

FORESTRY DEPARTMENT

**NON-WOOD FOREST PRODUCTS PROGRAMME**

**NON-WOOD FOREST PRODUCTS  
IN THE NEAR EAST:  
A REGIONAL AND NATIONAL OVERVIEW**



Food  
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A REGIONAL AND NATIONAL OVERVIEW**

by

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## FOREWORD

This regional study presents an overview of the socio-economic importance and ecological impact of the use of non-wood forest products (NWFP) in the Near East. The document consists of two main parts: i) presentation of background information on the programme activities and analysis of the available information on the regional level; and ii) presentation of data on NWFP on the national level (so-called "country profiles").

The country profiles were originally compiled to be made available on the FAO Web site. However, taking into consideration the limited access to the Internet in various countries, it has been decided to publish, in addition, a hardcopy version of the country profiles and to add a regional analysis of the data.

Most of the data presented in this report are indicative figures, which have been collected in published and unpublished reports, and therefore do not represent official statistics.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 is still weak. It is hoped that this report will support the on-going process of data improvement on NWFP. Improved data is considered to be essential to ensure that the use and importance of NWFP is adequately taken 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 Near Eastern countries would be very much appreciated. The authors of the country profiles will be duly acknowledged in the Web version. Information and comments can be sent to:

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During the last two years, various colleagues have been involved in the compilation and finalisation of the NWFP country profiles. At FAO Headquarters, Alexia Baldascini, Tina Etherington, Helena Kästel, Liana Micotti, Laura Russo and Paul Vantomme contributed to the collection, analysis and editing of the information presented.

Technical supervision was provided by Mr Tom O.M. Bazuin, Associate Scientist, Forest Genetic Resources at the International Plant Genetic Resources Institute (IPGRI), Regional Office for Central, West Asia and North Africa, Aleppo, Syria and Mr Riad Baalbaki, Chairperson and Associate Professor, Crop Production and Protection Department, American University of Beirut, Lebanon.

Their efforts are appreciated.

It is hoped that readers will find this publication useful and that it will be a start to continuously update the information on NWFP.

## SUMMARY

In Near Eastern countries, there is a long tradition of management of forests and forest lands for non-wood forest products (NWFP).

The main aim of this study is to compile standardized NWFP country profiles for the countries in the Near East and to present the most important uses of the country forest and tree resources providing goods other than timber and fuelwood. The country profiles should present the currently available national statistics on the production and consumption of, as well as on the trade in, NWFP in the Near East. Furthermore, they should evaluate

- the socio-economic importance of NWFP; and
- the ecological impact of the collection/extraction of NWFP and the management of natural resources providing NWFP in the respective countries.

This work has been carried out in support to the FAO Forest Resource Assessment 2000 ([www.fao.org/forestry/fo/fra/index.jsp](http://www.fao.org/forestry/fo/fra/index.jsp)).

The study is intended to help countries identifying the NWFP and forest services for which the collection of regular statistical data can significantly contribute to the sustainable management of its forest resources.

This report includes the standardised country profiles of the 16 Near East countries (which are also available on the FAO Web site) as well as a regional synthesis of the results.

In drylands and other areas of the Near East, NWFP support the livelihoods of millions of people. Traditionally, the most important roles played by NWFP are health care, food security and nutrition (fruits, leaves, seeds and nuts, mushrooms, honey and animals are all important sources of food and food additives in the Near East), support to agricultural and livestock production, construction materials, household items and cultural values.

The available data show that some NWFP are of high socio-economic importance in the entire region (e.g. medicinal and edible plants), whereas others are only of relevance in selected countries (e.g. the 'Dragon's Blood Tree' [*Dracaena cinnabari*] in Yemen). Most of the NWFP are used at local level for subsistence and/or income generation. National and international trade in NWFP is limited to selected products.

Due to the prevailing harsh climatic conditions of the region, forest land is mostly comprised of savannah areas, open woodlands, and land with scattered trees and xerophytic shrubs. However, in the highlands of Cyprus, Pakistan and Turkey, temperate forests are found.

Despite their importance for local economies and for the people, NWFP in the Near East are still largely neglected in the policy and decision-making processes of natural resource management. Therefore, substantial efforts still have to be undertaken to improve the availability of data on NWFP for a better understanding of their socio-economic significance in national economies.

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# 1. Methodology

In support to the FAO Forest Resource Assessment (FRA) 2000, the available information on NWFP was reviewed and compiled at national level, for each country, to assess the socio-economic significance and ecological impact of its utilisation. A standard format (see below) for the presentation of information was used showing key information requirements for the evaluation of NWFP.

The FAO Forestry Department NWFP Programme has organized two regional meetings with the specific aim to promote the sustainable use of NWFP in the Near East: the first meeting, "Medicinal, Culinary and Aromatic Plants in the Near East", was held in Cairo in May 1997, and opened a forum for the exchange of information on NWFP use in the region, and for the formulation of recommendations on actions to be undertaken in various fields in order to promote the sustainable use of NWFP.<sup>1</sup> Building upon those recommendations, the second meeting, "Development and Coordination of Regional Activities on Non-Wood Forest Products in the Near East Countries", was organized in Lebanon in May 1999.

The major part of the work was to compile standardized NWFP country profiles for 16 Near East countries and to present the most important uses of the country forest and tree resources providing goods other than timber and fuelwood. The country profiles reflected the currently available national statistics on the production and consumption of as well as on the trade in NWFP in the Near East.

Furthermore, the sub regional synthesis report evaluated

- the socio-economic importance of NWFP; and
- the ecological impact of the collection/extraction of NWFP and the management of natural resources providing NWFP in the Near East.

This study was intended to help individual countries identify the NWFP and forest services for which the collection of regular statistical data can significantly contribute to the sustainable management of its forest resources. The socio-economic importance and the ecological impact of the production, consumption and trade of NWFP in the Near East is documented and analysed on the national level.

NWFP country profiles drafts were compiled for Afghanistan, Bahrain, Cyprus, Iran, Iraq; Jordan, Kuwait, Lebanon, Oman, Pakistan, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates and Yemen.

No quantitative data about NWFP were found for Oman, Saudi Arabia, Afghanistan, Iraq, and Yemen, and even the descriptive information found was scant. In general, information was scarce about NWFP in the Arab gulf countries, with no information available for United Arab Emirates, Kuwait and Bahrain.

Finally, institutions in the region working on NWFP were identified (see chapter 4).

The country profiles and the regional synthesis can be accessed on the FAO Web site ([http://www.fao.org/forestry/fo/country/nav\\_world.jsp](http://www.fao.org/forestry/fo/country/nav_world.jsp)), where they will be updated when additional information becomes available.

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<sup>1</sup> The proceedings of this meeting are available at <http://www.fao.org/docrep/X5402e/X5402e00.htm>.

## Methodology used

Under the general supervision of the Chief, Wood and Non-Wood Products Utilization Branch, Forest Products Division of FAO's Forestry Department and the Forestry Officer, FAO NWFP Programme, as well as under the direct supervision of the Regional Forestry Officer of the International Plant Genetic Resources Institute (IPGRI), Regional Office for Central & West Asia and North Africa (CWANA) and the Head of the Department of Crop Production and Protection at the American University of Beirut (AUB), main activities were to:

- validate the information of the NWFP country profiles already available at FAO;
- collect additional information and statistical data on NWFP in Near East countries (Sources of information: reports, projects, custom office, national statistics, governmental and non-governmental organizations, etc.);
- identify NWFP of major socio-economic importance on the national level and describe their relative importance compared to other products covered;
- document and evaluate the ecological implications of the use of NWFP;
- analyse the past, present and possible future trends of the production, consumption, trade and exportation of NWFP;
- evaluate the coverage of NWFP by national statistics; and
- identify institutions of major regional importance related to NWFP data collection and analysis (including address, scope of work, scope of data covered, contact persons, etc.).

The final report includes:

- a regional summary report;
- standardised country profiles for 16 Near East countries: Afghanistan, Bahrain, Cyprus, Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Pakistan, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates, Yemen; and
- a documentation of relevant organizations working on NWFP, which are based in the Near East region.

## Kind of information collected

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

### (a) Product information

For the purpose of this study (and especially for the table on quantitative data), NWFP are defined as "goods of biological origin other than wood, derived from forests, other wooded lands and trees outside forests" (FAO, 1999). For further information regarding the terminology of NWFP, see Chandrasekharan (1995).

To simplify the classification, NWFP were categorised according to their end use, as described in Table 1 (see page 4).

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 strongly needed 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 should initially help the country focus its efforts on improving data collection on major NWFP. A further step would then be to include also other NWFP.

**(b) Resource information**

Evaluation and monitoring of the resources providing NWFP resource bases are important to estimate the actual and potential socio-economic and ecological value of these products at the national level. The first step in that process is the identification of the plant or animal 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 reduces 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.

**(c) Socio-economic information**

To evaluate the economic importance of NWFP, quantitative data on resources, product consumption and trade are required. Figures should indicate quantity (tonnes, m<sup>3</sup>, 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 mainly used for subsistence or commerce. Therefore, it is suggested 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.).

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 and/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)
Dying and tanning	Plant material (mainly bark and leaves) providing tannins and other plant parts (especially leaves and fruits) used as colorants	Hides and skins	Hide and skin 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	Colorants	Entire animals or parts of animals such as various organs used as colorants
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	e.g. bones used as tools
Other	e.g. insecticides, fungicides		

## 2. Regional synthesis

### **The Near East region**

The Near East region, as defined for the purpose of this study, includes sixteen countries, namely Afghanistan, Bahrain, Cyprus, Iran, Iraq, Jordan, Kuwait, Lebanon, Oman, Pakistan, Qatar, Saudi Arabia, Syria, Turkey, United Arab Emirates and Yemen.<sup>2</sup>

In drylands and other areas of the Near East, NWFP support the livelihoods of millions of people. Traditionally, the most important roles played by NWFP are health care, food security and nutrition (fruits, leaves, seeds and nuts, mushrooms, honey and animals are all important sources of food and food additives in the Near East), support to agricultural and livestock production, construction materials, household items and cultural values. NWFP vary greatly in local availability and preferences. They range from products used for local consumption to products which are traded on the international markets and which have represented major commodities for a long time. However, in the Near East, the majority of NWFP are used for subsistence and in support of small-scale, household-based enterprises, which provide income and employment for rural people, especially women.

The largest forest area is found in Iran (11.4 million ha), followed by Turkey (8.9 million ha), and Afghanistan (1.4 million ha). The forest and woodland areas in the remaining countries are each less than one million hectares. Countries like Bahrain, Oman and Qatar have less than 1 000 ha of forests. Kuwait and United Arab Emirates have only man-made plantations. The land area, population numbers, GNP/person and forest area of the countries in the region are shown in Table 2.

Nineteen "centers of diversity" were recognized in the Middle East and South West Asia (Heller, 1991). They include the Levantine Uplands of Turkey, Syria, Lebanon, Israel and Jordan, which form part of the "Fertile Crescent", of major importance for agriculture. The region also contains Vavilov's Near Eastern Center of Origin of Crop Plants and the Near Eastern Complex recognized by Harlan (1992) where a wide variety of cultivated plants were domesticated for the first time.

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<sup>2</sup> Information on NWFP for African countries also belonging to the Near East region (i.e. Algeria, Egypt, Libya, Mauritania, Morocco, Sudan and Tunisia) can be found in FAO (2001).

Table 2. Basic data and forest cover in the Near East region

Country	Land area, 2000 (1 000 ha)	Population 1995 (million)	GNP/ person	Forest area, 2000	
				1 000 ha	% of land area
Afghanistan	64 958	20.1	C	1 351	2.1
Bahrain	69	0.6	7 870	n.s	n.s
Cyprus	924	0.7	10 380	172	18.6
Iran	162 200	67.3	n.a.	7 299	4.5
Iraq	43 737	20.4	G	799	1.8
Jordan	8 893	5.4	1 190	86	1
Kuwait	1 782	1.7	23 350	5	0.3
Lebanon	1 023	3.5	G	36	3.5
Oman	21 246	2.2	5 600	1	n.s.
Pakistan	77 088	140.5	430	2 361	3.1
Qatar	1 100	0.6	15 140	1	n.s.
Saudi Arabia	214 969	17.9	n.a.	1 504	0.7
Syria	18 378	14.7	G	461	2.5
Turkey	76 963	61.9	2 120	10 225	13.3
United Arab Emirates	8 360	1.9	22 470	361	4.3
Yemen	52 797	14.5	C	499	0.9
Total	756 118	373.9		23 810	

Source: FAO (1997); FAO (2000)

Key:

C: Estimated to be low income (US\$725 or less)

E: Estimated to be upper middle income (US\$2 896 to US\$8 955)

G: Estimated to be lower middle income (US\$726 to US\$2 895)

n.a.: No figures available.

n.s.: Not significant

### Main NWFP

NWFP include medicinal and aromatic plants, herbs and spices, gums, resins, tannins, fibres, mushrooms, honey, fruits and nuts for nutrition, fodder for animals and wildlife products.

There are also very important services provided by the forests in the region. Protection of soil and water resources are primary functions of forests and wood plantations. Forests play a vital role in combating desertification and preventing soil erosion in fragile regions (e.g. Yemen), as well as protecting watersheds in mountainous areas (e.g. Yemen and Cyprus). Shelterbelts and windbreaks protect fields, cities and infrastructure, ensure environmental stability and increase soil productivity by mitigating the effects of climatic fluctuations in many countries of the region (e.g. Iraq, Syria and Turkey).

Amenity and recreation are also among the important functions of forest areas. In line with the rapid urbanization in many countries of the region, demand for recreation activities have shown rapid increase. For example, in Turkey, 428 recreation sites covering 15 946 hectares have been established, and 32 national parks covering an area of 649 486 hectares. Forests play a significant role in the preservation of biodiversity and the gene reserves in the region. They provide work opportunities and additional income to rural populations living in and around forests.

Table 3. Main NWFP in Near East

Country	Main NWFP	Selected statistical data available
Afghanistan	Medicinal plants, nuts (pistachios, walnuts)	<ul style="list-style-type: none"> <li>• Annual production of 1 500-2 000 t of pistachio (<i>Pistacia vera</i>)</li> <li>• Annual production of medicinal plants worth US\$12 million</li> </ul>
Bahrain	No information available	No information available
Cyprus	Aromatic culinary and medicinal plants, carob, mushrooms	<ul style="list-style-type: none"> <li>• Annual production of 17 000 t of carob (<i>Ceratonia siliqua</i>) pods</li> </ul>
Iran	Natural colorants and dyestuffs: crocin extract, henna, aromatic and medicinal plants, essential oils, honey, nuts (pistachios, walnuts), gum tragacanth, fodder	<ul style="list-style-type: none"> <li>• Annual production of 50 000 t of cumin (<i>Cuminum cyminum</i>)</li> <li>• Annual Production of henna of 1 000-2 000 kg/ha</li> <li>• Exportation of 257 t of gum tragacanth with annual production of 400 t</li> </ul>
Iraq	Medicinal plants (licorice), aromatic plants, date palm, gum tragacanth, honey	No information available
Jordan	Mushrooms, nuts (stonepine, pistachios), carob pods, aromatic and culinary plants (thyme, laurel), medicinal plants, honey, fodder	<ul style="list-style-type: none"> <li>• Annual production of 120 t of honey</li> <li>• Exportation of fodder worth US\$118 000 in 1999</li> </ul>
Kuwait	Honey, fodder, recreational and protection value are important	No information available

Lebanon	Pine nuts ( <i>Pinus pinea</i> ), honey, fodder	<ul style="list-style-type: none"> <li>Total production of pine nuts of 14.9 t and export of 0.2 t in 1999</li> <li>Exportation of honey in 1999 worth US\$34 700 with annual production of 200-500 t/year</li> </ul>
Oman	Medicinal plants, dyestuffs, fibers, tannins	No information available
Pakistan	Wild fruits, condiments, pine resin, tanning materials, colorants and dyestuffs, sabai grass, neem leaves and seeds, fodder	<ul style="list-style-type: none"> <li>Total value of henna US\$596 250 per year</li> <li>Approximately US\$63.6/kg of morels and annual production worth 50 t</li> <li>Average annual production of crude resin between 1981 and 1989 reached 4 132 t</li> </ul>
Qatar	Recreational and protection value are important	No information available
Saudi Arabia	Fodder, recreational and protection value are important	No information available
Syria	Tannins, vegetable dyestuffs, fruits (carob; sumac), nuts, honey, mushrooms, medicinal and aromatic plants, fodder	<ul style="list-style-type: none"> <li>Annual production of carob is estimated at 8 t in 1993, worth US\$24 000</li> <li>Annual production of 4 t of pistachio, worth US\$12 000 in 1992</li> <li>Annual production of 1 056 t of liquorice, worth US\$380 000 in 1993</li> <li>Production of honey worth 678 t in 1991</li> </ul>
Turkey	Aromatic and medicinal plants, gum tragacanth, styrax, mushrooms, fodder, honey	<ul style="list-style-type: none"> <li>Annual production of 15 000 t of carob pods and Export worth US\$1.06 million in 1999</li> <li>Export of pine nuts worth US\$6.09 million in 1999</li> <li>Export of edible mushrooms worth US\$9.5 million in 1999</li> <li>Export of gum tragacanth worth US\$101 000 in 1999</li> <li>Annual production of honey worth 7 500 t</li> </ul>
United Arab Emirates	Recreational and protection value are important	No information available
Yemen	Honey, fruits ( <i>Ziziphus spina-christi</i> )	Annual production of 5 000 t of <i>Ziziphus sp.</i> and annual export revenue worth US\$40 million

The flora of the Near East region is diverse and comprises some 23 000 vascular plant species of which 6 700 are endemic to the region (Boulos, 1994). The flora of the Middle East was estimated at 15 000 species by Heller (1991).

The use of **medicinal**, culinary and aromatic plants, herbs and spices in the region dates back thousands of years and forms an important part of various cultures. Although many of the species concerned have fallen into disuse, traditional medicines still play a major role in health care systems. A list of the most important medicinal and essential oil and perfume plants is given in Table 4. The most important plant families are: *Boraginaceae*, *Caryophyllaceae*, *Chenopodiaceae*, *Compositae*, *Cruciferae*, *Gramineae*, *Labiatae*, *Leguminosae*, *Liliaceae*, *Rosaceae*.

In Turkey, more than 500 medicinal and aromatic plants are being used. Whole or parts of plants of about 250 species are exported (Koyuncu, 1995) Turkey is also rich in aromatic plants and Baser (1993) estimates that a third of the flora of Turkey consists of aromatic plants used for fragrance, flavouring or containing essential oil. Amongst the 1 500 or so plants used in Iraq, a large number serve medicinal and aromatic purposes (e.g. *Achillea santolina*, *Capparis spinosa* and *glycyrrhiza sp.*). Some of them are cultivated (Chakravarty, 1976).

In the Arabian Peninsula oleo-gum-resins are found in *Boswellia* and *Commiphora* of the family *Burseraceae*. These are produced in resin ducts in the bark. *Boswellia sacra*, one that played a key role in its economy until recent times, was widely used as a medicinal plant for a whole range of ailments by physicians. Three species of *Commiphora* are used medicinally in preparations made from their resinous wood or from the resins: *C. oliacea* (or *C. copobasamum*), the famous Balm of Gilead (Meccamyrrh), *C. foliacea*, whose wood is widely used, and *C. habessinica* whose resin is very valuable as a medicine.

Table 4. Major indigenous medicinal and aromatic plants of the Near East

<i>Achillea fragrantissima</i>	<i>Commiphora soctrana</i>	<i>Ocimum kilmandscharicum</i>
<i>Achillea santolina</i>	<i>Crocus sativus</i>	<i>Origanum syriacum</i>
<i>Achillea graecorum</i>	<i>Cymbopogon proximus</i>	<i>Otostegia fruticosa</i>
<i>Alkanna strigosa</i>	<i>Cynoglossum creticum</i>	<i>Papaver somniferum</i>
<i>Aloe perryi</i>	<i>Datura stramonium</i>	<i>Peganum harmala</i>
<i>Aloe dhufarensis</i>	<i>Digitalis spp.</i>	<i>Retama raetam</i>
<i>Aloe inermis</i>	<i>Dracaena cinnabari</i>	<i>Rhamnus spp.</i>
<i>Ammi spp.</i>	<i>Ephedra alata</i>	<i>Rhus tripartita</i>
<i>Anagyris foetida</i>	<i>Eryngium campestre</i>	<i>Rhus communis</i>
<i>Anastatica hierochuntica</i>	<i>Ferula asa-foetida</i>	<i>Ricinus communis</i>
<i>Artemisia herba-alba</i>	<i>Foeniculum vulgare</i>	<i>Ruta chalepensis</i>
<i>Artemisia judaica</i>	<i>Juniperus phoenicea</i>	<i>Salvia fruticosa</i>
<i>Boswellia sacra</i>	<i>Lavandula dentata</i>	<i>Symphytum spp.</i>
<i>Cannabis sativa</i>	<i>Leontice leontopetalum</i>	<i>Teucrium polium</i>
<i>Calamintha incana</i>	<i>Marrubium spp.</i>	<i>Thymelaea hirsuta</i>
<i>Calotropis procera</i>	<i>Glycyrrhiza spp.</i>	<i>Thymus spp.</i>
<i>Catha edulis</i>	<i>Gypsophila spp.</i>	<i>Tribulus terrestris</i>
<i>Cassia enna</i>	<i>Haplophyllum tuberculatum</i>	<i>Urginea maritima</i>
<i>Citrullus colycinthis</i>	<i>Hyoscyamus spp.</i>	<i>Verbascum sinuatum</i>
<i>Commiphora foliacea</i>	<i>Mentha pulegium</i>	<i>Verbena officinalis</i>
<i>Commiphora ileadensis</i>	<i>Myrtus communis</i>	<i>Ziziphus jujuba</i>
<i>Commiphora parviflora</i>	<i>Nerium oleander</i>	

Source: Boulos (1994)

The introduction of more extensive farming of medicinal plants should be considered. This requires more information about which species grow in the wild, their conservation status, how intensively wild species are harvested, how extensively they are cultivated and what are the existing and potential markets (local, national and international). This also requires the participation of the local community and its local knowledge, and proper analysis of the socio-economic, cultural, agricultural, technical, scientific and conservation factors involved.

The Near East forests provide a wide range of **food**. Edible fruits are particularly important as they provide essential nutrients to the diet of local people. Examples of the main fruit and nut trees are: *Pistacia spp.*, *Pinus pinea* and *Ceratonia siliqua*

(carob) in Syria, Iran and Turkey; *Juglans regia* (walnut), *Morus spp.* (mulberry), *Tamarindus indica* (tamarind), *Mangifera indica* (mango) and *Zizyphus sp.* in Pakistan. In countries that have no natural forests, fruits of *Ficus sycomorus*, *Eugenia jambolana* and *Morus sp.* are consumed.

