in Peru). However, most harvesting is done opportunistically and often in a predatory manner. The result is that wild populations of various species are threatened by overexploitation and habitat destruction. Species for which overharvesting is documented include *Jubaea chilensis*, *Araucaria araucana* (listed in Appendix 1 of CITES), *Uncaria tomentosa* and *Guadua angustifolia*.

Over the years there has been a general reduction of the proportion of South American NWFP in the international markets, as shown by trade statistics for commercial products (for example latexes, gums, resins). The Brazilian government agency for statistics, Instituto Brasileiro de Geografia e Estatística (IBGE), surveyed the production of some 34 products based on their past economic importance. In 1980, 11 of these had economic value (i.e. production value higher than US\$200 000) and the total production value was US\$160.2 million. By 1995, the number of products had decreased to six and the production value had dropped to US\$65.4 million (ITTO 1998). The decline, in many cases, can be ascribed to competition from synthetic substitutes or products from domesticated sources, but in some cases it is caused by the degradation of the natural resource base. On the other hand, some other products have seen a sharp rise in demand. In Bolivia, for example, in the past ten years recorded palm heart extraction increased from 11 to 4 185 tonnes. Expectations about the medicinal properties of *Uncaria tomentosa* have given rise to a boom in the production of bark in recent years.

Central America

The subregion that includes Central America and Mexico is endowed with rich and diverse forests, ranging from cloud forest to temperate hardwood and conifer forests to moist tropical high forests. As a result, the subregion has a wide variety of plant and animal species, providing a large number of different types of NWFP. The most important and common products in all countries of the subregion are medicinal plants, wild fruits, latex and handicrafts and utensils made with fibres of several plant species. Of local and national importance are ornamental plants (Guatemala, Costa Rica), fodder (El Salvador), fauna products (Nicaragua), pine resin (Honduras) and construction materials (Belize, Panama).

Medicinal plants are by far the most important. Some products, such as zarzaparilla roots (*Smilax* spp.), were already exported in large quantities in the seventeenth century to Spain. Costa Rica is the largest producer, with a yearly production of 170 tonnes of several species, but with a growing share now of cultivated origin (at present 50 percent). Major medicinal products are sen seeds (*Caesalpinia pulcherrima*), zarzaparilla roots and balsamo (*Myroxylon balsamum*). In Guatemala, the main species are calahuala (*Polypodium* spp.), with a yearly production of 50 tonnes of which 30 tonnes are exported (at a value of US\$140 000), and yerba de toro (*Tridax procumbens*) with annual exports of 15 tonnes (US\$90 000). In Honduras the major species is *Polypodium aureum*, with yearly export value of US\$110 000.

The forests of the region contain more than a hundred tree and palm species with edible fruits, e.g. cohune (*Attalea cohune*) and pejibaye palms (*Bactris gasipaes*) and tropical forest trees such as anono (*Annona* spp.), guabo (*Inga* spp.), zapotillo (*Couepia polyandra*) and caimito (*Chrysophyllum cainito*). Costa Rica exports around 36 tonnes of zapote (*Pouteria sapota*) yearly. In El Salvador, flour is made from seeds of ojushte (*Brosimum alicastrum*) and from pito seeds (*Erythrina berteriana*); between 3 and 16 tonnes of the latter are exported per year.

Chicle is a major product of the region's tropical lowland forests. It is a latex tapped from the sapodilla tree (*Manilkara zapota*) and is used for making chewing gum. Sapodilla is most frequent in Guatemala (Petén) and Belize, where tree densities in the forests vary from 24 to 40 trees per hectare. The high tree density is an indication of the tree's use in pre-Columbian times, when the Olmec and Maya collected the latex or possibly managed stands for local consumption and export. Only trees with diameter at breast height (DBH) greater than 30 cm can be tapped by law. Chicle production in Guatemala was about 1 000 tonnes per year from 1940 until the 1970s, but has now dropped to some 500 tonnes (valued at US\$2 million in 1998) because of deforestation and habitat degradation.

A wide variety of plant species are used for handicrafts and construction materials, mainly palms such as *Desmoncus* sp., *Sabal* spp., palma chonga (*Astrocaryum* spp.) and bellota (*Carludovica palmata*). These palms provide leaves, fibres and canes comparable to rattan. Export of cane furniture from Nicaragua amounts to US\$5.7 million per year. Other handicrafts include hats made from pita palm leaves (*Cardulovica palmata*), pine needle baskets (*Pinus oocarpa*) and bamboo products. An important handicraft in the region is sculptures and mouldings made from small pieces of timber

species such as conacaste (*Enterolobium cyclocarpum*) and cedro (*Cedrela odorata*) and from vegetable ivory (*Phytelephas seemannii*). Other NWFP of national importance include honey (with, for example, production from *Apis mellifera* of 200 tonnes per year, valued at US\$3.5 million, in El Salvador); bushmeat from paca (*Agouti paca*); birds; iguanas (*Iguana iguana*) and garrobo (*Ctenosaura similis*), including eggs and live animals (with, for example, approximately 350 000 green iguanas exported from El Salvador in 1997, valued at US\$1 million, although increasingly of reared origin) and pine resin products (particularly in Honduras, with annual export value of around US\$2 million). Forage from forest land is also reported to be very important, although no quantitative data are available.