Many trees, shrubs and Savannah grassland in the Near East countries are used as **forage** for cattle, sheep, goats and wildlife (animals, birds and insects). Acacias are the most valuable forage trees in the region.

In Pakistan **gum** and **tannin** are obtained from *A. arabica*. Several other species, such as *Sapindus mukorossi*, *Pinus roxburghii* and *Juglans regia* are sources of gums and resins. In Turkey, gums and resins are extracted from *Abies sp.*, *Pinus brutia* and *Astragalus sp.*

In some Near East countries (e.g. Turkey), bulbous plants are used for **ornaments** as well as in pharmaceutical and cosmetic industries. They have traditionally been used in the floristic trade locally and are now also being sold abroad. The export of flowers earned US\$2 374 000 in 1995. Some of the most important bulbous plants are: *Eranthis hyemalis*, *Anemone blande*, *Leucozum aestivum* and *Cyclamen hederifolium*.

Some of the Near East countries are important producers of natural **honey** from Acacia and *Eucalyptus* species. Turkey is one of the major producers (annual production of 7 500 tonnes).

The lower plants in the forests including **mushrooms**, morels, truffles and other fungi supply a number of minor foods. Pakistan and Afghanistan are the main contributors to the world trade in morels. The activities of the FAO "Forestry and Food Security Project in the Mediterranean and Near East Region (Turkey, Syria and Jordan)" include cultivation of mushroom. The most commonly cultivated and exported mushroom in the project is *Agaricus bisporas*.

### **Ecological aspects**

The climate of most of the Near East region can be characterized as arid. Ecologically, these zones are fragile and difficult to develop and use. Except in limited areas, the vegetation of arid areas is sparse and usually highly specialized morphologically and physiologically. Cutting trees and clearing of forests in these fragile ecosystems usually causes irreversible damages. The imports of wood products in the last few years, when compared to exports, illustrate the pressure on these forest ecosystems in all Near Eastern countries (Table 5). No Near Eastern country exports more wood products than it imports, and most have no exports at all. In terms of percentages, countries import thousands of times more wood products than they export. Since all Near Eastern countries are in a wood-deficit situation, sustainable forest growth becomes more difficult, in turn making a sustainable production of NWFP less likely. Obviously, the need to develop the production and use of NWFP has to be assessed in light of the continuously diminishing forest resources.

Table 5. Imports of wood and derived forest products into Near Eastern countries

Country	Imports (US\$1 000)					% of Exports <sup>1</sup>
	1992	1993	1994	1995	1996	
Afghanistan	1 087	1 590	1 201	1 040	1 183	No exports
Bahrain	23 760	17 081	22 602	33 281	29 314	No exports
Cyprus	106 637	84 604	96 061	121 563	91 711	2 824
Iran	386 416	102 443	234 453	253 377	273 335	Almost no exports
Iraq	1 788	606	439	439	148	No exports
Jordan	141 637	166 832	116 332	177 112	181 217	2 230
Kuwait	102 349	83 647	101 130	78 075	93 985	No exports
Lebanon	76 643	74 343	115 766	91 756	150 232	1 621
Oman	50 480	52 387	34 770	53 403	48 316	Almost no exports
Pakistan	191 580	155 089	184 551	154 902	194 159	No exports
Qatar	13 117	8 881	11 306	10 332	11 781	No exports
Saudi Arabia	569 392	634 368	953 925	925 656	645 086	7 184
Syria	113 099	72 196	96 729	68 335	74 196	Almost no exports
Turkey	472 048	839 425	517 354	815 162	737 487	1 150
United Arab Emirates	203 070	237 577	306 296	273 929	256 169	
Yemen	61 554	40 402	22 900	49 018	46 009	Almost no exports
<b>TOTAL</b>	<b>2 514 657</b>	<b>2 571 471</b>	<b>2 815 815</b>	<b>3 107 380</b>	<b>2 834 328</b>	

Source: FAO (1996)

<sup>1</sup>Based on comparisons of imports and exports in 1996.

One way of conserving forest trees and developing the use of NWFP is to demonstrate the value of such products. The idea that wood products are more valuable than NWFP is not always correct and needs further examination under specific country conditions. Taking into consideration the many indirect or hidden forest products, the values of NWFP may indeed be much higher than previously estimated.

Due to the prevailing harsh climatic conditions of the region, forestland is mostly comprised of savannah areas, open woodlands, and land with scattered trees and xerophytic shrubs. However, in highlands of Cyprus, Pakistan, Turkey, temperate forests and humid zones are found.

In countries lacking natural forests, fast growing and multipurpose tree species (i.e., Eucalyptus, Casuarina, Poplars and Acacias) are planted in the form of windbreaks or shelterbelts around farms, highways, public facilities and in agroforestry systems. These help to meet the local needs for wood and to protect the agricultural crops against wind as well as providing amenity and amelioration of the environment. In countries that have natural forests, such plantations provide significant amounts of wood (e.g. 4 million m<sup>3</sup>/annum of wood are made in Turkey mainly from poplar plantations) and even greater amounts than the natural forest production (e.g. Iraq, Iran, Lebanon and Syria) (Heywood, 1997).

In general, the forestlands in the Near East countries are state owned, although there are some variations among the countries regarding ownership and the rights of forest

dwellers and local populations. Many countries in the region have enacted laws and legislation to regulate the use of forests by local populations and protect them against damaging interventions.

According to FAO statistics (Table 6), the forest area of the region decreased during the period 1990-1995. The main causes for degradation are: over exploitation of wood for fuel by rural populations, overgrazing and the increase in need for wood and non-wood forest products and forest services by the growing population in the region.

Table 6. Changes in forest cover in the region (1990 - 2000)

Country	Forest area 1990 in 1 000 ha	Forest area 1995 in 1 000 ha	Forest area 2000 in 1 000 ha	Forest Cover Change 1990-2000	
				1000 ha	Rate (%)
Afghanistan	1 990	1 398	1 351	0	0.0
Bahrain	0	0	n.s	0	0.0
Cyprus	140	140	172	5	3.69
Iran	1 686	1 544	7 299	0	.00
Iraq	83	83	799	0	0.0
Jordan	51	45	86	0	.00
Kuwait	5	5	5	0	3.46
Lebanon	78	52	36	0	-.41
Oman	0	0	1	0	5.28
Pakistan	2 023	1 748	2 361	39	1.84
Qatar	0	0	1	0	9.60
Saudi Arabia	231	222	1 504	0	.00
Syria	245	219	461	0	.00
Turkey	8 856	8 856	10 225	22	.22
United Arab Emirates	60	60	361	8	2.84
Yemen	9	9	499	-9	-1.86

Source: FAO (2000)

Over exploitation of NWFP is a major problem in the Near East countries. As a part of its policy to protect the natural resources, the Lebanese government issued decisions to protect aromatic and medicinal plants and to control their exploitation. Moreover, the Lebanese Ministry of Agriculture is encouraging pine nut production

through banning the importation of pine nuts, thus protecting the growers and producers from unnecessary competition. This move has allowed the stabilization of the pine nuts market while giving the whole production and exploitation cycle a great push forward.

In Pakistan, collectors also endanger many species through indiscriminate exploitation. For quite a few of these valuable plants, either the quality has deteriorated or they have become extinct. Development of propagation and regeneration technologies of medicinal plants in their natural habitat are essential for the conservation of this natural resource. Because of indiscriminate and continuing overexploitation, mazri forests are disappearing in many places. The supply base is gradually shrinking and the incomes of families are threatened. Rehabilitation of mazri forests is, therefore, essential in order to maintain the supply base.

The great majority of aromatic culinary and medicinal plants are still collected from the wild in the Mediterranean countries and often subject to overharvesting. In Jordan, medicinal plants are massively used by Bedouins and local people in folk medicine as hot or cold drinks or chewed raw materials as fresh or dry. Many plants are under collection pressure and used often for many medicinal purposes, such as *Artemisia*, *Achillea*, *Salvia*, *Paronychia*, *Ecballium*, *Ephedra*, *Ajuga*, *Marrubium*, *Alcea*, *Thymus*, *Sarcopoteruim*, *Hyoscyamus*, *Ricinus communis* and many others.

In Syria, medicinal and aromatic plants are threatened by degradation of forest by fires, overgrazing, removal of trees for fuel and the lack of management plants; urban expansion in forest areas; scarcity of water and unsustainable harvesting of wild medicinal plants.

Negative environmental impacts of NWFP utilization in Turkey are caused by the increasing demand for medicinal and aromatic plant production. This high demand lead to overexploitation and to the use of incompatible production techniques. Thus the destruction of species is increasing rapidly and some important endemic species are consequently in danger of extinction. As a result, some regulations have been introduced related to production techniques and effective protection and control of excessive production, including certificates for collection and export.

Wild progenitors of ornamental species such as *Tulipa spp.*, *Narcissus spp.*, *Anemone spp.*, *Cyclamen spp.*, *Orchis spp.*, *Ophrys spp.*, *Fritillaria spp.*, etc. exist among the wild vegetation of Cyprus. Unfortunately, their numbers are rapidly decreasing owing to continuous developmental activities, use of herbicides and inconsiderate exploitation.

### **Socio-economic aspects**

In the Near East, the goods and services provided by forests and trees are much more important than timber production. Sylvopastoralism for livestock production (often based on nomadic systems) is the main production system in many of these countries: forest grazing and forest fodder, therefore, represent certainly one of the major contribution to local and national economies of Near East countries. Collection, grading and processing of aromatic and culinary plants (bay leaves, rosemary, thyme, sage and others) is a major income generating activity.

While wood production remains an important activity and constitutes in many cases the principal source of revenue from Mediterranean forests, the socio-economic importance of NWFP of this area has been increasingly recognized. NWFP have in particular long played significant roles in the subsistence and culture of mountain

communities, where the income generated from collecting fruits, nuts, resins, fibres, etc. has helped upland areas build a base of economic growth that capitalises on available forest resources and encourages their management for sustained productivity.

Several NWFP are unique to the region. The contribution of NWFP to the revenue of countries and their value in terms of earnings and employment is considerable, especially in the developing countries of the region.

Morels, or black mushrooms of the genus *Morchella*, are widely gathered by an army of men, women and children in the temperate forests of Pakistan, India, China and Afghanistan, and traded internationally in large quantities. Urban entrepreneurs buy them from local collectors and transport them in dried form to overseas markets, especially to Europe, where demand for them as gourmet or speciality foods consistently exceeds local or regional supplies, and prices are uniformly high. Pakistan produces about 50 tonnes of dry morels annually (equivalent to 500 tonnes of fresh morels); all of which are exported.

France, Switzerland and Germany are the main importers of dried morels from Pakistan and India. According to unpublished records of the International Trade Center (ITC), the imports, from the above mentioned countries, of dried morels to European Economic Community (EEC) countries and Switzerland range between 100 to 120 tonnes per annum (Iqbal, 1995).

Kernels of Chalghoza pine (*Pinus gerardiana*) constitute a popular dry fruit in Pakistan, Afghanistan and many Middle Eastern countries. According to the National Progress Reports on Forestry, Asia-Pacific Forestry Commission (15<sup>th</sup> Session, Colombo, Sri Lanka) world production estimates for the years 1990, 1991 and 1992 were reported to be 868 tonnes, 715 tonnes and 435 tonnes, respectively. The bulk of the production comes from Pakistan and Afghanistan. Small quantities are also produced in India. Pakistan exports about 120 tonnes of pine nuts annually to a number of Middle Eastern countries. The average wholesale price within Pakistan ranges from Rest. 40 000 to 50 000 (US\$1 330 to US\$1 670) per tonne, whereas the export price ranges from US\$3 600 to 4 300 per tonne.

Walnuts are an important NWFP in Iran, Afghanistan and Pakistan, where the walnut tree (*Juglans regia*) is an important broad-leaved associate of temperate coniferous forests. The tree is also widely cultivated. Nearly one fourth of all walnuts traded come from the Asia-Pacific region: China (16.6 percent), India (6.8 percent), Iran (0.03 percent), Afghanistan (0.03 percent) and Pakistan (0.02 percent). Outside the Asia-Pacific region, USA, Turkey, Chile, Hungary and Argentina are the main suppliers of walnuts.

Gum tragacanth is an important commercial gum produced by several shrubby plants of the genus *Astragalus*, which grow from Pakistan to Greece, particularly in Iran and Turkey. Iran and Turkey are the main producing countries, with about 70 percent of the supplies originating from Iran alone. Iran's average annual production potential has been estimated at 400 tonnes. The gum is also known to be produced in Afghanistan and Syria, but export consignments are very rare. According to *Agricultural Products*, November 1991, Iran's average annual production potential has been estimated at 400 tonnes.

Annual collection of honey from forest areas in Pakistan has been estimated to be 55 to 60 tonnes. Beekeepers in Pakistan shift their bees to the mountains each summer to forage. According to FAO statistics, world production of natural honey was

estimated to be 1.19 million tonnes in 1991. Turkey is the major producing country in the region, which contributed 4 percent to total world production in 1991.

It is estimated that more than 100 species of medicinal value occur in Pakistan. In 1992, the total value of international trade in liquorice was US\$0.94 million, of which 23.7 percent originated from Pakistan and 7.3 percent from Afghanistan. Syria and Turkey are also major producers. During 1992, total world trade in medicinal plants was about US\$171.234 million, of which 0.5 percent originated from Pakistan.

WWF (undated) identified four main constraints which hinder the sustainable use of NWFP in general, and that of medicinal and aromatic plants, in particular:

- Low prices paid to gatherers;
- Insufficient legislation regarding plant harvesting and trade;
- Lack of awareness, among end users, of the detrimental effects arising from the demand; and
- Reluctance among traders to provide information related to their practices.

Taking into account the current production of NWFP in the Mediterranean region (the annual total production of NWFP is estimated to exceed 12 million tonnes), WWF concludes that the production could be tripled in the future.

## **Conclusions**

Policy – makers and urban and rural populations in the region have started to show an increasing interest in the protection and multiple uses of forest resources. However, this awareness is yet to be expressed in institutional and financial support for forestry and adoption of sustainable forest management.

Interest and contributions of rural communities and grassroots participation for the conservation and development of forests and forestry should be extended and improved. Competing interests and needs of a growing population with a dwindling natural resource base, have developed serious conflicts among owners and users of the resources as well as among the latter's.

It is evident from the above considerations that there is a need for cooperation between research institutions of the Near East to promote the forest products and services of this area. Therefore, according to many sources (e.g. Kizmaz, 1997; FAO, 1996) it is recommended to:

1. Encourage companies dealing with the trade of medicinal, culinary and aromatic plants to set up a fund which should be used to support research and developments covering the rehabilitation of Near Eastern ecosystems.
2. Implement production plans, which introduce proper production techniques for plants including NWFP inventories.
3. Revise the production plans at the end of the rotation period by comparing new plans with previous ones.
4. Enforce export quotas in order to prevent over production resulting from high demand and market competition.
5. Draw up legal and organizational regulations in order to prevent destructive and illegal collection.
6. Encourage the cultivation of native plant species by forest dwellers by providing forest villagers with training, technical and financial assistance.
7. Determine the market value of potential NWFP.

8. Identify and formulate a regional projects/programmes to promote the sustainable development of NWFP in the Near East.
9. Prepare project flyers for submission to interested donors in close collaboration with relevant regional organizations and with agencies from the countries concerned (such as the Arab Center for the Study of Arid Zones and Dry Lands (ACSAD) or the Arab Organization for Agricultural Development (AOAD).
10. Involve each country in a national and regional process of promotion of NWFP through the forest departments of each country.
11. Review national forest policies and regulations in the region as to identify critical gaps which could impede the conservation of forest biodiversity and at the same time the sustainable development of the NWFP sector.
12. Develop processing activities, using innovative techniques and quality standards, to bring products up to international market levels.
13. Develop the medicinal, culinary and aromatic plants industry by providing required establishment and support.
14. Strengthen international cooperation and obtain external financial resources to support innovative cultivation techniques.
15. Improve preservation and storage methods to maintain a high quality of the products.
16. Take account of the conservation of gene resources and the sustainability of bio-diversity in production, conservation and breeding plans.
17. Study of potential marketing problems, including statistics, on production and trade.

## REFERENCES

- Baser, H.C.** 1993. Essential oils of Anatolian Labiatae: Aprofile. *Acta Horticultureae* 333:: 217-238.
- Boulos, L.** 1995. Flora of Egypt Checklist. Al Hadara Publishing, Cairo.
- Chakravarty, H.L.** 1976. Plant Wealth of Iraq. *A dictionary of Economic plants. Vol.1*.
- FAO.** 1996. FAO yearbook. Forest Products. Rome.
- FAO.** 1997. State of the World's Forests. Rome. Italy.
- FAO.** 1999. Towards a harmonized definition of non-wood forest products. *Unasylva* No. 198, vol. 50.
- FAO.** 2000. State of the World's Forests. Rome. Italy. Internet: [http://www.fao.org/forestry/fo/country/nav\\_world.jsp](http://www.fao.org/forestry/fo/country/nav_world.jsp), viewed in July 2001.
- FAO.** 2001. Non wood forest products in Africa: A regional and national overview - Les produits forestiers non ligneux en Afrique: Un aperçu régional et national, by S. Walter. Working Paper FOPW/01/1. Rome.
- Harlan, J.R.** 1992. Crops & Man. Second edition. American society of agronomy, inc., crop science society of America, Inc., Madison.
- Heller, D.** 1991. Conspectus Florae Orientalis. *Botanica Chronica* 10: 55-61.
- Heywood, V.** 1997. Plant resources and their diversity in the Near East. Proceedings of the international expert meeting on medicinal, culinary and aromatic plants in the Near East. Cairo, Egypt, 19-21 May 1997.
- Iqbal, M.** 1995. International trade in non-wood forest products in the Asia Pacific Region. *Beyond Timber: Social, Economic and Cultural Dimensions on Non-Wood Forest Products in Asia and the Pacific*. Proceedings of a Regional Expert Consultation, 28 November-2 December 1994, RAPA, Bangkok, Thailand.
- Kizmaz, M.** 1997. Medicinal, culinary and aromatic plants production in Turkey. *Proceedings of the International Expert Meeting on Medicinal, Culinary and Aromatic plants in the Near East*. Cairo, Egypt, 19-21 May 1997.
- Koyuncu, M.** 1995. Medicinal and aromatic plants in Turkey. Ankara University. Ankara.
- Miller, A.G. & Cope, T.A.** 1996. Flora of the Arabian Peninsula and Socotra.
- WWF. undated.** Forest Harvest: An overview of non-timber forest products in the Mediterranean region. by Y. Moussouris & P. Regato, WWF Mediterranean Programme. Rome (Internet: <http://www.fao.org/docrep/x5593e/x5593e00.htm>, viewed in July 2001).

## 3. Country reports

### 3.1 Afghanistan

#### INTRODUCTION

##### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Afghanistan are medicinal plants (*Ferrula asafoetida*, *Cumin*, *Zizyphus vulgaris*, *Glycyrrhiza spp.*) and fruits (almonds, walnuts, pistachios and pine nuts).

Other NWFP include morels, gums and wild animals (e.g. birds).

##### General information

Plant life in Afghanistan is sparse but diverse. Common trees in the mountains are evergreens, oaks, poplars, wild hazelnuts, almonds, and pistachios. The plains of the north are largely dry, treeless steppes, and those of the south-western corner are nearly uninhabitable deserts. Common plants in the arid regions include camel thorn, locoweed, spiny restharrow, mimosa, and wormwood, a variety of sagebrush.

The annual value of NWFP exploited in Afghanistan is estimated to be about US\$15 million for nuts and US\$12 million for medicinal plants. Permits for exporting these items are issued by the Department of Forestry and Range and are an important source of revenue (Tandon, 1988).

#### PLANTS AND PLANT PRODUCTS

##### Food

Morels, or black **mushrooms** of the genus *Morchella*, are widely gathered by an army of men, women and children in the temperate forests of Afghanistan as well as Pakistan, India, and China and traded internationally in large quantities. Urban entrepreneurs buy them from local collectors and transport them in dried form to overseas markets, especially to Europe, where demand for them as gourmet or speciality foods consistently exceeds local or regional supplies, and prices are uniformly high.

Kernels of Chalghoza pine (*Pinus gerardiana*) constitute a popular dry **fruit** in Pakistan, Afghanistan, India and many Middle Eastern countries. Chalghoza pine is a medium-sized tree, growing naturally at an elevation of 1 800 to 3 000 meters in the dry temperate forests of Afghanistan, Pak and India. Production varies from year to year, with good seed production cycles occurring every fifth year.

According to the National Progress Reports on Forestry, Asia-Pacific Forestry Commission (15<sup>th</sup> Session, Colombo, Sri Lanka) production estimates for the years 1990, 1991 and 1992 were reported to be 868, 715 and 435 tonnes, respectively. The bulk of the production comes from Pakistan and Afghanistan.

**Walnuts** are an important NWFP in China, India, Iran, Afghanistan and Pakistan, where the walnut tree (*Juglans regia*) is an important broad-leaved associate of temperate coniferous forests. The tree is also widely cultivated. Based on the UNCTAD database, the total value of the world's trade in walnuts in 1992 was about

US\$331.238 million (0.03 percent from Afghanistan). EEC, Japan, Canada, Switzerland, Austria and Hong Kong are the major markets (Iqbal, 1995).

Pistachio (*Pistacia vera*) is native of Iran, Afghanistan and central Asia from Turkmenia to Pamir-Alai and Tien Shan. Pistachio forests are distributed mainly in the Provinces of Herat, Badghis, Fariab, Balkh, Samangan, Jauzjan and Kunduz. Annual production of pistachio nuts is roughly between 1 500 and 2 000 tonnes (Chandrasekharan, 1981).

About 1 500 tones of pistachios are consumed annually in USA and is expected to reach 23 000 tones in the next decade. Pistachios are exported from California to Japan, Hong Kong, China, Singapore, Germany and United Kingdom. Other major exporting countries are Iran and Turkey, and to a lesser extent, Afghanistan.

Premium nuts made up 25 percent of the UK snack market in 1990 and were expected to reach 30 percent by 1995. Naturally occurs in the oak forests of Northern Syria, Turkey, Caucasus, Iran and Iraq. Introduced and widely naturalized in North Africa, Cyprus, Crete, southern Europe, Afghanistan, Kashmir, California, etc. (FAO, 1995).

### **Medicines**

Liquorice (*Glycyrrhiza* spp.), in addition to being used as an expectorant and anti-inflammatory, has a multitude of other uses ranging from flavouring for chocolate, beer, tobacco and toothpaste, and as a stabilizing agent for foam in fire extinguishers (Lewington, 1993). In 1992, the total value of international trade in liquorice was US\$0.94 million, of which the bulk (55.1 percent) originated from China (24.1 percent), Pakistan 23.7 percent) and Afghanistan (7.3 percent). Outside the Asia-Pacific region, Syria, Russia and Turkey are the major producers (Iqbal, 1995).

### **Exudates**

**Gum** tragacanth is an important commercial gum produced by several shrubby plants of the genus *Astragalus*, which grow from Pakistan to Greece, particularly in Iran and Turkey. The exudate is produced spontaneously on the bark of the shrub, but making an incision and driving wooden wedges into it often increase the yield.

Iran is the main producing country within the Asia-Pacific region. Small quantities are also produced in Afghanistan, but export consignments are very rare.

Asafoetida is the oleoresin exudate obtained from certain *Ferula* species, particularly *F. assafoetida*, which occur in Afghanistan, Turkey, Iran and surrounding areas. The product is one of the few examples (another one is tragacanth gum) of an exudate which is obtained by "tapping" the roots of a shrubby plant.

Just prior to the flowering stage, the plants are cut above the ground and the taproot/rhizome exposed. A small quantity of "latex" exudes and this is collected every few days.

According to the national statistics, Afghanistan was by far the largest supplier of *F. assafoetida* exudates to India, averaging 525 tones annually outside the peak year 1990/91, when 950 tones were exported (FAO, 1995).

### **ANIMALS AND ANIMAL PRODUCTS**

The wild animals of Afghanistan include 123 mammal species, some of which are nearing extinction. The most seriously endangered are the goitered gazelle, leopard, snow leopard, markor goat, and Bactrian deer. Other wild animals of Afghanistan include Marco Polo sheep, urials, ibex, bears, wolves, foxes, hyenas, jackals, and

mongooses. Wild boar, hedgehogs, shrews, hares, mouse hares, bats, and various rodents also occur. Some 460 bird species are found in Afghanistan, with more than 200 breeding there. Flamingo and other aquatic fowl breed in the lake areas south and east of Ghazni. Ducks and partridges are also common, but all birds are hunted widely and many are becoming uncommon, including the endangered Siberian crane. (Encarta, 2001)

## REFERENCES

- Chandrasekharan, C.** 1988. Forests and Forestry in Afghanistan, FAO, Rome.
- Encarta Home.** 2001. Afghanistan wild life, Internet: <http://encarta.msn.com>. viewed on 1 June 2001.
- FAO.** 1995a. Edible nuts. by G.E. Wickens. *Non-wood forest products No. 5*, Rome.
- FAO.** 1995b. Gums, resins and latexes of plant origin. by J.J.W. Coppen, *Non-wood forest products No. 6*, Rome.
- Iqbal, M.** 1995. International Trade in Non-wood Forest Products in the Asia-Pacific Region. *Beyond Timber: Social, Economic and Cultural Dimensions of Non-wood Forest Products in Asia and the Pacific*. Proceedings of a Regional Expert Consultation, 28 November-December 1994. FAO/RAPA, Bangkok
- Sarsam, A.A.** 1990. Forestry in Afghanistan. Paper presented at Eleventh Session of the Forestry Commission of the Near East, Ankara, October, 1990
- Tandon, J.C.** 1988. Forest and Forestry in Afghanistan: Sector Review. FAO Project (AFG/86/011). Kabul.

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

## QUANTITATIVE DATA ON NWFP OF AFGHANISTAN

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			
<b>Plants and plant products</b>										
<b>Food</b>	1	Pistachio	<i>Pistacia vera</i>	fr	F,P	W	N,I	Annual production of 1 500-2 000 t		Chandrasekharan, 1988
		Walnut	<i>Juglans regia</i>	nu	F,P	W,C	N,I	Export worth US\$100 million		Iqbal, 1995
<b>Medicines</b>	1	Liquorice	<i>Glycyrrhiza spp.</i>	ro	F	W	N,I	Export worth US\$68 620		Iqbal, 1995

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## **3.2 Bahrain**

### **INTRODUCTION**

#### **Main Non-Wood Forest Products**

No information is available on non-wood forest products (NWFP) in Bahrain.

### **ACKNOWLEDGEMENT**

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

### 3.3 Cyprus

#### INTRODUCTION

##### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Cyprus are medicinal and aromatic plants and carob (*Ceratonia siliqua*).

Other NWFP are exudates. The use of forest as for recreational purposes is a main forest service.

#### PLANTS AND PLANT PRODUCTS

##### Food

*Ceratonia siliqua*, the carob tree, is both grown in the wild and cultivated for its ripe fruit. It is widely cultivated in lowland areas. The carob tree is an inseparable element of the natural and cultural heritage of Cyprus. It is the dryland crop, friendly to the environment. Carobs have long been harvested as major crops called the 'black gold' of Cyprus.

During the 1960's the low prices of the international market and the increase in labor cost gradually resulted in abandonment of the crop. From the data of 1977 and 1994 inventories, it seems that the total number of trees was decreased to 77 percent. According to the 1994 inventory, the total number of trees is estimated to be 265 764. As a result, the total crop production gradually decreased to 8 800t in 1996 (FAO, 1995).

Locust bean (or carob) gum is the whitish powder obtained from grinding the endosperm of the seeds of *Ceratonia siliqua*. Uses of locust bean gum are divided between food and other, miscellaneous applications. Exports of locust bean seed from Cyprus for 1988-92 are shown in Table 1. Apart from the United Kingdom, all other exports from Cyprus go to the three main gum producers, Spain, Italy and Portugal. The level of exports fluctuated but averaged approximately 1 000 tonnes/year. (FAO, 1995)

Table 1. Locust bean seed<sup>a</sup>: exports from Cyprus, and destinations, 1988-92 (tonnes)

	1988	1989	1990	1991	1992
<b>Total</b>	1578	868	1199	752	466
<i>Of which to :</i>					
UK	na	687	750	409	na
Italy	na	80	308	184	na
Spain	na	101	-	159	na
Portugal	na	-	122	-	na

Source: FAO (1995b)

Note: a Includes decorticated, crushed or ground seed and non-decorticated seed

Yields of pods are extremely variable and depend very much on the cultivar in question, as well as climatic and other conditions where the trees are growing. Individual trees have been reported to yield up to 0.5-1.0 tonnes of pods but average yields in cultivated stands rarely exceed 2.5 tonnes/ha. Average yields in Cyprus for 1967 (based on 55 000 tonnes production) were equivalent to approximately 2 tonnes/ha or 22 kg/tree. However, higher yields were reported by Padulosi (1998):

average yields in Cyprus, Israel and Mexico are stated to be equivalent to 10-17 tonnes/ha. Yields increase steadily up to 25-30 years of age, but may vary in alternate years, being high one year and low the next. Well cared for cultivated trees have a productive life of 80-100 years (Padulosi, 1998).

### **Medicines**

Local people use scattered aromatic and medicinal plants in the forest but they do not represent an important economic activity.

In Cyprus, there are over 280 wild aromatic and medicinal plant species. The inhabitants in the villages bordering the forest gather and use them for both local and foreign trade.

However, this has been restricted to a minimum for two main reasons:

1. The persistent drought prevailing in Cyprus has restricted production.
2. Trade in aromatic plants cannot be carried out depending only on dry aromatic plants from the forest, which are restricted in quantity, quality and type.

For this reason, the Ministry of Agriculture, Natural Resources and Environment has launched the Project for the "Development and Cultivation of Aromatic and Medicinal Plants" in Cyprus.

### **Exudates**

*Pistacia lentiscus* prefers an arid, sub-tropical climate and occurs in coastal Mediterranean regions of both southern Europe and north Africa, and some of the islands in the Mediterranean such as Sicily, Sardinia and Cyprus. However, it is only cultivated for mastic on the Aegean island of Chios, where it occurs as *P. lentiscus* var. *chia*; it is often interspersed with olive trees. Although usually termed a gum, mastic is a hard resin, produced by tapping the stem bark of the small tree *Pistacia lentiscus*, which is cultivated on the Greek islands of Chios.

Mastic is produced in the form of small tears, pale yellow in colour, clear and glassy in nature and liable to fracture. Its age-long use in Arab countries has been for chewing, where it sweetens the breath and helps preserve the teeth and gums. Its aromatic properties also make it suitable as a flavouring agent for alcoholic beverages. In the past it was also used in the manufacture of high-grade varnishes for paintings, and for medicinal purposes.

An essential oil can be distilled from the gum and finds some use for fragrance and flavouring purposes.

### **Perfumes and cosmetics**

Among Cyprus's natural vegetation, a number of aromatic, medicinal and other useful plants are being exploited in their wild form in order to obtain essential oils.

*Origanum* spp. has long been valued as the source of a valuable aromatic oil. It is harvested, dried, packed and sold as an aromatic substance for food. Likewise the sage, *Salvia fruticosa*, is collected from the wild and used as a medicinal plant for tea preparation against sore throats and colds. *Thymus capitatus* is collected for use as an aromatic in cooking. The tender shoots, the buds and the fruit of the wild caper (*Caparis spinosa*), as well as the tender leaves of *Eryngium maritimum*, are consumed and preserved in vinegar as appetizers. Tender leaves or shoots of *Silene*

*spp.*, *Asparagus sp.*, *Malva sp.*, and other species are collected from the wild and used for culinary purposes.

*Rosa damascena*, the Damask Rose, a very ancient garden rose, is also cultivated in villages at high elevations as an aromatic plant. Flowers are used to prepare rose water and also to prepare sweets in heavy syrup. *Laurus nobilis* (Laurel), is gathered or grown for its aromatic leaves and fruits. The leaves are used as aromatics and the oil from its fruits in cosmetics.

An interesting plant of economic importance is *Rhus coriaria* (Sumach) an erect or spreading shrub to about 2 m high which grows on stony mountainsides and in vineyards from 600 to 1 800 m. Leaves of this plant, which is an industrial plant rich in tannin, are collected every year and exported.

In Cyprus, there are over 280 wild aromatic and medicinal plant species. Tables 2 list the most important cultivated and wild aromatic plants in Cyprus and their production values.

Table 2. List of cultivated aromatic plants and their production values

Species	Trade name	Production (in tonnes)	Value of production (in US\$)
<i>Origanum dubium</i>	Oregano	20	80 000
<i>Salvia fruticosa</i>	Sage	10	40 000
<i>Thymus vulgaris</i>	Thyme	30	60 000
<i>Mentha viridis</i>	Mint	100	400 000
<i>Coriandrum sativum</i>	Coriander	2 000	4 000 000
<i>Ocinum basilicum</i>	Basil	20	74 000
<i>Artemisia dracunculus</i>	Tarragon	12	72 000
<i>Lavendula</i>	Veralavender	5	80 000
<i>Rosa damascena</i>	Damas rose	6	60 000

Source: Georgio & Gavrilides (1999)

Initiatives related to the cultivation of aromatic and medicinal plants in Cyprus began in 1991. During this year the "Project for the Development of Aromatic and Medicinal plants in Cyprus" was set up.

Briefly, this project entails the following:

1. Establishment of trial plantations with both local and imported aromatic plants, such as Oregano, Sage, Lavender, Tarragon, *Dictamus*, *Hyssope*, Mint, Bay, Rosemary, Thyme, *Sideritis*, Melissa etc., with the intention of defining those areas of Cyprus where these plants grow best, and are economically viable.
2. Establishment of mother plantations for the production of propagating material.
3. Establishment of nursery and seedling stock production unit to meet the farmers' requirements.
4. Installation of a distillation unit for distillation trials.
5. Establishment of botanical collections.
6. Allocation of long-term, low interest loans to interested farmers up to L30 000 (US\$1=L0.67) for the establishment of viable aromatic plantations.
7. Foundation of a sector in the department of agriculture of aromatic and medicinal plants to put into effect the above project.

This project can be split up into three categories:

- Production and marketing of dry and aromatic plants.
- Production and marketing of fresh aromatic plants.
- Production of essential oils by distillation.

The main aromatic plants that are promoted by the Department of Agriculture are: Oregano, Sage, Mint, Basil, Tarragon, and Lavender and to a lesser extent Marjoram, Bay, *Dictamus*, Rosemary, *Mellssa*, Thyme and *Siderlitis*. There is a great demand for such products in the countries of the E.U. and other countries because of their excellent quality, which is attributed to the favorable climatic conditions of Cyprus.

### **Ornamentals**

Wild progenitors of ornamental species such as *Tulipa spp.*, *Narcissus spp.*, *Anemone spp.*, *Cyclamen spp.*, *Orchis spp.*, *Ophrys spp.*, *Fritillaria spp.*, etc. exist among the wild vegetation of Cyprus. Unfortunately, their numbers are rapidly decreasing owing to continuous developmental activities, use of herbicides and inconsiderate exploitation.

### **REFERENCES**

- Encarta Home.** 2001. Cyprus Forests. Internet: <http://encarta.msn.com>., viewed on 1 June 2001.
- FAO.** 1995a. Natural colourants and dyestuffs. by C.L. Green. *Non-wood forest products No. 4*, Rome.
- FAO.** 1995b. Edible nuts. by G.E. Wickens. *Non-wood forest products No. 5*, Rome.
- FAO.** 1995c. Gums, resins and latexes of plant origin. by J.J.W. Coppen. *Non-wood forest products No. 6*, Rome.
- Georgio G. and Gavrillides A.** 1999. Non Wood forest products in Cyprus. Expert meeting on developing and coordinating the activities for non-wood forest products, FAO. Beirut, 1999.
- Padulosi, S.** 1998. Priority-setting for underutilized and neglected plant species of the Mediterranean region. Report of the IPGRI conference-February 1998-ICARDA, Aleppo, Syria.

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

## QUANTITATIVE DATA ON NWFP OF CYPRUS

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			
<b>Plants and plant products</b>										
Food	1	Carob	<i>Ceratonia siliqua</i>	fr	F	W	N,I	Export worth 466 t in 1992		FAO, 1995
Perfumes, cosmetics	2	Oregano	<i>Origanum dubium</i>	fl,le	F,P	W,C	N,I	Production of 30 t worth US\$140 000		Georgio & Gavrilides, 1999
	2	Sage	<i>Salvia fruticosa</i>	fl,le	F,P	W,C	N,I	Production of 15 t worth US\$42 000		Georgio & Gavrilides, 1999
	2	Thyme	<i>Thymus capitatus</i> , <i>Thymus vulgaris</i>	fl,le	F,P	W,C	N,I	Production of 33 t worth US\$78 000		Georgio & Gavrilides, 1999
	1	Caper	<i>Capparis spinosa</i>	pl	F,P	W,C	N,I	Production of 100 t worth US\$20 000		Georgio & Gavrilides, 1999
	1	laurel	<i>Lauris nobilis</i>	le	F,P	W	N,I	Production of 3 t worth US\$18 000		Georgio & Gavrilides, 1999

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## 3.4 Iran

### INTRODUCTION

#### Main Non-Wood Forest Products

The most important non-wood forest products (NWFP) of Iran are dying (crocin extracts, henna), medicinal plants (cumin) and exudates (gum tragacanth).

Other NWFP include aromatic plants and essential oils, honey and edible foods (nuts) such as Pistachios (*Pistacia vera*) and Walnuts (*Juglans regia*).

#### General information

The use of NWFP in Iran has a very long history: evidence of the use of medicinal plants goes back a thousand years, when Avicenna, the known Iranian medical scientist and practitioner, wrote a volume on medicinal plants upon which western medicine was based until the thirteenth century.

The pastoral nomads of Iran have sustainably managed rangelands for thousands of years. Until the early twentieth century, the rich grasslands, which cover some 90 million ha, provided the basis for national governments formed by nomadic pastoral tribes. Rangelands were protected and used as pasture for livestock (sheep and goats, cattle, camels, horses and donkeys, domestic fowl); to provide fuel wood; as hunting grounds; for harvesting wild plants as medicines; for dyeing material for handicrafts such as rugs, and industrial products such as gums; for extracting building materials for tents, fencing and tools; for harvesting and gathering wild plants as a constant and varied source of food. This last use has given nomads the leading nutritional edge over settled populations. Wild herbs, roots, berries, spices and fruits provide a rich supplement of vitamins, minerals, proteins and carbohydrates that many settled villagers and poor urban populations lack.

Range vegetation cover has many benefits including the following:

- Conservation of soil and protection from erosion;
- Maintaining the hydrological balance;
- Greening and purifying the environment;
- Provision of wildlife habitats;
- Providing forage and fodder for villager's and nomad's livestock;
- Through the grazing animals providing a part of the protein requirements of the country;
- Producing medicinal herbs and other products for human use. (Iran-UNEP-FAO Initiative, 1999).

At present, the production and use of some NWFP are encountering difficulties. The sustainability of rangelands, which is covering 55 percent of the country's area, is threatened by recent policies, particularly the efforts to settle nomads and the support to the expansion of dry farming.

### PLANTS AND PLANT PRODUCTS

#### Food

Iran is one of the main countries where natural stands of walnut trees (*Juglans regia*) still exist, mainly in the north and western forests of the country. The presence of old seed trees in many ecological zones of Iran, from the Caspian forest in the North to the area of Kerman, Fars, and Izeh in the South, testifies the long history of natural and artificial planting and selection of this species. In Iran, walnut trees can be found at an altitude of 0 to 2 500masl. Both, natural stand and plantations manifest a high genetic variability (De Salvador, 1988).

Walnut trees have traditionally been planted for their fruit and for their high quality timber. The kernel, rich in fat and protein, is used as a component of Persian food and has an important place in the Persian nut production.

The valuable nut of the Pistachio tree (*Pistacia vera*), is not only used for consumed but also for its medicinal properties. With an annual export of nearly 56 000 tonnes, pistachio and its kernel constitute one of the most important Iranian non-oil export commodities

The fruit of the date palm (*Phoenix dactylifera*) is another major exported commodity. The main regions under palm cultivation are Khuzistan, Fars, Aerman, Boushehr, Oistan, Eaiuchestan and some desert marginal lands. The whole land under date cultivation is estimated to produce more than 0.5 million tonnes annually.

Pomegranate (*Punica granatum*) is also grown in Iran. The main production centers are found in Saveh, Yazed, Kashan, Khorasan, Isfahan, Ars, Kermanshahan, and Mazanderan. Pomegranate is consumed as a fresh fruit or is made into a seasonal sauce. Its skin and seeds are largely used in the dye making and pharmaceutical industry. The area under pomegranate cultivation is estimated to be 540 594 hectares with an annual production of 496,215 tonnes, and an annual export volume of 9 532 tonnes (Report of the Islamic republic of Iran on forestry development and key events, 1996).

### **Fodder**

Currently the rangelands of the country produce about 10 million tones of grazable dry matter per year, which is sufficient for feeding 50 million animal units for 100 days. By implementation of suitable range rehabilitation programmes, fodder production can be increased by at least 35 mil. tones of usable dry matter per year, which is almost equivalent to the traditional flock and herd feed requirements.

The difference between the actual and the potential production is due to past policies lack of co-ordination, incorrect utilization, and destruction of rangelands by cultivation and conversion of these to the low yielding rain-fed crops (FAO, 1991).

### **Medicines** (Riazi, 1997)

Medicinal, culinary, and aromatic herbs have traditionally been used in Iran for many generations and have always been regarded as an integral part of farming and agricultural practices. *Atraphaxix spinosa*, fenngreek (*Trigonella foenum-graecum*), sweet root, almonds, *Atropa belladonna*, *Salvadora persica*, *Nigella* and *Anchusa officinalis* are amongst some of the plants used by the Iranian people.

Currently, research on medicinal plants and herbs is stimulated by the government and the private sector in Iran. Research is carried out by universities, pharmaceutical institutes, experimental farms and research centers. The Horticulture Department of the Ministry of Agriculture now also deals with medicinal plants and herbs affairs.

Iran is one of the main centers of Cumin (*Cuminum cyminum*) production. The area under cultivation is 50 000 hectares with an average annual production of 50 000 tonnes. In Iran, Cumin is cultivated in Eastern Khorasan, Sabzevar, Birjand, Gonabad, Sorkhe, Garmsar and Kerman.

The plant fits into the farming pattern of any given area. It has a short growing season of 100-120 days. The sowing season extends from December to mid-March. In plant rotation, cumin follows the summer crops and its maintenance does not affect the other cultivated crops. However, intensive weeding must be carried out in the early stages of its growth.

Cumin is used as a medicine to cure acid indigestion, heartburn, sour stomach, colic, constipation and flatulence. In powder form, mixed with other nutrients, it is prescribed as baby food and in the treatment of coughs. Cumin is also used as a toxicant for the eradication of harmful insects and pests. Finally, it has a common usage as an additive in confectionery, pastry, cheese, Soya and salads.

Iran exports cumin to Dubai, Pakistan, Japan, Cambodia, Kuwait, United Arab Emirates, Germany, France, the Netherlands, the Czech Republic, Saudi Arabia, Qatar, Hungary, the Philippines, Singapore, Belgium and the United Kingdom.

### **Perfumes and cosmetics**

Certain aromatic plants have been used traditionally as medicine, while others, notably varieties of roses and herbs, have been used for perfuming and flavouring. Production of rose water and water extracts (Araghiat) in central Iran in Kashan has led to the growth of a flourishing cottage industry as well as establishing the first industrial level rose water production unit.

Although considerable data on the occurrence and use of aromatic plants species is available, information on their quantity, consumption and export is scarce and limited.

Export and import figures of aromatic plants are not known, but data on export and import of perfumery raw material and other material used for the flavour and fragrance industry (85 million Iranian Rials, IRR)<sup>3</sup> and export of some (IRR14 million) reveal the underlying feature, which is an imbalance in the trade of such items.

Despite the existence of a rich flora and the traditional application of the natural resources in Iran, there does not seem to be any production of essential oils in the country. The main exception being some 20 kg of rose oil, which is being exported annually (FAO, 1991).

### **Dying and tanning**

Crocin extract is the trade term for the yellow, water-soluble food colorant obtained from Cape jasmine (*Gardenia jasminoides L.*) and from saffron (*Crocus sativus L.*). However, the extracts are not used interchangeably in all applications since saffron is valued as much for its aroma and flavour as for its colouring properties and, moreover, it is the world's most expensive spice/colouring.

*Crocus sativus L.* is a perennial, which resembles the purple spring crocus but blooms in the autumn. It is adaptable to a wide range of climates from the temperate to the sub-tropical and on soils varying from sandy to well-drained clay loams. Most commercial production areas may be described as dry. Two heavy rainfalls are sufficient, one in the spring and the other in the autumn.

Harvesting spans four to six weeks in the autumn. Each plant only flowers for about fifteen days and harvesting, therefore, must be timely. Intact flowers are picked and this is done early in the morning to prevent withering. On the same day the stigmas are removed from the harvested flowers the drying process is initiated.