Caribbean

The most important NWFP of the Caribbean ²⁶ are medicinal and aromatic plants, edible products (mainly fruits, mushrooms, bushmeat and bee products) and construction materials, utensils and handicrafts (see Table 10-6).

Medicinal plants are mainly used by rural communities. In Grenada, over 80 percent of the population uses herbal medicines. Important aromatic plants include candlewood (*Amyris balsamifera*), citronella (*Cymbopogon citratus*), rosewood (*Aniba rosaeodora*), sassafras (*Ocotea pretiosa*), common hazel (*Gevuina* spp.), vetiver (*Vetiveria zizanioides*) and *Eucalyptus* spp. Grenada is the world's second largest producer of essential oils derived from the seeds of the nutmeg tree, *Myristica fragrans*. Some 25 percent of the world production comes from Grenada, contributing around 40 percent of the country's export revenue. However, nutmeg exports

²⁶ The Caribbean subregion here includes large islands (Cuba, Dominican Republic, Haiti, Jamaica, Puerto Rico, Trinidad and Tobago), small islands (Antigua and Barbuda, Aruba, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Dominica, Grenada, Guadeloupe, Montserrat, Saint Christopher and Nevis, Santa Lucia, Saint Kitts and Nevis, Saint Pierre and Miquelon, Saint Vincent and the Grenadines, United States Virgin Islands) and continental countries (Belize, Guyana, Suriname). declined by nearly 50 percent from 3 362 tonnes

in 1986 to 1 863 tonnes in 1993 because of decreased world demand for raw nutmeg and competition from other producing countries. Important edible products are fruits such as maripa (*Astrocaryum maripa*) and awara (*Astrocaryum segregatum*) in Suriname and balata (*Manilkara bidentata*), hog plum (*Spondias mombin*) and serrette (*Brysonima coriacea*) in Trinidad and Tobago.

The heart of the manicole palm (*Euterpe oleracea*) is one of the most important products in Guyana and the principal source of income for Amerindian communities in the coastal wetlands.

Annual production rose from 942 tonnes in 1993 to 1 648 tonnes in 1995, with export revenue of US\$2 million. Other countries, including Cuba and Trinidad and Tobago, also cultivate this species.

Important faunal foodstuffs are honey and bushmeat. Beekeeping is an important activity in the Dominican Republic and Cuba. In Suriname, the dependence of indigenous people and urban inhabitants on wildlife species for protein threatens many species.

Construction materials, utensils and handicrafts are another important group of NWFP in the Caribbean. In Guyana, aerial roots of nibi (*Heteropsis flexuosa*) are used for the manufacture of furniture, while roots of kufa (*Chusia* spp.) are used as household items. For families in the lower Pomeroon Basin, nibi harvesting is the most important source of income. In Santa Lucia, latanier (*Coccoloba barbadensis*) is used in broom production.

Latanier is sold in rural and urban areas but faces competition from imported plastic brooms. In Jamaica, jippi jappa (*Carludovica palmata*) is the principal source of material from the forest for making hats, bags, table mats, etc. In addition, strips of the rose apple (*Eugenia jambos*) are used to make baskets and hampers. Bamboo (*Bambusa vulgaris*) is an important product used in Grenada as scaffolding during construction and as a raw material in the production of different handicrafts. Some villages are dependent in income from these handicrafts. There is concern about the supply of bamboo because of high demand.

The great expansion of the tourist sector has increased the consumption of palm leaves for thatch. In the Dominican Republic, for example, "palma cana" (*Sabal umbraculifera*) is used for thatch for both temporary and permanent structures. In Trinidad and Tobago, *Sabal mauritiiiformis*, *Maximiliana caribea* and *Manicaria saccifera* are used for thatching.