Yields of flowers vary considerably according to local site conditions. On average one hectare yields one million blooms, which provide 50 kg of fresh stigmas and 10 kg of dried saffron.

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<sup>3</sup> 1 000 Iranian Rials (IRR) = US\$0.57 (exchange rate on 14 June 2001).

*Gardenia jasminoides* Ellis originates from temperate areas but grows also well in the tropics at altitudes above 400 m. It requires an open sunny position on well-drained soils and prefers a soil pH of 6 to 7. The fruits are first dried and then extracted with aqueous alcohol. Crocin yields of up to 10 percent have been reported for dried fruit.

Quantification of the international trade in saffron is made difficult by the shortcomings in the statistics of many countries. Total annual trade is estimated at 50 tonnes, with Western Europe, North America and the Gulf States as the major markets. Japan and South American countries are also significant consumers. The principal supplier to all markets, except in the Gulf States, is Spain but it also imports Iranian and Indian material which, presumably, re-enters trade under a Spanish label. Annual import levels for individual countries fluctuate in response to availability and prices. The USA, for example, took 3 tonnes in 1992 and this level rose to 8.3 tonnes in 1994 (FAO, 1995).

Henna is a product derived from the dried leaf of *Lawsonia inermis* L., a shrub or small tree which is indigenous to the area between Iran and northern India. The plant has been introduced widely throughout the tropics and sub-tropics as an ornamental (frequently as a fragrant hedge), for home use as a dyestuff and elsewhere as a commercial crop, notably in several North African countries. Aqueous extraction of the dried leaf provides a dye, which can range in colour from black, to red through to blonde (neutral). Since ancient times, henna has been employed as a cosmetic dye for hair, skin and nails and it has acquired a particular significance in Islamic culture. More recently, there has been an increase in its usage as a hair dye in Western Europe and North America.

Prior to the widespread availability of synthetic dyestuffs, henna was employed also as a dye for textiles and leather. In the Persian Gulf market, black henna prices during 1992 ranged from US\$700 per ton for top grades to US\$250 per ton for lowest grades. Under rainfed conditions the dried leaf yield in the first year may be around from 200 kg/ha and then increases from 1 000 to 1 500 kg/ha in the following years. With irrigation and heavy fertilizer treatment yields can be as high as 2 000 kg/ha the peak productivity years (FAO, 1995).

Iran follows India and Pakistan as main supplier to the Middle East market.

### **Exudates**

Gum tragacanth is an important commercial gum produced by several shrubby plants of the genus *Astracantha* which is grown from Pakistan to Greece, particularly in Iran and Turkey (Anderson, 1989). The exudate is produced spontaneously on the bark of the shrub, but the yield is often increased by making an incision and driving wooden wedges into it. (Iqbal, 1995).

Iran is the main producing country within the Asia-Pacific region. Small quantities are also produced in Afghanistan, but export consignments are very rare. About 70 percent of supply originates from Iran. According to *Agricultural Products* November 1991, Iran's average annual production potential has been estimated at 400 tonnes (Iqbal, 1995).

Iran's export of tragacanth was 91 tonnes in 1987, increasing to 142 tonnes in 1988. The export volume further increased to 257 in 1990. Thus, there was an increase of 182 percent in 1990, over exports in 1987. With this growth rate, it is expected that Iran may very soon be able to export 400 tonnes of the production. Tragacanth finds markets in many different countries, but the EEC, USA Japan and the former Soviet Union are the major importing regions (Iqbal, 1995).

Table 1. Iran's export of tragacanth in 1987-1990

Year	1987	1988	1989	1990
Export value (tonnes).	91	142	176	257

Source: Jqbal (1995)

## ANIMALS AND ANIMAL PRODUCTS

Beekeeping and trade in honey have been practised in Iran for many hundreds of years. Evidence of this activity can be traced back to the Persian Empire. Traditional beekeeping, based on local resources and materials, has greatly declined since the introduction and rapid success of modern frame hives in the 1950's. Furthermore, changes in beekeeping over the last decade have been due to the devastating effects of the Varroa disease caused by the mite *Varroa jacobsi* (Paterson, 1994).

Of the six main honeybee species of the world, four are found in Iran: *Apis dorsata*, *A. flora*, *A. cerana* and *A. mellifera*. The first two are found in the forests of the Elburz and Zagros ranges, *A. cerana* is found in a limited area of northern Khorassan in northeastern Iran. *A. mellifera meda* (named after the Medes, the inhabitants of north-western Iran who appeared in the ninth century BC) is native to the country.

Every year imported queens reduce the purity of the native stock of *A. mellifera meda*, partly as a result of the lack of studies and selection of the species. Similar problems apply to silkworms: of the 12 species known unofficially in the country, only one is the subject of research. Once completely self-sufficient in silkworm production, Iran now imports silkworm eggs every year (FAO, 1991).

The 1986 annual report of the Ministry of Agriculture indicates the presence of 1 331 877 colonies of honey bees in Iran of which less than one quarter are traditional hives. The modern hives produce 10 kg. A year, whereas the traditional hives have an annual yield of 3 kg. The important centers of beekeeping are the provinces of: East and West Azerbaijan, Esfahan, Gilan, Masandaran, Tehran, Farse, Lorestan, Kerman, Hamedan and Markazi. The report also states that the value of the beekeeping industry on a national basis is IRR32 963 953 000.

The bee *Apis mellifera meda* is indigenous to northern Iran. However, as a result of the heavy losses caused by disease and the considerable importation that have been made in recent years, the honey bees currently used are derived from crosses of local and imported specimen (Paterson, 1994).

## REFERENCES

- Anderson, D.M.W.** 1989. NET gums. Ancient and modern commercial products. NFT highlights, 89-1-01. Nitrogen Fixing Association. Hawaii.
- De Salvador, F.R.** 1988. Assistance to walnut production in Iran: Final Mission Report. FAO. Rome.
- FAO.** 1991. FAO project (Iran-IRA/89/030) Enhancing research development and capabilities of aromatic plants.
- FAO.** 1995. Natural Colorants and Dyestuffs. A review of production, markets and development potential. by C.L. Green. *Non-wood forest products*, 4. FAO. Rome, Italy.
- Iqbal, M.** 1995. International trade in non-wood forest products in the Asia-pacific region. *beyond timber: social, economic and cultural dimensions on non-wood forest products in Asia and the pacific*. Proceedings of a regional expert consultation. 28 November - 2 December 1994. FAO/RAP, Bangkok.
- Iran- UNEP- FAO Initiative.** 1999. Low cover country (LFCC) Meeting.
- Ministry of Agriculture.** 1986. The annual report.
- Paterson, P.D.** 1994. Caspian Model Forest Management Plan. Iran. Apiculture. FAO project (FO:DP/IRA/89/014) in collaboration with the Forest and Range Organization, Iran.
- Report of the Islamic republic of Iran on forestry development and key events.** 1996. Presented to: The Twelfth Session of the Near East Forestry Commission. 21-24 October. Cairo, Egypt.
- Riazi, Y.** 1997. Medicinal herbs, culinary and aromatic plants in agriculture of Iran. paper submitted to *The International Expert Meeting on Medicinal, Culinary and Aromatic Plants in the Near East (Cairo, 19-21 May, 1997)*. Ministry of Agriculture, Iran.

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

## QUANTITATIVE DATA ON NWFP OF IRAN

Product			Resource				Economic Value		References	
Category	Importance	Trade name	Species	Part used	Habitat	Source	Utilisation	Quantity, value	Remarks	References
	1, 2, 3				F, P, O	W, C	N, I			
<b>Plants and plant products</b>										
Food	2	Pistachios	<i>Pistacia atlantica</i>		F, O	W, C	N	Production volume in 1989-1993 of 1 567 t		Iran Report, 1996
	2	Date	<i>Phoenix dactylifera</i>		F, O	W, C	N, I	Annual production of 54 000 t		FAO, 1991
	1	Pomegranate	<i>Punica granatum</i>		P	C	N, I	Annual production 496 215 t Annual export of 9 532 t		FAO, 1991
Fodder					F	W		Annual production worth 10 million of grazable dry matter		FAO, 1991
Perfumes, cosmetics	U		<i>Achillea sp.</i>	le, fl	F	W	N, I	Import of IRR85 million; Export of IRR14 million		FAO, 1991
			<i>Zataria multiflora</i>	le						
			<i>Salvia hydrangea</i>	le						
			<i>Nepeta crassifolia</i>	le						
			<i>Rhus coriaria</i>	le, fr						
Medicines	1	Cumin	<i>Cuminum cyminum</i>	pl	O	C	N, I	Annual production of 50 000 t		Riazi, 1997

<b>Dying and tanning</b>	1	Crocin extract	<i>Gardenia jasminoides</i>	fr	F, O	W, C	N, I	Annual export of 50 t		FAO, 1995
		Saffron	<i>Crocos sativus</i>	fl	F, O		N, I	Approximate yield: 10 kg of saffron/hectare		FAO, 1995
	1	Henna	<i>Lawsonia inermis</i>	le	F,O	W, C	N, I	Production of 1 000-2 000 kg/ha Price=US\$ 250-700/t	Iran and India are the main suppliers to the Middle East area	FAO, 1995
<b>Exudates</b>	1	Gum tragacanth	<i>Astracantha sp.</i>	gu	F,O	W	N, I	- Average annual production = 400 t; - Export of 257 t in 1990		Iqbal, 1995
<b>Animals and animal products</b>										
<b>Honey, beeswax</b>	2		<i>Apis mellifera meda</i>	ho	F, O	W, C	N	1 331 877 colonies	Modern hives produce 10kg/year Traditional hives produce 3kg/year	Paterson, 1994

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## 3.5 Iraq

### INTRODUCTION

#### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Iraq are medicinal plants.

Other NWFP include date palms, gums and honey.

#### General information

In the Zagros mountains, over cutting and overgrazing have reduced some of Iraq's oak forests to scrubland. Stands of other trees - maple, hawthorn, and pistachio, for example - remain, however. At higher elevations are alpine plants that can survive harsh weather. Reeds, boxthorns, buttercups, rushes, and saltbush grow in the nation's plains and marshlands. Date palms thrive in many parts of the country, and occasionally poplars and willows appear. Centuries of human settlement have depleted Iraq's wildlife.

Surviving mammals include bats, rats, jackals, hyenas and wildcats, with wild pigs and gazelles living in remote areas. Reptiles are numerous and lizards and snakes make their homes in the country's deserts. Among Iraq's domesticated animals are camels, oxen, water buffalo and horses. Northern Iraqis raise large flocks of sheep and goats for their wool and skins.

### PLANTS AND PLANT PRODUCTS

#### Food

Date Palm (*Phoenix dactylifera*) may represent the oldest domesticated palm, having originated most likely in Mesopotamia (modern Iraq) 5 000 to 10 000 years ago. The earlier time period would place the date palm among the most ancient of domesticated plants. In 1994, the three leading date-producing countries were Iran, Egypt and Iraq (FAO, 1994).

#### Medicines

In folk medicine in Iraq, most medicinal plants are taken in the form of beverages (bush tea) prepared by soaking in boiling water either the leaves or the whole plant. Amongst the 1 500 or so plants used in Iraq, a large number serve medicinal and aromatic purposes. Some of them are cultivated.

Information about the medicinal and aromatic plants of the region is scattered in a range of different works. An ethnobotanical survey was carried out in different regions of Iraq following interviews with various traditional healers, who are called Attars, and various other people. Ninety-seven medicinal plants belonging to forty-three families were identified (Al-Nouri, 2000).

Tab. 1. Some medicinal plants used in Iraq

<i>Achillea santolina</i>	<i>Ephedra foliata</i>
<i>Anchusa strigosa</i>	<i>Haloxylon articulatum</i>
<i>Capparis spinosa</i>	<i>Prosopis farcta</i>
<i>Centaurea phyllocephala</i>	<i>Quercus infectoria</i>
<i>Cleome quinquenervia</i>	<i>Salvia spinosa</i>
<i>Echium italicum</i>	

Source: Al-Nouri (2000)

The vapour of wormwood (*Artemisia absinthium*) plant was inhaled to stop a cough. Tests conducted in 1987 demonstrated that besides possessing anti-bacterial activity; the oil also has a very powerful anti-spasmodic activity. In 1988, research was undertaken in Iraq into the medicinal activity of Wormwood. This was because it was widely used in traditional medicine to treat diabetes mellitus. It was shown that oral administration of an aqueous extract did in fact produce a significant fall in blood sugar levels. Wormwood extracts have long been used by Medical Herbalist's for their potential worm expelling properties. As infestation of the gut with parasitic worms is common in societies with primitive sanitation, then it is very likely the ancients were well aware of the effects of this plant (Al-Nouri, 2000).

*Liquorice* is obtained from the dried roots and rhizomes of several *Glycyrrhiza* species, in particular *G. glabra* - all perennial herbaceous shrubs indigenous to southern Europe and the Near East. Most of the world's supply comes from plants gathered wild in the former USSR, Spain, Turkey, the Syrian Arab Republic, Iraq and Afghanistan.

### Exudates

*Astragalus* sp. naturally occurs in the oak forests of Iraq. The better gum-yielding species are small, low, bushy perennials, frequently with a cushion-like form. However, they have relatively large taproots, which are the primary source of the gum. *A. gummifer* is a low shrub. *A. microcephalus*, which produces a high quality gum.

The Asiatic species of *Astragalus*, which are the sources of commercial gum, are native to countries of Asia Minor: Iran, Turkey, Iraq, Syria, Lebanon, Afghanistan and parts of Russia. They are usually found in the drier mountainous regions, although they require some water.

## ANIMALS AND ANIAML PRODUCTS

### Honey and beeswax

In Iraq, beekeeping has traditionally been a well known source of food and income. Recently-introduced beekeeping methods are giving problems because of honeybee diseases and lack of access to equipment and technical know how. Assistance to beekeepers has been initiated and funded by the Food and Agriculture Organization of the United Nations (FAO) and the United Kingdom Department for International Development (DFID).

The indigenous honeybee is *Apis mellifera syriaca*. A species reported to be *Apis florea* has been documented in eastern Iraq although it is not known whether this species has naturally increased its distribution westwards from Asia, or this represents an introduction by man, as has happened in Sudan.

Iraqis regard honey as a special, precious food. An ongoing project in Iraq is working to bring back the country's once high numbers of honeybees, which had been nearly wiped out by disease and war. In the early 1980s, "Every farmer a beekeeper" was the message and more than 500 000 traditional hives were active in Iraq. Then, from 1985 to 1987,

apiculturists worldwide were hit hard by the spread of the Asian predatory mite, *Varroa jacobsoni*. The Iraqi Beekeepers' Association estimates that 90 percent of the over 500 000 honeybee colonies in Iraq had been lost to *Varroa jacobsoni* by 1987, The most recent threat to Iraq's honeybee population is the so-called "crawling disease". First reported in early 1994.

According to the statistics of the Arab Organization for Agricultural Development, the production of honey in Iraq in 1997 was 125 tonnes, the number of beekeepers were 17 000 (El-Shehawy, 1998).

## REFERENCES

- Al-Nouri, N.** 2000. A survey of medicinal plants and their traditional uses in Iraq. *Pharmaceutical Biology*. 2000, vol. 38, no. 1.
- Arab Net Home page.** 2001. Iraq flora and fauna. Internet: [http://www.arab.net/iraq/geography/iq\\_florafaua.html](http://www.arab.net/iraq/geography/iq_florafaua.html), viewed on June 10, 2001.
- Bradbeer, N.** 1996. Zooming in on Iraq. *Beekeeping & Development* 39: 8
- EL-Shehawy, M. A.** 1998. The Future of Bees and Honey Production in Arab Countries. Internet: [http://www.beekeeping.com/index\\_us.htm](http://www.beekeeping.com/index_us.htm), viewed on June 10, 2001.
- FAO.** 1994. Tropical palm. Non-wood forest products 10.
- Glaïim, M K.** 1992. First record of *Apis florea* in Iraq. *Beekeeping & Development* 24: 3
- Iraqioasis Home.** 2001. Internet: <http://www.iraqioasis.com/p1.htm>, viewed on June 12, 2001.
- Twaij, A. and Al-Jebbory, A.** 1985. Screening of Iraqi medicine plants for diuretic activity. *India J. Pharmac.* 1985, vol. 73.

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

## QUANTITATIVE DATA ON NWFP OF IRAQ

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			
<b>Animals and animal products</b>										
Honey, beeswax	2		<i>Apis mellifera syriaca.</i>	ho	F,P	W,C	N	Production worth 125 t in 1997		EL-Shehawy, 1998

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## 3.6 Jordan

### INTRODUCTION

#### Main Non-Wood Forest Products

The most important non-wood forest products (NWFP) of Jordan are edible products such as mushrooms (e.g. *Boletus aestivalis*, *Boletus aereus*, *Lyophyllum decastes*, *Lepista nuda*, *Cantharellus cibarius*, *Agaricus campestris*), fruits (e.g. stonepine, carob, sumac, palm nut) and aromatic plants (eg. *Laurus nobilis*, *Thyme*).

Other NWFP include medicinal plants (*Aremisia herba-alba*, *A. judiaca*, *A. monosperma*, *Achillia fragrantissima*), reeds (*Fragmyites communis*) and honey.

#### General information

The forest administration in Jordan is aware of the importance of NWFP for the local population of its different uses for social, environmental and health purposes. That's why the forest department is dealing with the subject through the following issues (Al Wadi, 1999):

- Encouraging people to benefit of NWFP of forests free of charge and without licenses in a sustainable way;
- Collecting, handling, storing and distributing of seeds of important NWFP producing tree and shrub species through forest seed centre of department of forests;
- Giving a considerable importance for multi-purpose forest trees by producing its seedling in forests nurseries;
- Producing seeds for planting in forest areas and for farmers to be used in their lands;
- Establishing a genetic resource conservation unit in the National Center for Agricultural Research and Technology Transfer (NCARTT), which is dealing with the conservation of most important plant species;
- Conserving the resources through its sustainable use;
- Giving high priority to culinary medical and aromatic plants.

### PLANTS AND PLANT PRODUCTS

#### Food

Many people in rural areas are dependent on forests for critical portions of their food supplies. These include food from fruits of:

- *Castanopsis acuminatissima*, Oak (Balout) for human and livestock consumption;
- *Pistacia vera*, Pistachio (Fustouk – Butum);
- *Ceratonia siliqua*, Carob (Kharoub);
- *Ziziphus* (seder);
- *Pirus syriaca* (Agas bari);
- *Rubus* (ulaik);
- *Phoenix dactylifera* (Tamer, Nakheel);
- *Crataegus azarolus* (Nabak);
- *Rhus coraria* (sumak);
- *Olea europaea* (zaytoon).

Edible **mushrooms** such as *Boletus aestivalis*, *Lepista nuda*, *Lactarius delicious*, *Cantharellus cibarius*, *Agaricus campestris* and *Pleurotus eryngii* are commonly collected by villagers in the Ajloun and Jerash districts (Najwa Najjab, 1996).

### Fodder

Forest trees, shrubs and vegetation contribute to food security of rural population by providing fodder for livestock (see table 1). Species such as *Acacia*, *Prosopis* and *Atriplex* sp. are rich in protein and energy required by animals.

The land area of Jordan is about 8.93 million ha. Rangelands (100-200 mm rainfall) constitute about 91 percent of this area. Fodder production by shrubs in the wadis of the Jordanian Hamad comprised 57 percent of total vegetation in 1981 and 69 percent in 1982. These figures show the importance of fodder shrubs as a source of feed on the rangelands. *Artemisia herba-alba* is the main fodder shrub in the Jordan Hamad.

Forage production in some developed range reserves in the steppe was estimated at about 6-20 fold that of open rangelands. In spring 1992, native fodder shrub production at Lajjoun was about 60 kg/ha. In autumn 1992, native fodder shrub production was about 46 kg/ha.

Most of the studies concerning vegetation production on the rangelands of Jordan estimate total dry matter (DM) production. The Arab Organization For Agricultural Development (AOAD) estimates vegetative production in Jordan at about 40 kg DM/ha for the desert rangelands (<100mm average annual rainfall). The forests and marginal lands in high rainfall areas at about 300 kg DM/ha (Tadros, 1995).

Fodder shrubs in the arid rangelands in Jordan, as well as other range plants, can be divided, according to palatability, into three major categories:

- Highly palatable fodder shrubs such as *Salsola vermiculata*, *Atriplex halimus* and *Colutea istrisa*.
- Moderately palatable fodder shrubs such as *Artemisia herba-alba* and *Haloxylon articulatum*.
- Unpalatable fodder shrubs such as *Anabasis aphylla* and *peganum harmala*.

According to the National Information Center (NIC), the value of fodder export in 2000 was JOD821 000<sup>4</sup>.

### Medicines

About 485 species belonging to 330 genera and 99 families are recorded (Al Abbadi, 1999). The medicinal plants identified are either Herbs, shrubs or trees. Medicinal plants are distributed all over the country. With a wide range of distribution from the Eastern desert to other parts of the country, those plants are massively used by Bedouins or local people, in folk medicine as hot or cold drinks, or chewed raw materials as fresh or dry. The medicinal plants mostly used in Jordan are: *Teucrium polium* (jadah), *Citrullus colocynthis* (handhal), *Artemisia herba alba* (sheh), *Judiaca*, *Monosperma* (adher), *Achillia fragrantissima* (kaisoum), *Anthemis cotula* (beboneg) and *Euphorbia* sp..

The latex of *Euphorbia* species occurring in Jordan proved to be very efficient in the viral dermal infections, the warts for example, but this juice is very poisonous if taken orally or put on sensitive part, it may cause irritation.

Many plants are under collection pressure and often used for many medicinal purposes, some examples are: *Artemisia*, *Achillea*, *Salvia*, *Paronychia*, *Ecballium*, *Ephedra*, *Ajuga*,

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<sup>4</sup> 1 Jordanian Dinar = US\$1.4 (exchange rate of 14 August 2001).

*Marrubium*, *Alcea*, *Thymus*, *Sarcopoterium*, *Hyoscyamus*, *Ricinus communis* and many others.

### **Perfumes and Cosmetics**

There is an increasing tendency to cultivate some culinary and medicinal plants in gardens and farms for home consumption and marketing since there is an increasing demand on products such as *Thymus* and sage.

These are the major aromatic plants used in Jordan:

- *Laurus nobilis* (Ghar);
- *Capparis spinosa* (kubbar);
- *Thymus sp.* (zattar);
- *Rumex sp.* (homaidh);
- *Portulaca oleracea* (bakla);
- *Rosmarinus officinale* (hasalban);
- *Lavandula sp.* (Lavender);
- *Malva sp.* (khubaisa);
- *Trigonella sp.*;
- *Salvia sp.* (mairammiah);
- *Simmodensia japonica* (jujoba).

### **Ornamentals**

Many wild plants in Jordan are used as ornamentals, such as *Retama retam*, *Ceratoniasiliqua* (trees); *Astragalus*, *Cistus*, *Salvia*, and *Onions* (bushes); *Tulip*, *Orchis*, *Iris* and *Colchicum* etc. (bulbs); or *Cyclamen* and *Scorzonera* (corms).

## **ANIMALS AND ANIMAL PRODUCTS**

### **Honey and beeswax** (Anonymous, 1992)

Beekeeping is mainly practiced in the Irbid and Amman districts; *Apis mellifera syriaca* is the native honey breed. Italian queens are imported.

1987 figures showed 49 000 hives (41 000 traditional, 8 000 frame hives). Traditional beekeeping is practiced in hollow clay cylinders made from mud and straw known as 'baladi'. Another type of traditional hive is made from woven bamboo.

The wild flora is rich and varied (*Citrus spp.*, *Echinops spp.*, *Thymus vulgaris*) and provides an important source of dark-coloured, sweet honey.

In frame hives, average yields are around 4 kg per colony per year, but can be up to 20 kg. A typical yield from a traditional hive is 2 kg per colony per year. In 1988 total honey yield was 120 tonnes.

Forest and wild plants are considered the main source for honeybee fodder. Fruit trees also play an important role in feeding bee in Jordan (*citrus sp.*, *echinops spp* (murrar), *thymus vulgaris*, *eucalyptus*, *acacia sp.*, *robinia*), and other trees, shrubs and annual plants.

### **Other non-edible animal products**

Wild animals are a main category of food derived from the forests. Wild animals can provide a significant source of animal protein. Smaller wildlife such as rabbits and birds has real importance, while larger mammals have largely been exterminated. In Jordan, hunting is being managed by the Royal Society for the Conservation of Nature which issues annual hunting programmes specify hunting areas and game species and issue hunting licenses for hunters.

The wildlife conservation programme in Jordan is very active through:

- Wildlife reservation and regulation of hunting;
- Rangeland reservation and controlled grazing;
- Protection of forests.

## REFERENCES

**Anonymous.** 1992. Zooming in on Jordan. *Beekeeping and Development*, Number 23, June 1992.

**Al Wadi Al Abbadi, M.** 1999. Non wood forestry products in Jordan. Expert meeting on developing and coordinating the activities for non-wood forest products, FAO. Beirut, 1999.

**Najjab, N.** 1996, Mushroom cultivation in forest villages, Joint FAO-Ministry Project GCP/INT/539/ITA, Forestry and Food Security in the Mediterranean and Near East Region.

**National Information centre.** 2000. Department of statistics. Amman, Jordan.

**Ministry of Agriculture.** 1997. Department of Forests and Range, *Forestry and Rangeland in Jordan*. Amman, Jordan.

**Tadros, K.** 1995. Fodder shrubs in Jordan. Low Rainfall Areas Research Program, Baqa', Jordan.

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

## QUANTITATIVE DATA ON NWFP OF JORDAN

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			
<b>Plants and plant products</b>										
Fodder	1		<i>Salsola vermiculata</i> , <i>Atriplex halimus</i> and <i>Colutea istrisa</i> . <i>Artemisia herba-alba</i> <i>Haloxylon articulatum</i> . <i>Anabasis aphylla</i> <i>peganum harmala</i> .		F	W		Export worth JOD821 000 in 1999		NIC, 2000
Dying, Tanning								Total export worth JOD19 000 in 1999		NIC, 2000
Exudates								Total export worth JOD9 765 in 1999		NIC, 2000
<b>Animals and animal products</b>										
Honey, beeswax	2	Honey	<i>Apis mellifera syriaca</i>	Whole		W C	N	Production of 120 tonnes in 1988		Beekeeping and Development, 1992

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## **3.7 Kuwait**

### **INTRODUCTION**

#### **Main Non-Wood Forest Products**

No information is available on non-wood forest products (NWFP) in Kuwait.

#### **ACKNOWLEDGEMENT**

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

## 3.8 Lebanon

### INTRODUCTION

#### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Lebanon are edible fruits (e.g. pine nuts), medicinal (e.g. *Myrtus communis*) and aromatic plants (e.g. sage and oregano).

Other NWFP include fodder and honey.

#### General information

Lebanon was known for its dense and rich forests in the ancient times. It is now witnessing a severe depletion of its natural resources. Land degradation and deforestation are not problems of the last decades only; they started more than a century ago and kept going on. The total lack of control and appropriate legislation in the last few years, the increasing needs of the population and the ignorance of the negative impacts of improper natural resources management resulted in the actual alarming situation.

The different forest ecosystems in the country are mainly threatened by deforestation, over-grazing, urban development, road development, bad agricultural techniques, excessive use of chemical products, hunting and industrial development.

### PLANTS AND PLANT PRODUCTS

#### Food

The nut production of the stone pine (*Pinus pinea*) is highly important in Lebanon. The stone pine forests are the most abundant coniferous forest in Mount Lebanon (18 percent of total forest cover and 36 percent of the coniferous forest cover) where they extend over ca. 14 000 hectares (Baltaxe, 1966).

These forests are very important for nearby local communities. Besides for its highly valued nut production, the forests are also used for recreation, tourism, and as a source of fuel wood. Moreover, it plays a very important role in soil erosion control, especially on sandy slopes. As a production system, it remains very feasible and attractive to many landowners. Several villages in the middle mountain zone depend on the pine nuts production for their main source of income.

The Ministry of Agriculture is encouraging nut production through banning the importation of pine nuts, thus protecting the growers and producers from unnecessary competition. This move has allowed the stabilization of the pine nuts market while giving the whole production and exploitation cycle a great push forward.

In Lebanon, the shelled nut production is estimated at 200 kg/ha (Abi Saleh *et al.*, 1996). The pine area used for nuts production is 6 277 hectares. Eighty percent of the total Lebanese pine nut production is located in Mount Lebanon area, 18 percent in South Lebanon, 1 percent in North Lebanon and 1 percent in Nabatiya.

Total nut production is 20 000 tonnes or 3.2tonnes/ha (1/3 of total nuts) amounting to US\$9 200 or US\$1.46/ha (1/5 of total nuts) compared to US\$3.72/ha of almonds and US\$21/ha of walnut. Pine nuts have a significant contribution to the trade balance (Abi Saleh *et al.*, 1996). The price was reported to be US\$15/kg in 1990 (National report,1990).

The latest statistical data on edible nuts in Lebanon is listed in tables 1 and 2.

Table 1. Production and area of edible nuts in Lebanon

Edible nuts	1998		1999	
	Production (1 000 tonnes)	Area (1 000 ha)	Production (1 000 tonnes)	Area (1 000 ha)
Almond	28.6	6.5	3.2	6.8
Walnut	2.9	0.7	3.9	0.8
Pine nut	16.5	6.1	14.9	6.0

Source: MoA & FAO (2000)

Table 2. Total export values of edible nuts in Lebanon

Edible nuts	Total export (tonnes)		
	1997	1998	1999
Almond	97	96	70
Walnut	2	1	30
Pine nut	-	-	0.2

Source: MoA & FAO (2000)

The carob production (*Ceratonia siliqua*) was encouraged by the government by allowing forestland owners to clean their forests and to graft their carob trees with better producing varieties. This allows a higher yield of juicier carob pods, thus improving the carob molasses industry. These molasses are used as a dessert and as a sweetener in some traditional pastries. Other uses for these molasses could be developed as well. In the same time, the carob seeds are exported and used in several industries, while the leftovers could be used as soil organic matters. Carob molasses are thought to have several beneficial effects, ranging from the regulation of the gastro-intestinal tract to the improvement of the over-all health condition. Ground carob seeds are mixed with milk in babies feeding bottles to prevent vomiting. The annual production was estimated to be 50kg/tree (MoA, 2001).

### Fodder

The forests, especially oak forests, are used as rangeland by herders originating from Bekaa, North Lebanon and the Mountain Highlands (e.g. Kfarselwan, Baskinta) as a source of grazing for about 350 000 goats and 150 000 sheep (Tellawi, 1993).

In the early seventies and before, grazing was more organized. Herders used to pay the owners (by money or manure) and pass only the winter period in the lowlands. Nowadays, some herders do not pay any fees and exploit pine forests the whole year (e.g. Haret Hamzeh). These cases are also consequences of the political divisions during the war. On the other hand, urbanization, changes in income sources and use of pesticides are decreasing grazing activities

### Medicines

There are 236 species of wild and cultivated medicinal plants in Lebanon. 16 species are localized in certain regions and 29 are endangered. Several local species (*Linum toxicum*, *Erica manipuliflora*, *Viola libanotica*, etc) are considered as variants of recognized European species.

The emergence of the so-called "Chirch el Zallouh" or the Zallouh root has added to the threats on the high mountain flora. This plant (Zallouh root), the *Ferrula hermonis*, grows on the Mount Kekmel, in the sub-alpine zone and is thought to improve the sexual potentials while improving the over-all health conditions. This has led to the over-uprooting of the plant, as the active ingredients are only found in its root system. The Ministry has reacted by issuing a degree prohibiting the uprooting and exploitation of this commercially important

plant. Some researchers and scientists are working on the identification of the active ingredients of this plant, while some plant extracts are sold as herb teas in pharmacies.

As a part of its policy to protect the natural resources, the Lebanese government issued decisions to protect aromatic and medicinal plants and to control their exploitation. Decree 1/29, issued in February 1996, prohibits the export of aromatic and medicinal plants like *Salvia*, *Origanum*, *Myrtus*, *Chamomilla*, and *Calluma*. This decision followed decision 1/38, issued in April 1982, which prohibiting the export of all forest products.

Whereas decision 1/340, dated August 1996, aims at organizing the exploitation of sage and origano. The wild sage (*Salvia triloba* and *Salvia fruticosa*) and the local *Origanum* species suffered from uncontrolled exploitation and uprooting. The latest decision allows a better control of the exploitation. Picking *Origanum* is only permitted between August 1<sup>st</sup> and December, while exporting dried material is permitted all year round. Picking and exporting the sage is permitted between August 1<sup>st</sup> and December 31<sup>st</sup>, with a prior permit from the Rural Development and Natural Resources Directorate. Uprooting both sage and *Origanum* is completely forbidden. The annual production of sage was estimated to be 50 tonnes (MoA, 2001).

Table 3 lists the primary trees found in Lebanon with reported or expected medicinal properties.

Table 3. Some medicinal trees found in Lebanon and their common uses

Species	Habitat	Medicinal uses	Other uses
<i>Alianthis altissima</i>	West mountains of Mount Lebanon, between 0-2 000m; in Bekaa, south Riyyak and in the south of Lebanon	Powdered bark used to treat intestinal tapeworms and for dysentery and other stomach trouble	Insecticidal properties
<i>Ceratonia siliqua</i>	Coastal areas, and on the inferior slopes of coastal mountains 0-1 000m	The pulp has anti-diarrhea properties, the gum serves as a suspending agent, absorbent demulcent, lubricant	Food
<i>Clematis vitalba</i>	Localized in the northern part of the country between 0-1 000m	External usage against varicose ulcers	
<i>Cupressus sempervirens</i>	West and east mountains of Mount Lebanon between 300-2 000m	Mostly used to treat blood circulation disorders	
<i>Ficus carica</i>	Spontaneous	Laxative	Food
<i>Fraxinus ornus</i>	Between 0-2 000m	The extracted mannitol is used as an osmotic diuretic and as excipient	Aromatics

<i>Juglans regia</i>	West mountains of Mount Lebanon between 300-2 000m; in the Bekaa, south of Zahleh and towards Baalbek; and in Hermon	Leaves are astringent, eupeptic with a hypoglycemia action. The extracted juglone is an antiseptic and keratinizing	Food
<i>Juniperus</i>	Between 1 000 and 2 800m	Diuretic and eupeptic	Soil improvement and protection
<i>Laurus nobilis</i>	Coastal areas, between 0-2 000m and in the south	External usage, stimulant	Aromatics
<i>Melia azedarach</i>	Coastal areas and mountains, up to 1 000m	Anti-helminthic, remedy for intestinal worms and parasitic skin diseases	Insecticidal properties
<i>Myrtus communis</i>	West mountains of Mount Lebanon between 0-1 400m	Mostly antiseptic, for pectoral (respiratory) infections	
<i>Quercus infectoria</i>	Up to 1 600m on western slopes	Astringent for external and internal usage	
<i>Rhamnus cathartica</i>	West mountains of Mount Lebanon between 1 400-2 000m	Laxative and purgative.	
<i>Rhus coriaria</i>	West mountains of Mount Lebanon between 0-2 000m		Food
<i>Ulmis minor</i>	Sub-spontaneous	Tonic, astringent	

Source: Baalbaki (1997)

The estimated market value of medicinal and aromatic plants produced by forests in Lebanon is US\$18 600 000, based on 1994 figures (Biological Diversity of Lebanon, 1996).

The most common medicinal plants in Lebanon are:

- *Anethum grveolens*
- *Artemisia arborescens*
- *Ecballium elaterium*
- *Inula viscisa*
- *Nigella sativa*
- *Plantago psyllium*
- *Punica granatum*
- *Rhus coriara*
- *Rosa canina*
- *Taraxacum officinale*
- *Trigonella foenum-graecum*
- *Tussilago farfara*
- *Vinca libanotica*
- *Ziziphus vulgaris*

## Perfumes and cosmetics

The diversity of the Lebanese ecosystems contributes to the occurrence of a very wide vegetation range. This is translated by a wide variety of plants from different species and genera.

Some **aromatic plants** are used in the daily food of most Lebanese people, especially *Origanum sp.*. Mixed with the grinded sumac flower, sesame seeds and olive oil, it will result in the highly appreciated “zaatar wzayt”. Laurel leaves are used in several recipes; it was used in the past to perfume the laundry. Several wild leafy vegetables are used for salads and for cooking, while the wild apple fruits *Malus trilobata* are used as pickles.

Several teas are prepared and hundreds of recipes could be given to all sorts of illnesses and diseases. One remarkable example is that of hepatitis cured by the wild cucumber juice (*Echbalium elaterium*) (FAO, 1998c).

## Exudates

*Pinus pinea* is rich in resin. In Lebanon, the resin (*Katroun*) had been used as an insecticide applied to goats (FAO, 1991).

## Others

Research on biological resources, or biodiversity research, funded by pharmaceutical firms or research agencies, is proceeding in a number of countries. Forest biological resources have been the subject of several agreements between Lebanese institutes and international organizations. Several studies have been supported by the International Plant Genetic Resources Institute for surveys, collection and characterization of plant genetic resources of Lebanon. Specific studies include a survey on local genetic resources of pistachio, characterization and evaluation of the diversity of *Pinus pinea* forests, and a survey and characterization of Lebanese almond germplasm.

**Insecticides** of plant origin which are readily biodegradable are perceived to be environmentally safe and ecologically acceptable. Several studies have been conducted at the Faculty of Agricultural and Food Sciences of the American University of Beirut on the biopesticidal properties of *Melia azedarach*. This tree species contains several liminoids that act as feeding deterrents and growth regulators of insects. Leaf and fruit extracts were found to repel white fly adults. Aqueous extracts of leaves and fruits were found to be comparable in their efficacy to certain tested commercial biorational and synthetic pesticides against the pea leaf minor.

## ANIMALS AND ANIMAL PRODUCTS

### Honey and beeswax

Honey production is an important activity at the level of small farmers. Beekeeping is based on fodder from the forests.

A survey on honey production showed that the number of beehives in Lebanon is 100 000, of which 92 percent are based on new techniques and 8 percent are traditional ones. 36 percent of these hives are located in the mountainous area, while 33 percent are in the North. Total export of honey was recorded to be worth Lebanese Pounds (LL)75 million<sup>5</sup> (US\$49 500) in 1997 (Tellawi, 1993).

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<sup>5</sup> LL1 000 = US\$0.66 (mean exchange rate in 1997).

Table 5 shows the honey production with the corresponding number of beehives in Lebanon in 1997 (MoA, 2000).

Table 5. Honey production in Lebanon (1997)

Type	Number of beehives	Production (tonnes)	Production (kg/beehive)	Production value (million LL)	Price/kg (LL)
Traditional	8 063	38	5	884	22 150
New	91 973	990	11	19 447	18 700
Total	100 036	1 028	10	20 291	19 120

Source: MoA (2000)

## REFERENCES

- Abi Saleh, B., Nasser, N., Rami, H., Safi, N., Safi, S., and H. Tohme.** 1996. *Biological Diversity of Lebanon: La Flore Terrestre*. Lebanese Ministry of Agriculture and UNEP.
- Baalbaki, R.** 1997. NWFP : Resources and Potential. Expert meeting on developing and coordinating the activities for non-wood forest products, FAO. Beirut, 1999.
- Baltaxe, R.** 1966. *Carte Forestiere du Liban, 1:200.000*. FAO and Lebanese Government.
- FAO.** 1991. Non-wood forest products: the way ahead. FAO Forestry Paper 97. Rome
- FAO.** 1993. Forestry policies in the Near East region: analysis and synthesis. FAO Forestry Paper 111. Rome
- FAO.** 1995. Forest resources assessment 1990-Global synthesis-FAO Forestry Paper, 124.
- FAO.** 1998a. Forest products 1992-1996. FAO Yearbook 1996. Rome.
- FAO.** 1998b. Production, vol. 51 FAO Yearbook 1997.
- FAO.** 1998c. Forest products 1992-1996. FAO Forestry Paper 125. Rome
- Ministry of Agriculture and FAO.** 2000. Agriculture statistics project in Lebanon.
- Ministry of Agriculture.** 2001. Forestry department.
- National report of Lebanon.** 1990. World forestry congress X.
- Peters, C.M., Alwyn , H.G. and Mendelshon, R.O.** 1989. Valuation of an Amazonian forest. *Nature*, 339:655-56
- Republic of Lebanon, Ministry of Agriculture and UNEP.** 1996. Biological diversity of Lebanon. Publication #7, agricultural and livestock habitats and nature reserves; publication #8, national capacity and current economic evaluation. Commercial Business sarl, Beirut, Lebanon.
- Report of the FAO project** 'Development of forest resources for environmental protection and food security in arid and semi-arid areas of the Near East and North Africa'.
- Silva, E. and Appanah, S.** 1993. Forests management for sustainable development. An EDI policy seminar report, number 32. The World Bank, Washington, D.C.
- Tellawi, A.M.** 1993. Role of forestry in food security and environmental protection,

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

## QUANTITATIVE DATA ON NWFP OF LEBANON

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			
<b>Plants and plant products</b>										
<b>Food</b>	1	Pine nut	<i>Pinus pinea</i>	nu	F, P	W	N, I	- Total production of 16 500t and export of 0.2t in 1999 - Wholesale price worth LL22 000		FAO, 2000
	2	Almond	<i>Prunus dulcis</i>	nu	F, P	W, C	N	Total production of 28 600t and export of 70t in 1999		FAO, 2000
	2	Walnut	<i>Castanea sp.</i>	nu	F, P	W, C	N	Total production of 2 900t and export of 30t in 1999		FAO, 2000
	2	Carob	<i>Ceratonia siliqua</i>	fr	F, O	W	N	Annual production of 50kg/tree		MoA, 2001
<b>Perfumes, cosmetics</b>	1	Sage	<i>Salvia sp.</i>	le	F	W	N, I	Annual production of 50 t		MoA, 2001
<b>Animals and animal products</b>										
<b>Honey, beeswax</b>	1	Honey		ho	F, O	W, C	N, I	- Total export worth LL52 milion in 1999 - 200-500 t/year		Tellawari, 1993

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## 3.9 Oman

### INTRODUCTION

#### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Oman are medicinal plants (e.g. *Aloe barbadense*, *Commiphora quadricincta*) and dyestuffs (e.g. *Carthamus tinctorius*, *Indigofera coerulea*).

Other NWFP include fibres and tannins.

### PLANTS AND PLANT PRODUCTS

#### Medicines

Medicinal plants are used as health care products in traditional medicine in Oman. Listed below are the most important medicinal plants and their uses.

Tab. 1. Most important medicinal plants in Oman and their applications

Species	Use
<i>Aloe barbadense</i>	to prepare a cooling eye ointment
<i>Ecbolium viride</i>	to make tooth cleaners
<i>Cassia sophera</i>	tea for stomach ache
<i>Petropyrum scoparium</i>	tonic to "strengthen the blood"
<i>Andrachne aspera</i>	various applications
<i>Monsonia helitropoides</i>	snake bite remedy
<i>Olea africana</i>	to make poultices for livestock wounds and sores
<i>Ephedra intermedia</i>	ointment for sores
<i>Commiphora quadricincta</i>	medicinal gum

Source: Environmental profile (1981)

#### Dying and tanning

Dyestuffs such as *Carthamus tinctorius* (used in dying and cosmetics), *Indigofera coerulea* (used as a dye) and *Pergularia tomentosa* (used in leather making) are commonly used in Oman.

#### Utensils, handicrafts, construction material

*Daphne mucronata* is commonly used in Oman for fibre in bindings, and the leaf fiber of *Agave sp.* is used in rope making.

### REFERENCES

Draft Environmental Profile of the Sultanate of Oman. 1981.

Ministry of Regional Municipalities and Environment Home. 2001. Plants and wild life in Oman. Internet: [www.mme.gov.om](http://www.mme.gov.om), viewed on 5 June 2001.

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

## 3.10 Pakistan

### INTRODUCTION

#### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Pakistan are food products such as mushrooms (e.g. *Morchella esculenta*, *M. conica*, *M. anquistipt*), honey, pine nuts (*Pinus gerardiana*), walnuts (*Juglans regia*), fruits (*Diospyros lotus*, *Capparis aphalla*, *Ziziphus* spp., *Viurnum nervosum*, *Morus alba*), vegetables (*Bauhinia variegata*, *Moringa oleifera*, *Dryopteris filix-mas*), condiments (*Punica granatum*, *Carum carvi*), medicinal plants (e.g. *Valeriana wallichii*, *Artemisia maritima*, *Hyoscyamus niger*, *Ephedra nebrodemsis*, *Digitalis purpurea*) and essential oils (e.g. Eucalyptus oil, Peppermint oil, Menthol, Lemon oil and Orange oil)

Other NWFP include exudates such as resins (*Pinus roxburghii*) and gums (palosa gum from *Acacia modesta*), tannins (*Acacia nilotica*), utensils and construction materials such as bhabar grass (*Eulaliopsis binata*) and fibres (*Nonnorrhops ritchieana*) miscellaneous products such as soap nut (*Sapindus mukorossi*), neem leaves and seeds (*Azadirachta indica*), walnut bark (*Juglans regia*) and animal products (Honey and silk cocoons).

Mushrooms, pine nuts, some medicinal plants and resins constitute the main export products.