Europe

As reported in UNECE/FAO (2000) there are, in general, few reliable and systematically collected data on NWFP production for most European countries. National potentials, quantities and value by product category and the volumes traded or consumed are poorly known and/or documented in national forest statistics. A few countries maintain some regular statistics on NWFP for which harvesting permits are issued by the forest authorities, such as mushrooms, berries, game meat and hunting. Key NWFP on which data are reported include, in order of importance, Christmas trees (including production from plantations on farms and from cutting in forests), mushrooms, berries and game meat. A few countries also report on decorative foliage, cork, pine resin, herbal plants, honey and nuts

(particularly chestnuts, acorns, hazelnuts and stone nuts). For nuts, herbal plants and honey, reported data on total country production include significant outputs from agricultural lands and are usually reported in agricultural statistics. An overview of the main European NWFP for which data are available is presented in Table 10-7.

North America

In Canada and the United States, a great variety of NWFP are gathered, mainly for personal use, and their collection is widespread among rural populations. However, only a few products are included in national forest product statistics (UNECE/FAO 2000).

In Canada, reported products include Christmas trees, pelts and maple syrup. Reported data from the United States cover five products (Christmas trees, mushrooms, pelts, maple syrup and commercial fish catch). Even so, the records on mushrooms refer to only four major species from among 25 to 30 species that are commercially used. There are no data for some widely consumed products such as game meat and berries.

Major NWFP of the region are foodstuffs and forest plants for ornamental purposes (Table 10-8), but there is little information on production sources, the number of collectors, volume or value. Moreover, reported figures vary considerably from year to year. For example, in Canada, the reported value of maple syrup production varied from US\$59.1 million in 1992 to US\$44.9 million in 1993.

Commercial demand for mushrooms and berries is increasing throughout the region. In the Canadian province of British Columbia, 35 mushroom species are now commercially harvested. In the United States, data on mushrooms were available from only one region of the country, the Pacific Northwest, where commercial harvest is done largely for export markets in Asia and Europe.

No data at the country level are available on the production of medicinal and herbal plants collected in the region for personal and/or commercial use. Medicinals are collected mainly on forest lands, but a growing share is now being produced through farming.

The Pacific Northwest region of the United States has a significant industry based on processing decorative forest foliage. About one-quarter of its production is for export to Europe. Hunting, game meat and animal trophies provide significant income to both private forest owners and public land management agencies in the region. Canada produces the world's largest number of pelts, and the United States ranks third (after the Russian Federation). In both countries the data reported are for total harvest, which

includes species that are not associated with forests. Reported value is the price received by the trapper.

Sport fishing in the region is very popular, although it is difficult to separate fish harvest occurring in forests. The reported harvest in the United States is restricted to salmon species, which spend part of their life in forest environments. The United States salmon harvest in 1995 was 517 000 tonnes, valued at US\$521 million.

CONCLUSION

Data collection for this study confirmed that there is a serious lack of quantitative data at the national level on non-wood forest products and even less on the resources that provide them, with the exception of Asia where there is a tradition of national collection of information on NWFP resources and consumption. Information is scarce and often mixed with agricultural production statistics. Statistical data, where they exist at all, are mostly limited to selected internationally traded products and, in this case, data are usually limited to export quantities. Information on the resource base and on subsistence use of NWFP is non-existent, mainly because of the multitude of products used by local people and the technical difficulty and high cost of measuring and reporting on them.

Even when data exist, they are seldom based on recurrent, statistically designed surveys and inventories, and it is therefore difficult to assess the reliability of the information. For example, even in Asia much of the information is based on national inventories up to ten years out of date. A similar problem exists for the economic value associated with the products because value can be calculated at different stages of production and processing. The data obtained from traditional forestry institutions responsible for the forest resources often differ from the trade data reported by customs agencies.

National level data on the resources and on production and trade (quantities and values) of major products are essential to assess the full contribution of the forest sector to the economy of the country, and for forest management and policy development. In some cases NWFP resource and product information is available on a national basis, but in most cases, the information is available only for parts of the country. Therefore, extrapolation is necessary but difficult. Because of the factors described above, as well as the lack of internationally agreed-upon terminology, concepts and clear definitions, statistical data on NWFP resources and production are not usually comparable among or even within countries or regions. Therefore, regional and global aggregation of production and

value is very difficult. A classification system with unified terminology and measurements is needed.

Most of the products are extracted from natural stands in various types of forest and woodland ecosystems. However, among the current issues of global resource monitoring is the lack of management of non-wood resources. For products in high demand, this often leads to unsustainable harvest levels and the potential endangerment or extinction of the species. This has serious socio-economic implications for people dependent on the availability of these resources. Some important products, such as bamboo, are evolving into farmed crops, while others, such as many medicinal plants, are becoming endangered because of deforestation and/or overharvesting. The use of synthetic substitutes has made many others, such as guta percha, balata, sorva, copal and piassaba fibres, obsolete.

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