### PLANTS AND PLANT PRODUCTS

#### Food

A variety of **black mushrooms** or morels (*Morchella esculenta*, *M. conica*, *M. anquistipt*, etc.) grow naturally in the temperate forests of Pakistan between an altitude of 1 800 and 3 000 meters above sea level (masl). Around 50 tonnes of dried morels are collected each year by about 150 000 forest dwellers, mainly children and women.

The morels are purchased by local grocers or roving purchasers who sell them to dealers in nearby towns. The dealers sell the morels to wholesalers in Mingora, Rawalpindi and Peshawar. From there the mushrooms end up in the big cities such as Karachi, Lahore and Islamabad. Some of the wholesalers in Mingora are exporters as well.

Since 1962, the price of morels has risen constantly from Pakistan Rupees (Rs) 80<sup>6</sup> per kilogram of dried mushrooms to the current level of more than Rs 4 000 per kilogram. The gatherers, however, get one-half to two-thirds of the export price (RAPA, 1994).

The entire quantity of morels is exported; generating Rs.130 to 150 in foreign exchange (RAPA, 1994). Except for drying, de-stalking, grading and fumigating, no further processing is involved. To increase the supply base, technology for their cultivation needs to be developed and standardized for the benefit of the forest dwellers (Iqbal, 1991).

The roasted **seeds** of *Pinus gerardiana*, locally known as chalgoza pine, are very popular in Pakistan. Natural pine forests occur in the dry temperate zone in

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<sup>6</sup> Pakistan Rupes Rs100 = US\$1.57 (exchange rate of 16 August 2001).

Waziristan, near the Pakistan-Afghanistan border and in some parts of Baluchistan and the North-West Frontier Province.

Seeds are collected from the still-green cones by climbing the trees and wrenching off the cones with hooks attached to long poles. The cones are buried for about a fortnight until they open. The seeds are then extracted by striking the cones against a hard surface. The pine nuts are roasted by mixing them in a special kind of soil in iron containers placed over fire.

A tree yields 20 to 40 kilograms of nuts. The roasted nuts are sold at Rs1 500 per 40 kilograms. Total production in the country is estimated at 21 000 tonnes of which 95 percent comes from Baluchistan Total annual value of production is about Rs37.5 million.

In addition to domestic consumption, the pine nuts are exported to the Middle East. Information on the export of pine nuts during the last five years is given in Table 1 in the annex, which indicates that about 271 tonnes of pine nuts are exported each year, fetching Rs.6.3 million.

Table 1. Export of roasted pine nuts from Pakistan

Year	Quantity (tonnes)	Value (RS 1 000)	Unit value (Rs/Kg)
1986	768	11 131	14.49
1987	234	6 996	29.78
1988	105	2 800	26.59
1989	122	4 063	33.28
1990	125	6 719	53.72
Average	271	6 342	31.57

Source: Tenth World Forestry Congress (1991)

Walnut (*Juglans regia*) kernels are a favourite dry fruit in the country. Walnut trees grow naturally between 1 500 and 3 000 meters in the northern and northwestern mountains. In cultivated form, they grow at about 1 000 meters. The total production is about 20 000 tonnes per year. The majority is produced in the North-West Frontier Province and Azad Kashmir. The average wholesale price is Rs10 per kilogram. The total annual value of the production is around Rs200 million. The average number of walnut trees per household is five and average production per tree is 115 kilograms (Iqbal, 1991). About 35 000 families are involved in walnut production. The entire production is consumed within the country.

The wild persimmon tree (*Diospyros lotus*) grows naturally between 600 and 1 800 masl in the north and north-western mountains. The fruit is purple, globoid or ovoid, and 12 to 20 millimetres in diameter. It has a sweet taste and can be eaten fresh or dried. Semi-dried fruits are collected from the trees in November and December. The number of households involved in collecting persimmon is about 2 000 (Iqbal, 1991).

Wild persimmon is considered an inferior fruit tree, because the fruits are perishable and deteriorate in storage. An average tree can yield more than 120 kg of dry fruit. However, not all of it is collected. The total annual production is estimated at about 80 tonnes (Iqbal, 1991), of which most comes from the North-West Frontier Province. All of it is consumed domestically (Iqbal, 1995). In 1994 wholesale price was Rs3.50 to 3.75 per kilogram and the total value of the production has been estimated at Rs2.8 to 3.0 million.

Unopened flower buds of the tree *Bauhinia variegata* are collected as a favourite vegetable called Kachnal. The tree is cultivated in plains and sub-mountainous tracts. Flower buds, which appear from March to April, are collected 2 to 3 times a season. The collection of the individual buds is a tedious process.

An average tree yields 20 to 25 kilograms. Total production in Pakistan is estimated to be 30 tonnes, of which 20 tonnes are produced in the North-West Frontier Province. Wholesale price is Rs. 5 to 10 per kilogram. The vegetable is cooked fresh as well as in dried form. All of it is consumed within the country.

The drumstick, or horse-radish tree (*Moringa oleifera*), is locally known as "suhanjna" and cultivated on a limited scale in irrigated plains of the country, primarily for its partially opened inflorescences. These are eaten as a vegetable. There is a small supply of about 10 tonnes, which is used domestically. Prices average around Rs.7 to 8 per kilogram (Iqbal, 1991).

*Dryopteris filix-mas* is a male fern called Kinjai which grows in moist temperate forests in the country at 1,500 to 3,000 masl. Women, while going to forests for grazing livestock or collecting firewood, collect the fern. It is available from mid-April to mid-May. Total production is 15 to 20 tonnes, all of which is used locally. Average retail price is Rs.7 to 8 per kilogram (Iqbal, 1991).

Dried seeds of wild pomegranate (*Punica granatum*), locally known as "anar dana," are widely used in cooking to develop a sour taste in dishes. They also have medicinal properties. The tree grows naturally in sub-mountainous tracts of the country from 900 to 1 800 masl. Flowers appear in April and May and the fruit is ready for harvesting in September and October. An average tree yields 15 to 25 kilograms of fresh fruit (Iqbal, 1991).

Production of fresh pomegranate fruit is estimated at 35 kilograms per household. About 6 000 to 7 000 families collect wild pomegranate fruits. The seeds are extracted by 150 to 200 old women who work in the warehouses of dealers. The women generally do not like the work because it stains their hands. Total production of the fruit is about 250 tonnes, of which two-thirds comes from the North-West Frontier Province and one-third from the Punjab. The fruit yields 90 to 95 tonnes of dried seed and about 100 tonnes of skin. The skin is used by tanneries in Punjab. The entire production of Pakistan wild pomegranate is consumed within the country. It is not enough to meet the local demand and some quantities are imported from Iran. The Iranian anar dana is, however, of inferior quality because of its sweetish taste and is mostly used in pharmaceutical preparations by local Greco-Arab pharmacies (Iqbal, 1991).

*Carum carvi* is a perennial herb with thick tuberous roots. It grows wild in dry temperate regions of the country. The plant is known locally as "zeerasiah" and is widely used to flavour bread, biscuits, cakes and cheese. It is also an ingredient of pickling spice. It is a stomach soothing medicine and is occasionally used for flatulent colic and as an adjunct or corrective for medicines. The fruit is collected before ripening. The plants are dried and fruits are thrashed, cleaned, and stored in bags. Total production is about 300 tonnes, all of which is consumed locally (Khan, 1985). Wholesale prices range from Rs.160 to 180 per kilogram.

Small quantities of wild fruit such as gurgura (*Reptonia buxifolia*); deela (*Capparis aphalla*), pelu (*Salvadora oleoides*); jujube (*Ziziphus spp.*); sumal (*Berberis lycium*); guch (*Viburnum nervosum*); wild fig (*Ficus glometra*); and mulberry (*Morus alba*) are collected by men, women and children for domestic use and often eaten on the spot.

The wild fruit is collected by graziers in the forests. Occasionally, small quantities appear on the local market.

### **Medicines**

The use of medicinal plants has played a very important role in the province of Balochistan since the prehistoric era. The dry, vast desert of the province has been a source of plant stock with a higher content of active chemicals than the tropical rainy areas of the subcontinent. More than 70 percent of the local communities depend on medicinal plants and the local people have their own plant classification according to the use and effects on health. Indigenous knowledge of medicinal plants forms the basis for health care in the local communities.

A survey of the naturally available plant wealth of Pakistan shows that medicinal plants grow in abundance in Hazara, Malak and Kurram Agency, Murree Hills, Azad Kashmir, Northern Areas and Baluchistan, or are cultivated on farmlands in Punjab, Sindh, Baluchistan, North West Frontier Province and Kashmir. According to the surveys carried out by the Pakistan Forest Institute (1989), 500 tonnes of medicinal plants are produced in Hazara and Malakand, 16 tonnes in Murree Hills, 38 tonnes in Azad Kashmir and about 24 tonnes in Northern Areas (Khan & Zaidi, 1989). These plants are collected from the wild, dried and processed and sold in the local markets or exported to other countries. Pakistan obtains more than 80 percent of its medicaments from higher plants.

Medicinal plants are used as:

- Health care products in traditional medicine (either as raw, single herb preparations or as manufactured finished products, including substances of psychotropic and ritual/religious value);
- Raw material for the pharmaceutical industry for extraction of essential oils, fixed oils, tannins, gums and resins, and pharmacologically active constituents like alkaloids, glycosides, flavonoids, etc.;
- Culinary additions, spices and colourings;
- Natural cosmetics and in perfumes;
- Health foods either distributed through pharmacies under prescription or as "over-the-counter" medicines (Khan & Zaidi, 1989).

The collection of medicinal plants is controlled by the Forest Department. Three methods of collection are practised (Iqbal, 1991; RAPA, 1987):

- Leasing the area for collection of medicinal herbs. This method is used in the Hazara forests in the North-west Frontier Province.
- Collection by the traders from local people who pay nominal royalties to the Forest Department. This method is common in the Malakand forests in the North-West Frontier Province.
- In Azad Kashmir, the Forest Department auctions off fixed quantities.

The method adopted in Malakand forests has given encouraging results. It is flexible and competitive because of the absence of unnecessary controls from the Forest Department. As a result, Mingora has emerged as one of the biggest trading centres of medicinal herbs in the country. Some of the traders in Mingora also export medicinal herbs (Iqbal, 1991).

The herbs are sold either dried or fresh to the local grocers who sell them to wholesalers. The wholesalers sell them to the pharmaceutical concerns or to exporters. Saeed (1995) provides information on: consumption by manufacturing laboratories, consumption of crude drugs in (Pansara) markets of Pakistan, 1995

average price lists for several hundred medicinal plants, a market survey of local traditional medicines in the Baluchistan area, and consumption of crude drugs by the national pharmaceutical industry.

A variety of medicinal plants grow in the temperate hilly region of Pakistan. These plants gained importance in the allopathic system of medicine after Europeans investigated into their curative values. Plants such as *Digitalis purpurea*, *Atropa belladonna*, *Colchicum sp.* (Suranjan talkh), and many others were used in British and American pharmacopoeias, and a number of life-saving drugs are currently in use. This has resulted in the depletion of the existing stock and presently most of the plants can only be found scattered in remote areas.

Some other species are also endangered through indiscriminate exploitation by the collectors. For quite a few of these valuable plants, either the quality has deteriorated or they have become extinct. Development of propagation and regeneration technologies of medicinal plants in their natural habitat are essential for the conservation of this natural resource. Studies carried out by the Medicinal Plants Branch have revealed that temperate medicinal plants acquire perennial habits and therefore take more time to reach the stage of commercial exploitation.

The country's list of plants is quite long but not all of the plants are exploited commercially. A survey conducted by the Pakistan Forest Institute records 320 medicinal plants, growing in different ecological zones (RAPA, 1987). Saeed (1995) identifies 350 plants used in traditional medicine.

The actual supply/demand of herbs and medicinal plants is in the range of 20 000 tonnes per annum. About 14 000 tonnes of herbs were imported in 1989-1990 while about 106 tonnes of herbs and 3 083 tonnes of medicinal plants were exported in that year. During 1992, total world trade in medicinal plants was about US\$171 234 million, of which 20.9 percent originated from countries in Asia and the Pacific, Pakistan share was 0.5 percent of this amount (Saeed, 1995).

Table 2. The commercially most important medicinal plants collected from forests in Pakistan

Botanical name	Part used	Estimated quantities extracted annually (tonnes)	Price (Rs/kg)	Export potential
<i>Valeriana wallichii</i>	Roots	300-400	40-50	About 150 t exported to Hong Kong and Germany for Rs.40-50 per kg.
<i>Adiantum capillus</i>	Whole plant	100-125	6-8	About 15-20 t exported to Germany each year. Extraction can be increased up to 1 000 t/year.
<i>Polygonum amplexicule</i>	Roots	40	10	-
<i>Zizyphus vulgaris</i>	Fruits	30-40	10-12	-
<i>Myrtus communis</i>	Fruits and leaves	40-45	40	-
<i>Viola serpens</i>	Flowers Leaves	30 40	100-240 15	Up to 200 t can be collected easily

<i>Colchicum luteum</i>	Corms Seeds	12 2	60 125-150	Entire quantity is exported to Germany, South Africa, France and Bulgaria.
<i>Podophyllum emodi</i>	Rhizomes and roots	30-60	40-45	Exported to Belgium
<i>Mallotus philippensis</i>	Fruits	4-5	40-50	-
<i>Paeonia emodi</i>	Rhizomes	18	22	-
<i>Artemisia maritima</i>	Leaves/shoots	100-150	15	-
<i>Carum copticum</i>	Seeds	200	15	-
<i>Swertia chirata</i>	Twigs	30	28	-
<i>Acorus calamus</i>	Roots	10	24	-
<i>Berberis lycium</i>	Wood Roots	600 120	10 14	-
<i>Hyocymaus niger</i>	Seeds	2	20	-
<i>Sisymbrium irio</i>	Seeds	50	10	-
<i>Carum carvi</i>	Seeds	10	160-180	-
<i>Centella asiatica</i>	Whole plant	12	32	-
<i>Aconitum chasmanthum</i>	Roots	4	25	-
<i>Aconitum heterophyllum</i>	Roots	2	250	-
<i>Dioscorea deltoidea</i>	Rhizome	230	16	Kurram Chemical purchases it @Rs.4-5 per kg. Also reported to be exported to Japan.
<i>Atropa acuminata</i>	Whole plant	10	12	-
<i>Digitalis purpurea</i>	Whole plant	10	10	-
<i>Adhatoda vasica</i>	Leaves	20	5	-
<i>Cannabis sativa</i>	Whole plant	20	10	-
<i>Withania coagulans</i>	Fruit	125	5	Khyber Agency, Waziristan
<i>Withania somnifera</i>	Roots	32	35	Naziampur, Peshawar. Exported to India
<i>Cassia fistula</i>	Pods	150	15	Haripur and Gadoon
<i>Salix alba</i>	Bark	10	18	Mardan, Peshawar Swabi, Rustam
<i>Urginea indica</i>	Bulbs	6	30	Rustam, Kot, Buner
<i>Citrulus colocynthus</i>	Fruits	12	9	Risalpur, Nazampur, Peshawar
<i>Ephedra nebrodensis</i>	Twigs	780	43	Baluchistan

Source: RAPA (1994)

Several *Glycyrrhiza spp.* are a source of liquorice, which has a multitude of uses. It is used, for example, as an expectorant and anti-inflammatory but also as a stabilizing agent for foam in fire extinguishers, as well as for the flavouring of chocolate, beer, tobacco and toothpaste (Lewington, 1993). In 1992, the total value of international trade in liquorice was US\$0.94 million, of which the bulk (55.1 percent) originated

from China (24.1 percent), Pakistan (23.7 percent) and Afghanistan (7.3 percent) (Iqbal, 1995).

The seeds of *Azadirachta indica*, the so-called 'enema seeds', contain 40 percent of deep yellow fatty oil known as "merges oil". It is effective in the treatment of leprosy and skin diseases and is used in pharmaceutical preparations, face cream, hair lotion, medicated soap, tooth paste, disinfectant and as an emulsifying agent in insecticides. The unrefined margosa oil is used as lamp oil. The seed cake is a good fertilizer and is said to keep white ants away from plants. All parts of the neem tree, including "neem toddy", which is the juice that exudes from the trunk spontaneously or through wounds, have numerous therapeutic uses in traditional medicine. The potential of this multipurpose tree has only begun to be exploited, although it grows abundantly in the plains of the Punjab, Sind, and the southern parts of the North West Frontier Province. There is a need to re-introduce neem as a multipurpose tree through social forestry programs of the Forest Department and to harness its potential for supplying raw material for industry. The leaves of *Azadirachta indica* are used by rural women as insect repellent. Layers of leaves are placed between woollen clothes to keep the moths away while storing them. The leaves also protect grain from grain pests during storage. At present there is no market for the product.

### Perfumes and cosmetics

Essential oils of Anise, Caraway, Coriander, Fennel, Lavender, Spearmint and Rosemary are extensively used as flavors for domestic consumption and for export.

Consumption of essential oils in Pakistan has been estimated by the Agricultural Development Bank of Pakistan and values are shown in Table 3.

Table 3. Annual consumption of essential oils in Pakistan

Products	Consumption (kg)
Eucalyptus oil	10 000
Pepper mint oil	10 000
Menthol	25 000
Lemon oil	15 000
Orange oil	15 000
Herbaceous oils	1 000
Other oils	10 000
<b>Total</b>	<b>86 000</b>

Source: Saeed (1995)

### Dying and tanning

The bark or "babul" of *Acacia nilotica* is the principal agent used in vegetable tanning of hides in Pakistan. The bark is obtained as a by-product when the trees are felled. It is separated from logs by beating them with wooden mallets and the strips are dried in the open and sent to tanneries. The proportion of bark to wood is 1:5 by weight and a plantation of 25 trees per acre, when 15 years old, may yield about five

tonnes of bark (RAPA, 1994). The leather produced by babul bark possesses firmness and durability, but it exhibits harshness and is dark coloured. Babul bark is bulky and its tannin content is comparatively low.

Recently, farmers in some parts of Punjab (Sargodha, Jhang and Faisalabad) have started raising babul plantations around their crops. They harvest the plants after two years and extract the bark. Thus the status of bark has shifted from being a by-product to being a main product. The bark is sold to the crushing plants at Rs.1.00 to 1.25 per kilogram. The crushing plants sell the crushed bark to the tanneries at Rs.1.75 per kilogram. About 210 kilograms of crushed bark are needed to produce 100 kilograms of leather (5 hides). The tanneries are concentrated in Punjab (Wazirabad, Qusur, Gujranwala, Sialkot, Daska and Pasrur). Total annual production of vegetable-tanned leather in the country is estimated at 40 000 tonnes. Annual consumption of babul bark is estimated at 84 000 tonnes. Potential production of the bark is more than that, but not all of it is currently extracted.

Henna of commerce is the dried leaf of *Lawsonia inermis* L., a shrub or small tree, which is indigenous to the area between Iran and northern India. The plant has been introduced widely throughout the tropics and sub-tropics as an ornamental (frequently as a fragrant hedge), for home use as a dyestuff and elsewhere as a commercial crop, notably in several North African countries (FAO, 1995).

Aqueous extraction of the dried leaf provides a dye which can range in colour from black, to red through to blonde (neutral). From ancient times, henna has been employed as a cosmetic dye for hair, skin and nails and it has acquired a particular significance in Islamic culture. More recently, there has been an increase in its usage as a hair dye in Western Europe and North America. Prior to the widespread availability of synthetic dyestuffs, henna was employed also as a dye for textiles and leather.

Pakistan is one of the main suppliers to the Middle East market. Prices for henna reflect international supply levels and differentials between grades. In the Gulf market, the value of black henna is generally twice as much as the price of red henna and during 1992 prices ranged from approximately US\$700/tonnes for top grades of Indian and Pakistani black henna to US\$250/tonnes for the lowest grades (FAO, 1995).

Cutch is the purified aqueous extract of the heartwood of the multipurpose tree, *Acacia catechu* Wild. This deciduous, thorny species grows up to 15 m high and is indigenous to the southern range of the Himalayas (extending in India as far south as Andhra Pradesh and Orissa), Myanmar and northern Thailand.

Processing cutch involves three stages: 1) Production of a crude extract "black catechu"; 2) Isolation of "Katha"; and 3) Solidification of the residue "cutch".

Black catechu has traditionally been employed in Pakistan for crude dyeing, leather tanning and in indigenous medicines. The further processed cutch is employed as a cheap brown dye and preservative for canvas, fishing nets and similar items and also as a tanning agent for leather. In more recent times, cutch has found use as a viscosity modifier in oil well drilling. It is composed mainly of catechu-tannic acid with catechin, catechu red, quercetin and a gum as minor components (FAO, 1995).

Pakistan is a major exporter of safflower (*Carthamus tinctorius* L.) (FAO, 1995). This annual herb is well adapted to semi-arid conditions in the tropics and sub-tropics. It is a thistle-like plant with a deep taproot, growing up to 120 cm high, with a

branched stem and a flower head at the end of each branch. Safflower, also called "dyer's saffron", was formerly employed, as its synonym implies, as an inexpensive substitute for saffron in textile dyeing. The term "red tape" originates from the use of safflower to impart a pink-red colour to the tape employed to bind legal documents. The colour tone can be varied according to the mordant used through pink, red rose, crimson to scarlet. Today, dyestuff usage of safflower is limited to traditional applications in countries such as India. It is offered as a food colorant in some developed countries under the description of a "natural vegetable extract". Toxicological clearance has not yet been secured in the European Community for assignment of an "E number" as an approved natural colorant; nor is it listed under the Food and Drug Administration's permitted list of natural colours for foods and beverages.

### **Utensils, handicrafts and construction materials**

Bhabar or Sabai (*Eulaliopsis binata*) is a tufted perennial grass. It grows on dry and bare sub-mountainous tracts in Torai Shinai (Kohat), Nizampur and Parang Ghar (Mohamad Agency) in the North-West Frontier Province. The grass is hardy, surviving both frost and drought and is light demanding. When carefully collected and free from weeds and foreign material, Sabai grass yields medium-quality writing paper. It is singularly homogenous in quality throughout the whole plant. Even the nodes are digestible and consequently it is reduced to a clean and regular pulp by simple digestion. Sabai grass is harvested annually in November and December, which is a tedious and low-paying work. Only poor people with no alternatives resort to this work. Yields vary from 20 to 75 maunds (748 - 2 805kg) per acre, depending upon locality, rainfall and intensity of management (RAPA, 1994). A person can earn Rs.25 to 30 per day. After harvesting, the grass is bundled and despatched to the only paper mill available in trucks. About 250 to 300 people are involved in supplying the mill.

The paper mill at Noqwsheera uses Sabai grass in addition to *Saccharum* grass. The mill purchases 1 000 to 1 500 tonnes of the grass annually at Rs.750 per ton. The supplies come exclusively from the Parang Ghar area. The yield of good quality bleached pulp ranges from 33 to 35 percent (of the weight of raw material). The fibre length is about two millimetres (RAPA, 1994).

Another 500 to 600 tonnes of grass are sold each year in local markets at Rs.1.00 per kg, for use as carpeting in mosques (RAPA, 1994).

Mazri is the local name for dwarf palm (*Nonnorhops ritchieana*). It is a gregarious, tufted, low-growing and shrubby palm, growing naturally in the North West Frontier Province, Baluchistan and the adjacent tribal belt along both sides of the Suleiman Range, from 600 to 1100 meters in elevation. Farmers in some parts of the North West Frontier Province have also started cultivating this palm in their agriculture fields between other crops.

Mazri leaves are used in a variety of everyday products, including mats, baskets, brooms, trays, hand fans, grain bins and cordage. Average annual production of raw mazri leaves in the country is 37 315 tonnes. It has been estimated that an average worker can process more than 0.5 tonnes of raw mazri leaves per year. About 65 000 people are involved in processing mazri leaves, 78 percent of them women (Iqbal, 1991).

The retail price of raw mazri leaves is about Rs.3.40 per kilogram with a total value of collected leaves reaching Rs.126 million annually. Although prices of the finished

mazri products vary considerably, the estimated value of mazri leaves almost doubles after processing (Iqbal, 1991).

Because of indiscriminate and continuing overexploitation, mazri forests are disappearing in many places. The supply base is gradually shrinking and the incomes of families are threatened. Rehabilitation of mazri forests is, therefore, essential in order to maintain the supply base.

Branches of *Tamarix dioica*, locally known by the nomads as "lei", are used for making baskets. The branches are cut during July and August and stored for the rest of the year. An average household, consisting of five working members makes 2 000 baskets each year. The baskets are made without tools. The number of households involved has been estimated to be 300. Total annual production is estimated to 600 000 baskets, consuming 2 000 to 2 500 tonnes of raw materials each year.

The baskets are transported to the nearby towns where they are sold to the shopkeepers at an average price of Rs.5 each. This produces a revenue of Rs.3 million each year.

### **Exudates**

Resin is obtained by tapping the chir pine (*Pinus roxburghii*) trees. Chir pine forests occur primarily in the Punjab (60 000 hectares), Azad Kashmir (60 000 hectares), and the North-West Frontier Province (80 000 hectares) (RAPA, 1994).

The French method of resin tapping, introduced in 1888, is still in use. Trees under 30 centimetres in diameter are not tapped. Trees between 30 and 57 centimetres are given 2 blazes. When a tree is tapped for the first time, a 20-centimeter broad cut is made about 15 centimeters above ground level. A thin sheet of iron, 15 centimeters long and 5 centimeters wide, is hammered into this cut to form a lip. Above the lip a 15 x 12 centimeters gash is made in the wood. This is called a "channel," or "blaze." An earthen pot is hung below the lip to collect the resin. The blaze is freshened every week. At each freshening, the length of blaze is increased by about 0.8 centimeters. The process continues for about 5 years, after which a new blaze is started about 15 centimeters to the left of the old one. At each freshening of the blaze, the resin from the clay pot goes into an empty kerosene tin. The tins are transported to roadside depots and from there to the resin processing factories. This method yields 1.5 to 2 kilograms of resin per tree each season.

The Government through its Forestry Departments controls resin extraction and processing. The average production of crude resin during the last 10 years was 4 132 tonnes.

Table 4. Production of crude resin in Pakistan (tonnes)

Year	Azad Kashmir	North West Frontier Province	Punjab	Total
1981	2 697	1 350	1 200	5 247
1982	2 369	1 163	1 105	4 637
1983	2 371	1 714	937	4 022
1984	1 870	1 021	991	3 882
1985	1 448	780	1 320	3 548
1986	2 151	1 092	1 318	4 562
1987	2 098	887	1 659	4 644
1988	2 180	653	604	3 437
1989	2 318	887	-	3 205
<b>Average (1981-1989)</b>	<b>2 167</b>	<b>950</b>	<b>1 142</b>	<b>4 132</b>

Source: Amjad & Khan (1990)

Crude resin is processed to produce rosin and turpentine. The yield of rosin from crude resin is about 65 to 70 percent and turpentine 15 to 20 percent. At present, only one state-owned factory, at Haripur in the North-West Frontier Province is producing rosin and turpentine. The capacity of the factory at Haripur is 3 600 tonnes, but it is running at one-third capacity because of a shortage of resin. The wholesale prices of rosin and turpentine is Rs.28.82 per kilogram and Rs.27.08 per litter, respectively, at the factory gate. The importation of synthetic rosin, which is cheaper than domestic rosin, has further set back the processing plants and the closure of the Haripur factory is being considered (Amjad & Khan, 1990).

Gum collected from *Acacia modest* is locally known as "palls". Palls gum is eaten by women as a sweet. It is believed to restore vitality, particularly after childbirth.

The trees are growing in sub-mountainous tracts up to 1,200 masl. Production of the gum starts after four or five years of age, yielding about 0.06 kilograms of gum. Production increases with age until about 20 years, when it stabilizes at about 0.25 kilograms per tree per year. The gum oozes spontaneously from the stems and main branches in October and November and is then collected by hand (Iqbal, 1991).

A recent survey in the village of Sherawala (Haripur) found the number of *Acacia modesta* trees ranged between 2 and 200 per family with an average of 69. The quantity of gum obtained from these trees ranged from 1 to 20 kg per household (average 11.2 kilograms), of which 15 percent is estimated to be consumed within the household (Iqbal, 1991). The majority is sold for about Rs.60 per kilogram, generating an average revenue of Rs.571 per family. Production figures for the entire country are not available (RAPA, 1994).

### Others

Soap-nut, known as "retha," is the fruit of the tree *Sapindus mukrossi*. Its pericarp contains saponin, which makes lather with water and is used as a substitute for soap. It is preferable to regular soap for washing certain articles such as flannel and silk clothes. Women use it as shampoo. The soap-nut tree is cultivated in sub-Himalayan tracts up to 1 200 masl. People in Haripur (Hazara) grow the tree in their courtyards and agricultural fields (RAPA, 1994).

The tree starts bearing when six to eight years old. It flowers between May and June and all the fruit ripens at once in November and December. The fruit is picked from the tree and dropped to the ground where it is gathered. Two people can collect the fruit of one tree in a single day. The wholesale price has risen from Rs.5 per kilogram in 1988 to Rs.10 per kilogram in 1990. The product is often sold while still on the tree at Rs.400 to 500 per tree. The purchaser is then responsible for collecting the fruits. A recent survey in the village of Najafpur (Haripur) indicated that yields per tree are 50 to 100 kg (average 60.8 kg) and the number of bearing trees is between one and three per family (Iqbal, 1991). The number of families involved in collection is about 4 100. Total production in the country is estimated at 250 tonnes with a total value estimated to be Rs.2.5 million, based on an average wholesale price of Rs.10 per kilogram. (RAPA, 1994).

Root bark of walnut (*Juglans regia*), and sometimes even the stem bark is frequently used in the country as a tooth cleaner, particularly by women, as it imparts a pinkish colour to the lips. However, removal of the bark can injure the trees with fatal consequences. Moreover, it is suspected that the bark is used in preparing fake tea, which is harmful to the health. For this reason extraction of walnut bark has been banned by the government. It is still extracted by forest dwellers, however, for domestic use and for sale to visitors. Prior to the ban, the bark was exported to the Middle East (RAPA, 1994).

## **ANIMALS AND ANIMAL PRODUCTS**

### **Honey and beeswax**

Honey collected from wild beehives is an important source of nutrition and income for forest dwellers in the country. Between 55 and 65 tonnes of honey are collected each year in the country from wild beehives by approximately 15 000 persons (RAPA, 1994).

Traditional beekeeping by rearing colonies of Oriental bees (*Apis cerana*) in earthen pots and hollow logs fixed in the walls of the houses is popular among women living in remote forest areas in the north and north-west parts of the country. The total number of these beehives is 35 000 to 40 000, producing about 50 tonnes of honey. The honey is sold to local grocers at Rs.60 to 80 per kilogram. An average colony yields 4 to 5 kilograms of honey, but 35 to 45 percent of the colonies are sub-standard and produce little or no honey (RAPA, 1994).

Iqbal (1991), observed that Oriental bees do not colonise the hives as frequently as they did 10 to 12 years ago, possibly because the local bees are unable to compete with the 20 000 colonies of European bees (*A. mellifera*) brought by the Afghan refugees into the tracts. Consequently, natural populations of the local bees have dwindled. To overcome the problem and to augment income of the rural women, Iqbal recommended that modern beekeeping with European bees should be introduced among the traditional beekeepers.

The entire production of honey is used within the country as food and in a number of medicinal formulations. Although modern beekeeping is gaining popularity in the country, the demand for honey cannot be met and honey worth Rs.3 to 4 million is imported each year (RAPA, 1994).

### Other non-edible animal products

Silkworm rearing on mulberry leaves obtained from high-trunk trees grown in government plantations and farmlands is an old cottage industry in many rural areas. Only one crop of silkworms is reared during the spring season. About 40 000 packets (one packet contains 20 000 eggs) of silkseed imported from Korea and Japan are distributed each year among silkworm rearers, by both public and private agencies. About 13 000 families are involved in silkworm rearing. Total production of dry cocoons in the country is about 245 tonnes (RAPA, 1987).

Up to 600 kilograms of mulberry leaves are required to rear silkworms obtained from one packet of silkseed. Thus, 22 000 to 24 000 tonnes of mulberry leaves are consumed each year. Iqbal (1991) has reported that the value of the leaves required to rear one packet of silk seed is Rs. 200 to 300. The total value, therefore, is about Rs.10 million, based on an average price of Rs.250. Net return to the rearers is estimated at Rs.2 140 per packet (Iqbal, 1991), generating a total net income of Rs.45.6 million to the silkworm rearers in the country.

Silkworm rearing techniques are generally primitive. Consequently the yield is low. Moreover, a recent survey by Iqbal (1991) observed that silkworm rearing is mainly done by women. However, the extension staff of the sericulture sections of the Forest Departments are all men, who are unable to communicate directly with the women silkworm rearers. Therefore, there is an obvious opportunity to improve extension services by employing women extension workers.

The entire production of cocoons is processed locally on primitive hand-reeling machines. The raw silk is used as weft in the local weaving industry. The warp is imported.

### REFERENCES

- Amjad and Khan.** 1990; Records of Rosin and Turpentine factory, Haripur
- FAO.** 1993. Medicinal and aromatic Plants in Asia. Proceedings. RAPA publication 1993/19. Bangkok, Thailand.
- FAO.** 1994. Regional Office for Asia and the Pacific (1994). Non-wood forest products in Asia. Bangkok, Thailand.
- FAO.** 1995. Natural colourants and dyestuffs. A Review of Production, Markets and Development Potential. by C.L. Green. *Non-wood Forest Products, 4.* FAO. Rome.
- Iqbal, M.** 1991. NTFPs: a study on their income generation potential for rural women in North-West Frontier Province (NWFP), Pakistan. Planning and Development Department, Govt. of NWFP and ILO. Peshawar.
- Iqbal, M.** 1993. International trade in NWFP: an Overview. FAO, Rome, Italy.
- Iqbal, M.** 1995. International trade in non-wood forest products in the Asia Pacific Region. *Beyond Timber: Social, Economic and Cultural Dimensions on Non-Wood Forest Products in Asia and the Pacific.* Proceedings of a Regional Expert Consultation, 28 November-2 December 1994, RAPA, Bangkok, Thailand.
- Khan, S. A.** 1985. An analysis of supply situation of pharmaceutical and medicinal herbs in Pakistan. Export Promotion Bureau, Government of Pakistan, Karachi.
- Khan, A. A. and S.H. Zaidi.** 1989. Propagation and regeneration technology of pharmaceutical and medicinal plants. Biological Sciences Research Division. Bulletin No. 8. Pakistan Forest Institute. Peshawar.

- RAPA.** 1987. Forest based rural enterprises in Pakistan. Regional Office for Asia and the Pacific (RAPA), Food and Agricultural Organization of the United Nations. Bangkok.
- RAPA.** 1994. Non-wood forest products in Asia. Regional office for Asia and the Pacific (RAPA). Food and Agriculture Organization of the United Nations. Bangkok.
- Richardson, S.D.** 1995. Non-wood forest products: a regional overview. *beyond timber: social, economic and cultural dimensions on non-wood forest products in Asia and the Pacific*. Proceedings of a Regional Expert Consultation, 28 November-2 December 1994, RAPA, Bangkok, Thailand.
- Reid, Collins and Associates.** 1990. Forest and rangeland products in Pakistan. In association with Silviconsult Ltd., Sweden.. Forestry Sector Master Plan, Pakistan.
- Reid, Collins and Associates.** 1990. Upland forests of Pakistan. Canada. In association with Silviconsult Ltd., Sweden.. Forestry Sector Master Plan, Pakistan.
- Reid, Collins and Associate,**1992. Forest policy, tenure and legislation. Canada. In association with Silviconsult Ltd., Sweden. Forestry Sector Master Plan, Pakistan.
- Saeed, A.** 1995. Medicinal, culinary and aromatic plants in Pakistan. proceedings of the international expert meeting on medicinal, culinary and aromatic plants in the Near East. Cairo, Egypt, 19-21 May 1997.
- Tenth World Forestry Congress.** 1991. Country Report: Pakistan.

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

## QUANTITATIVE DATA ON NWFP OF PAKISTAN

PRODUCT			RESOURCE				ECONOMIC VALUE		REFERENCES		
Category	Importance	Trade name	Species	Part used	Habitat	Source	Utilisation	Quantity, value	Remarks	References	
	1, 2, 3				F, P, O	W, C	N, I				
<b>Plants and plant products</b>											
Food	1	Walnut	<i>Juglans regia</i>		F	W, C	N	Annual total production of 20 000 t (Iqbal, 1991) worth Rs200 million (RAPA, 1994)		Iqbal, 1991 RAPA, 1994	
		Wild pomegranate	<i>Punica granatum</i>	fr	F	W	N	Total annual production of 250 t		RAPA, 1994	
			<i>Carum carvi</i>	fr, st				N	Total annual production of 300 t		RAPA, 1994
		Morels	<i>Morchella esculenta</i> ; <i>M. conica</i> ; <i>M. anquistipect</i>	pl	F	W	N, I	Annual production of 50 t		RAPA, 1994	
		Vegetable	<i>Bauhinia variegata</i>	fl	O	W	N	Total annual production of 30 t		RAPA, 1994	
			<i>Moringa oleifera</i>	fl	O	C	N	Total annual production of 10 t		RAPA, 1994	
			<i>Dryopteris filix-mas</i>	pl	F	W	N	Total annual production of 10 t		RAPA, 1994	
		Wild persimmon	<i>Diospyros lotus</i>	fr	F	W	N	Annual production of 80 t (Iqbal, 1991) with an annual value of Rs.3. million (RAPA, 1994)		Iqbal, 1991 RAPA, 1994	

Food	1	Pine nuts	<i>Pinus gerardiana</i>	se				Annual production of 21 000 t		lqbal, 1991
		Pine nuts	<i>Pinus pinea</i>	se	F			Total annual value of Rs.37.5 million		lqbal, 1991
Dying and tanning	2	Henna	<i>Lawsonia inermis L</i>	lf		C	N, I	Prices reach US\$250/t (lowest grade) up to US\$700/t for "black henna"		FAO, 1995
			<i>Acacia nilotica</i>	ba	F	W	N	Total annual production of 40 000 t.		RAPA, 1994
Utensils, handicrafts and construction materials	2	Mazri leaves	<i>Nonnorrhops ritchieana</i>	le	P	W, G	N, I	Average annual production of 37 315t		RAPA, 1994 lqbal, 1991
			<i>Tamarix dioica</i>	st	F			Total annual production of 600 000 baskets, consuming 2 000 to 2 500 t of raw material		RAPA, 1994
Exudates	2		<i>Pinus roxburghii</i>	re	F	W	N, I	Average annual production of crude resin (1981-1989) of 4 132 t		RAPA, 1994
<b>Animals and animal products</b>										
Honey, beeswax	1		<i>Apis cerana</i>	ho		W	N	Annual production of 55-65 t		RAPA, 1994
Other non-edible animal products	2	Silk cocoons			O	C	N	Production of 245 t of dry cocoons	On mulberry leaves	IRAPA, 1994

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## 3.11 Qatar

### INTRODUCTION

#### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Qatar are medicinal plants.

Other NWFP include fodder and wildlife.

### PLANTS AND PLANT PRODUCTS

#### Fodder

Forest trees, shrubs and vegetation contribute to food security of rural population by providing fodder for livestock in Qatar.

Along the sea coasts around Qatar, *Avicennia marina*, is eaten by camels and goats. In Southern Qatar, Salwa and Wadi El Ineig, *Leptadenia pyrotechnica* is grazed by camels. *Arnebia hispidissima*, *Heliotropium ramosissimum*, *Capparis spinosa* (especially for camels), *Amaranthus viridis*, *Heliotropium bacciferum*, *Acacia tortilis* (Common shrub in Qatar) are common fodder source in Qatar.

#### Medicines

Medicinal plants have traditionally been used in Qatar for many generations. Herbal medicine is a very common tradition in Qatar. The most important medicinal plants are listed in table 1.

Table 1. Most important medicinal plants in Qatar

Arabic Name	Scientific Name	Uses	Distribution
Abushal	<i>Cynomorium coccineum</i>	Entire plant is aphrodisiac, spermatopoietic, astringent. Herb is used as a remedy for back, kidney ailments, constipation, and sterility.	Rare plant in the sheep farm, southern Qatar
Adhatoda	<i>Justicia adhatoda</i>	Used as diuretic, in curing fevers. Also has antiseptic and insecticidal properties	Rare in gardens
Dhanon	<i>Cistanche phelypaea</i>	Plant is used as anaphrodisiac, used as a tonic in speratorrhoea impotence, against diarrhea	Common in southern Qatar
Ein Al Quitt	<i>Anagallis arvensis</i>	Used as an application for slow healing wounds, to ulcers, skin diseases. Treats rheumatism, chronic nephritis, and liver complaints.	Common in north and northeastern Qatar.
Askhabar	<i>Cymbopogon parkeri</i>	Plant possess antispasmodic properties	Central and northern Qatar
El Rawa, Tarf, Twaim	<i>Aerva javanica</i>	Used for stuffing pillows and animal saddles, also eaten by sheep	Central Qatar at Karaana, Shahania

Gargeer	<i>Eruca sativa</i>	Plant is considered an aphrodisiac. It is also cures, skin eruptions, inflammations, ulcers, and toothache.	Commonly cultivated in gardens and rodats.
Gassab,Boos	<i>Phragmites australis</i>	Shoot is an antidote, antiemetic, antipyretic, refrigerant, and is used for cholera. Also for cough, arthritis, earaches .	Common in the south of Qatar at Salwa and in the wetter places at Doha
Githgath	<i>Pulicaria crispa</i>	Used as a diuretic, also used in folk medicine.	Very common in Qatar
Ghbeisha	<i>Salvia aegyptica</i>	Plant is used in diarrhoea, gonorrhoea, haemorrhoids, eye diseases, Is also an antiseptic, antispasmodic.	Common in Qatar
Handhal	<i>Citrullus colocynthis</i>	Leaves are used in curing jaundice, asthma. Fruit is pungent and has antipyretic, antihelminthic properties. Cures, amenorrhoea.	Common in Qatar, particularly in the southern part, Dukhan.
Hommad	<i>Rumex vesicarius</i>	Used against jaundice, hepatic conditions, constipation, bad digestion.	Fairly common in cultivated fields and along roadsides.
Kaff Maryam	<i>Anastatica hierochuntica</i>	Leaves used as a purgative, extracts are known to possess anti-inflammatory activity.	Common in Qatar
Labna	<i>Euphorbia sp.</i>	Plant is used against flu, dysentery, and diarrhea, to purify blood. Also used as a diabetes remedy, also in snakebite cures.	Common in Qatar
Mouker	<i>Herniaria hemistemon</i>	Used as a diuretic and purgative.	Common, located in the north and south of Qatar
Shok El Homar, Shaflah	<i>Capparis spinosa</i>	Fodder for animals especially camels. Buds used in cooking, also for treating arthritis.	North east , Shafalahia, El Khor

Nakhl	<i>Phoenix dactylifera</i>	Used as a diuretic and in treatment of bronchitis, abdominal complaints, fevers etc.	Near seashores in the south of Qatar, cultivated all over Qatar
Name1	<i>Conyza dioscoridis</i>	The plant is used as a remedy for colic.	Rare in Qatar, recorded in Doha
Name2	<i>Reseda muricata</i>	The plant possess anti microbial activity.	Common in southern Qatar
Shamar	<i>Foeniculum vulgare</i>	Used as a condiment, remedy for jaundice. Seeds exhibit anti inflammatory activity. Also used in curing liver ailments.	Fairly common in gardens and avenues
Thallaj	<i>Cornulaca monocantha</i>	Possess anti microbial activity. Extract caused moderate intestinal stimulation.	Common in southern Qatar

Ministry of Municipal Affairs and Agriculture (2001)

## REFERENCES

**Ministry of Municipal Affairs and Agriculture Home.** 2001. Bioland/plants/animals. Internet: [www.mmaa.gov.qa](http://www.mmaa.gov.qa), viewed on 14 May 2001.

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

## 3.12 Saudi Arabia

### INTRODUCTION

#### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Saudi Arabia are medicinal plants and fodder.

Other NWFP include honey and edible plant products.

#### General information

Species classified in Saudi Arabia forests are mostly Acacias and some wild olives. These forests are managed as protective rather than productive forests. Hence, the main mode of exploitation is on NWFP rather than on wood products.

It is estimated that more than 300 plant species are used for medicinal purposes, as fodder and for honey production.

### PLANTS AND PLANT PRODUCTS

#### Food

The palm tree (*Phoenix dactylifera*) has a special and distinct importance to Saudis for its historical and economic significance. The State endeavored since long time to spread growing palm trees by all available means which helped expand the palm trees grown areas and introduce new types until the number of palms reached 13 million trees producing more than 500 thousand tonnes per year. Grown palm trees currently count for more than 400 types of renowned names such as Sifri, Sukkari, Khalas, Meskani, Shalabi (Ministry of Water and Agriculture, 2001).

The Kingdom ranks first in the production of dates over the world with an annual production of 500 000 tonnes. This huge production has been achieved through the generous support and subsidies offered by the government to palm trees farmers. Palm plants are offered and some production purchased from farmers at good prices. (MAW, 2001)

#### Fodder

Forest and woodlands are used for grazing. Branches of trees such as Acacia and Ziziphus are lopped and used as fodder (Kishal, 1985).

Forests in Saudi Arabia are the main source for grazing animal. MAW (Ministry of Agriculture and Water) established 24 enclosures, each with an area ranging between 250 donums and 87 000 donums (1 donum = 1 000 m<sup>2</sup>). Some of these enclosures are designed for rangeland and environmental studies and others as reserves for natural fodder to be opened up for grazing in years of drought. Conservation of such rangelands led to noticeable improvement in vegetation cover and pasture productivity (MAW, 2001).

#### Medicines

Using medicinal plants is very well accepted among the people in Saudi Arabia. Herbal medicine has been inherited from old tribes and traditionally used among people. A survey done in King Abdul Aziz City for Science and Technology revealed that 300 species are used in traditional medicine in Saudi Arabia (Al Moussa, 1999).

Table 1. The most important medicinal plants in Saudi Arabia

NAME	HABITAT
Acacia arabica	Middle Region
Balanites aegytiaca	South of Hijaz
Azadirachta indica	South of Hijaz and Najd
Acacia seyal	Middle area and south of Hijaz
Tamarix aphylla	North area, Najd and Hijaz
Alaoc vera	South of Hijaz and all the southern area
Delonix elata	Hijaz and all the southern area
Datura metel	All over the kingdom
Nigella sativa	North of Hijaz

Source: Al Moussa (1999)

## ANIMALS AND ANIMAL PRODUCTS

### Honey and beeswax

Honey production is important in Saudi Arabia. Beekeeping is very common in Saudi Arabian forests all over the country. "Sadar" is the best quality honey produced in Saudi Arabia. The government is establishing companies to produce and market this honey inside and outside the country.

## REFERENCES

- Al Moussa.** 1999. Non-wood forestry products in Jordan. Expert meeting on developing and coordinating the activities for non-wood forest products, FAO, Beirut, 1999.
- Kishal, H.** 1985. Conservation and Development of wildlife in Saudi Arabia. FAO report.
- Ministry of Water and Agriculture.** 2001. Internet homepage: [www.agrwat.gov.sa](http://www.agrwat.gov.sa), viewed on 14 May 2001.

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

## QUANTITATIVE DATA ON NWFP OF SAUDI ARABIA

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			
<b>Plants and plant products</b>										
Food	1	Date	<i>Phoenix dactylifera</i>	fr	F,P	W,C	N,I	Annual production of 500 000 t		MAW, 2001

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

### 3.13 Syria

#### INTRODUCTION

##### Main Non-Wood Forest Products

The most important non-wood forest products (NWFP) of Syria are edible fruits (e.g. *Ceratonia siliqua*, *Prunus amygdalus*), medicinal plants (e.g. *Crataegus monogyna*, *Matricaria aurea* and aromatic plants (e.g. *Laurus nobilis*, *Myrtus communis*).

Other NWFP include tannins and dyestuffs (e.g. *Rhus sp.*, *Quercus infectoria*, *Rubia sp.*), ornamental plants (e.g. *Daphne oleifolia*), edible mushrooms and truffles, exudates, honey and bushmeat.

##### General information

Syria has a diverse base of flora and genetic resources. About 3 459 species belonging to 865 genus and 131 families grow in Syria. The production of non-wood forest products (NWFP) in Syria during the period 1990 – 1995 is shown in Table 1.

Table 1. Production (in tonnes) and value (in Syrian Lira<sup>7</sup>) of NWFP in Syria

Product	1990		1991		1992		1993	
	Pro-duction	Value	Pro-duction	Value	Pro-duction	Value	Pro-duction	Value
<b>Myrtus branches</b>	200	500	168	420	189	472	105	315
<b>Magoran a leaves</b>	100	1 500	72	1 080	163	2 445	103	1 751
<b>Gly-cyrrhiza roots</b>	1 200	18 000	1 142	17 130	1 228	20 876	1 056	19 008
<b>Carob pods</b>	10	120	8	96	7	105	8	120
<b>Rhus sp.</b>	150	4 500	89	2 670	105	3 150	82	2 460
<b>Grape fruits and leaves</b>	50	1 500	8	240	-	-	-	-
<b>Pistacia fruits</b>	10	150	-	-	4	60	-	-
<b>Ferns</b>	5	25	-	-	-	-	-	-
<b>Humus</b>	5 000	1 500	-	-	-	-	-	-
<b>Total</b>	<b>6 725</b>	<b>27 795</b>	<b>1 487</b>	<b>21 636</b>	<b>1 696</b>	<b>27 108</b>	<b>1 354</b>	<b>23 654</b>

Source: Wahbe (1997)

<sup>7</sup> US\$1 = Syrian Lira (SL) 47,6 (mean exchange rate between 1/1/1990 and 31/12/1993). Current exanche rate as of 16/8/2001: US\$1 = SL53.5.

## PLANTS AND PLANT PRODUCT

### Food

Edible **fruits** have been traditionally used in Syria as a source of food. *Pistacia palaestina* (edible fruits sold by herbalists in Lattakia for SL40/kg), *Ceratonia siliqua* (the pulp is sweet and contains anti-diarrhoea properties and the fruits are sold by herbalists in cities for an average price of SL45/kg) and *Prunus amygdalus* (the dry seeds of these fruits contain an oil which is much valued by consumers and the price of a kg of dry seeds is about SL1 100) are the most common edible fruits used by Syrian people. (Al-Hakim, 1994)

A socio-economic study, recently carried out, revealed the importance of *Pistacia atlantica* for local communities. Its fruits are collected and eaten fresh or roasted. The fruits are also used in a softdrink called bareeka. Furthermore, oil is extracted from the seeds, which has a value of SL0.35/kg (Mona, 2001).

*Juglans regia* (walnut) and *Castanea sativa* (chestnut) are also known in Syria for their edible nuts.

Edible mushrooms and truffles (e.g. *Coprinus spp.*, *Morchella spp.* and *Helvella spp.*) are collected. According to Al-Hakim (1994) the truffles are sold on the market for SL800-2 000/kg.

### Perfumes and cosmetics

In addition to medicinal properties (anti-rheumatism), the oil of the Laurier *Laurus nobilis* is used in the production of soap, especially among the populations of Kassab. It is estimated that 50 tonnes of soap are produced in Kassab each year. Other soap factories can be found, especially in Aleppo, but these use synthetic products instead of the butter of Laurier.

The fruits of *Rhus coriaria* are rich in organic acids and often used in several cooking recipes. They are sold for SL70/kg.

### Medicines

The medicinal aromatic and toxic wild plants constitute a high proportion of the flora in Syria. Many plants such as *Matricaria sp.*, *Thymus sp.*, *Artimisia sp.*, Fungi and truffle are collected directly from nature by rural people for use as traditional medicines. The most important wild and cultivated medicinal and aromatic plants and their production are listed in tables 2 and 3 in the annex.

According to Wahbe (1997) the government and the private sector have developed a programme to conserve medicinal plants through:

- Formulation of a clear policy for production, transport and marketing based on the local and international needs of medicinal plants raw material.
- Coordination between all sectors (ministries, organizations, universities, research centers and private agencies) dealing with medicinal plants.
- Survey of medicinal and aromatic genetic resources and establishment of gene resource banks.
- Establishment of pharmaceutical and insecticide industries based on medicinal, aromatic and toxic plants.
- Supporting research on medicinal plants, training of technical staff and improving production techniques.

- Formulation of extension programmes for rural people on the conservation and importance of medicinal and aromatic plants.
- Cultivation of medicinal plants.
- Protection of endangered species.
- Establishment of botanical gardens for breeding of medicinal and aromatic plants.

Medicinal and aromatic plants are threatened by the following factors:

- Degradation of forest by fires, overgrazing, removal of trees for fuel and the lack of management plants;
- Urban expansion in forest areas;
- Scarcity of water;
- Unsustainable harvesting of wild medicinal plants.

In 1985, the Productive Project Administration (PPA), which is a Project of the Ministry of Defense, started jointly with the University of Damascus to deal specifically with medicinal plants and aims at providing the Army and the Syrian public with products that have scientifically proven beneficial effect on their health. The work of PPA on medicinal plants has been receiving prestigious recognitions within and outside Syria (ISO 9002 is being awarded to PPA in 1994). Today the production of tea bags has reached an amount of 600 000/year. More than 85 species are currently being used which are mostly indigenous to the region. The plant material is provided to PPA through a broad network of farmers and collectors spread throughout the country (pers. com. S. Padulosi and R. Khalil, 24/07/2001).

Table 2. The most important wild medicinal and aromatic plants used in Saudi Arabia

Species	Price (SL/kg)
<i>Maticaria Chamomilla</i>	400-600
<i>Matricaria aurea</i>	-
<i>Thymus sp.</i>	400
<i>Salvia</i>	250
<i>Micromeria myrtifolia</i>	250
<i>Majorana sp.</i>	250
<i>Athea sp.</i>	250
<i>Glycyrrhiza sp.</i>	500
<i>Paronychia argentea</i>	400
<i>Lippia citrio dora</i>	400
<i>Laurus nobilis</i>	250
<i>Artemisia sp.</i>	400
<i>Equisetum</i>	120
<i>Ceratonia siliqua</i>	70
<i>Cynara cardunculus</i>	70
<i>Lepidium sativum</i>	50
<i>Foeniculum sp.</i>	50
<i>Fungi</i>	200
<i>Truffle</i>	400-1000
<i>Anabasis syriaca</i>	250
<i>Amygdalus communis</i>	1000
<i>Rosa damascena</i>	600

<i>Carthamos binctoria</i>	900
<i>Acacia senegal</i>	900
<i>Astragalus gummifera</i>	200
<i>Celtis tournefortii</i>	-

Source: Wahbe (1997)

### Dying and tanning

The tannin producing species in Syria are *Rhus coriaria*, *Rhus cotinus* and *Quercus infectoria*. The tannins of *Rhus coriaria* and *Quercus infectoria* are exploited in Syria in the industrial sector for the treatment of leather. Tannins from other species (such as Chestnut, Oak, and Walnut trees) are used on a small scale in traditional medicine (Al-Hakim, 1994).

The most important **dyestuffs** of Syria are taken from the following species: *Rubia tinctorum*, *Rubia aucheri*, and *Rubia tenuifolia*. Herbalists in the cities of Lattakia and Damascus sell the roots that contain the natural colorants (Al-Hakim, 1994).

### Exudates

*Pinus brutia* has an economical importance in Syria; the amount of **resin** (oleoresins) that can be extracted from one tree is 2.5 kg. Oleoresin is composed of rosin, which is used in soap industry, and turpentine (Madi, 1999).

The **gum tragacanth** extracted from *Astragalus sp.* has many uses due to its capacity to form thick viscous gel that is used as an important pharmaceutical application and as an effective stabilizer for culinary uses. It mainly grows in semi-arid, mountainous regions of Syria (FAO, 1992).

## ANIMALS AND ANIMAL PRODUCTS

### Honey and beeswax (Stotz, 1992)

Honey is a specially recognized NWFP in Syria. It is regarded not so much as a foodstuff but as a tonic and remedy for illness.

In Syria, beekeeping is principally a supplementary source of income. Most beekeepers are farmers, but many government employees such as teachers or agricultural extension officers also keep bees. It is not unusual that the income from beekeeping exceeds their salaries.

Traditionally bees are kept in earthenware pipes, but these are being superseded by Langstroth (movable frame) hives.

The principal honey bee fodder species of Syrian forests are: *Crataegus monomyna*, *Castanea sativa*, *Eucalyptus camaldulensis*, *Foeniculum vulgare*, *Lavandula stoechas*, *Hedera helix*, *Melissa officinalis*, *Origanum syriacum*, *Thymus sp.*, *Euphorbia sp.*, *Calycotome villosa*.

Table 3. The development of the number of beehives and their production on the national scale from 1979 to 1991

Year	Beehives			Production (in tonnes)	Production (in tonnes)
	Local type	Modern type	Total	Honey	Wax
1979	102 251	20 093	122 344	359	47
1980	107 218	26 819	134 037	688	50
1981	112 299	29 511	141 810	501	47
1982	109 226	34 463	143 689	623	61
1983	105 045	43 218	148 263	695	67
1984	96 258	50 750	147 008	683	65
1985	79 110	52 932	132 042	513	47
1986	78 625	49 869	128 494	533	40
1987	67 631	47 624	115 255	590	
1988	72 666	62 582	135 248	800	
1989	71 788	63 149	134 937	647	
1990	64 191	73 116	137 307	518	
1991	60 366	82 234	142 500	678	

Source: Al-Hakim (1994)

## REFERENCES

- Al-Hakim, W.** 1994. Rapport sur les produits forestiers non-ligneux dans les forêts Syriennes (surtout dans le Département de Lattakia de Qunaitra). Forêts et Sécurité Alimentaire dans les Régions Méditerranéenne et Moyen-Orientale. FAO (GCP/INT/539/ITA).
- FAO 1992.** Tragacanth gum [published in FAO Food and Nutrition Paper 34, 1986]. In Compendium of Food Additive Specifications. FAO Food and Nutrition Paper 5 (Joint FAO/WHO Expert Committee on Food Additives. Combined Specifications from 1<sup>st</sup> through the 37<sup>th</sup> Meetings, 1956-1990). Rome.
- Güler, M.** 1995. Mission report on edible mushrooms cultivation in forest villages in Syria. Forestry and Food Security in Mediterranean and Near-East Region. FAO (GCP/INT/539/ITA).
- Madi, S.** 1999. Non wood forest products in Syria. Expert meeting on developing and coordinating the activities for non-wood forest products in the Near east, FAO. Beirut, 1999.
- Mona, N.** 2001. Socio-Economic study of *Pistacia atlantica* in Syria. A consultant report prepared for the International Plant Genetic Resources Institute. Draft version.
- Stotz, D.** 1993. Beekeeping in Syria. A GTZ Financed Promotion of Beekeeping in Syria. *Beekeeping & Development*, Number 26, March 1993.
- Wahbe, T.** 1997. Report on Syria. Paper submitted to The International Expert Meeting on Medicinal, Culinary and Aromatic Plants in the Near East (Cairo, 19-21 May, 1997). Ministry of Agriculture and Agrarian Reform, Department of Agricultural Research.

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

## QUANTITATIVE DATA ON NWFP OF SYRIA

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			
<b>Plants and plant products</b>										
<b>Food</b>	1	Carob	<i>Ceratonia siliqua</i>	fr			N,I	Annual production of 8 t worth SL120 000 in 1993		Wahbe, 1997
			<i>Pistachia plaestina</i>	nu			N,I	Annual production of 4 t worth SL60 000 1993		Al-Hakim, 1994
<b>Medicines</b>	1	Liquorice	<i>Glycyrrhiza glabra</i>	ro			N,I	Annual production of 1 056 t worth SL19 million in 1993		Wahbe, 1997
<b>Perfumes, cosmetics</b>	1		<i>Myrtus communis</i>	le			N	Annual production of 105 t worth SL315 000 1993		Wahbe, 1997
<b>Dying, Tanning</b>	2		<i>Rhus coriaria</i>	fr,le			N	Annual production of 82 t worth SL2 460 000 in 1993		Wahbe, 1997
<b>Exudates</b>	2		<i>Pinus brutia</i>	re			N		Production of 2.5 kg resin per tree	Madi, 1999
<b>Animals and animal products</b>										
Honey, beeswax	2			ho		W,C	N	Production of 678 t in 1991		Al-Hakim, 1994

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## 3.14 Turkey

### INTRODUCTION

#### Main Non-Wood Forest Products

The most important non-wood forest products (NWFP) of Turkey are edible products such as mushrooms (e.g. oyster mushroom, desert truffle, black truffle) and fruits (e.g. pine nuts), medicinal plants (e.g. *Betula pendula*, *Quercus infectoria* Mill., *Quercus thaburencis* Decne.) and aromatic plants (e.g. Laurel, Oregano, Sage).

Other NWFP include ornamental plants (*Galanthus* and tulip), resins (e.g. pine resins, storax), honey and fodder.

#### General information

Statistical data is available on the production, export and import of NWFP in Turkey.

Information on the production of NWFP in Turkey is poorly monitored and vague, since available figures (see table 1) are derived from tax collection on products for which resource access and gathering permits have been issued to villagers. Because of widespread tax evasion and illegal harvesting, NWFP are considerably undercounted. For example, the production of bay leaves (Laurel) is estimated to reach 852 tonnes in 1990, whereas exporters contend that the real figure was in the order of 2 500 tonnes (GDF, 1989).

Table 1. Production of NWFP in Turkey

PRODUCT	UNIT	1990	1991	1992	1993	1994	1995	1996
Resin	Ton	390	320	290	330	355	240	113
Storax	Kg	1 000	1 000	1 000	700	2 000	3 000	1 000
Leaves of <i>Laurus nobilis</i> L.	Ton	2 108	2 049	2 890	3 498	4 325	3 890	6 763
Resinous wood	Ton	5 200	2 200	2 200	1 200	1 200	1 200	5 550
Incense	Kg	800	800	1 600	1 050	800	-	800
Leaves of <i>Salvia</i> sp.	Ton	575	760	807	842	802	975	450
Leaves of <i>Thymus</i> sp.	Ton	4 796	5 552	7 354	7 444	11 149	8 328	2 235
Seeds of <i>Pinus pinea</i>	Ton	519	1 046	717	421	529	629	412
Mushrooms	Ton	825	1 384	740	433	127	165	61
Leaves of <i>Rhus</i> L.	Ton	99	113	13	51	45	25	19
Leaves of <i>Rosmarinus officinalis</i>	Ton	81	195	270	197	434	398	450
Leaves of <i>Larocerasus officinalis</i>	Ton	124	47	59	41	10	67	73
Flowers of <i>Tiatal</i> L.	Ton	391	310	135	78	352	458	28
Fruits of <i>Castanea sativa</i> Mill	Ton	35	83	171	174	259	160	350
Corms of <i>Galanthus</i> L.	Ton	24	11	29	15	56	4	3

Source: Kizmaz (1997)

Foreign trade of NWFP in Turkey is summarized in Figure 1. It shows that the trading balance of NWFP, as against some wood products, was positive in the last ten years. The export value oscillated between US\$59 million in 1990 and US\$81 million in 1998. The import values increased during the same period from US\$2.8 million to US\$8.2 million in 1999. The export-import ratio decreased from 20:1 in 1990 to 8:1 in 1999 (Koc et al., 2000).

Foreign trade of NWFP has an important share in the overall foreign trade of forest products. Between 1990 – 1999 period, 36 percent of the total US\$1.8 billion of export of forest products and 1.5 percent of the total US\$3.2 billion of forest products import were achieved with the NWFP (Koc et al., 2000).

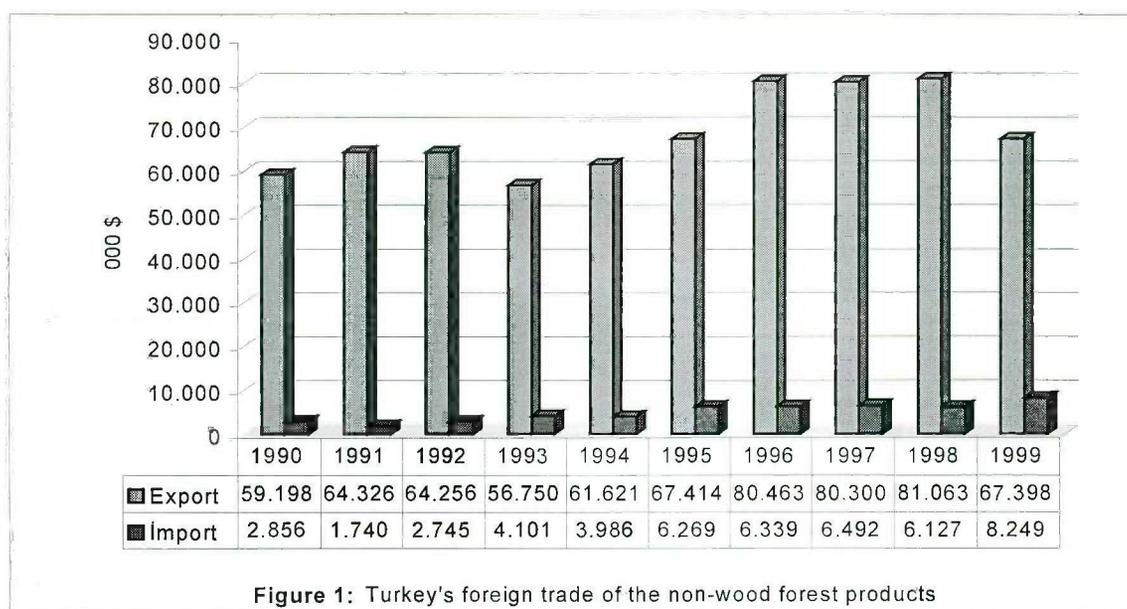


Figure 1: Turkey's foreign trade of the non-wood forest products

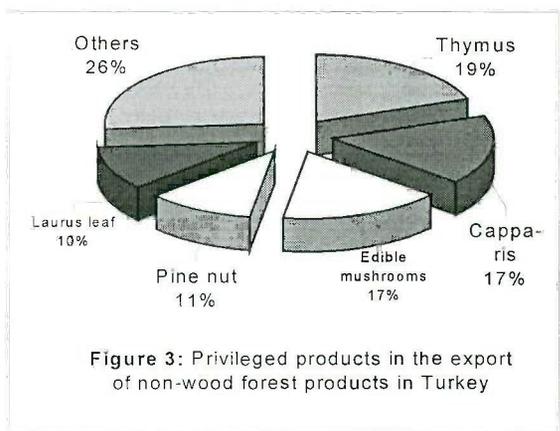
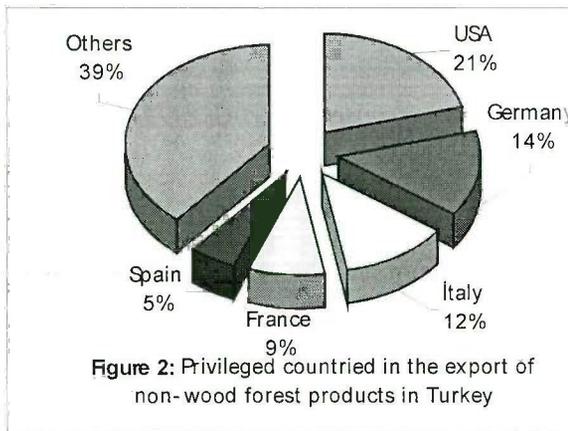
Source: Koc et al. (2000)

Exports of NWFP from Turkey maintained a reported average of US\$34.7 million from 1983-88 (May, 1991) and US\$68.3 million from 1990-1999 (Koc et al., 2000; see table 3 in the annex).

Koc (2000, see table 3) lists 23 NWFP being exported from Turkey. The most important exported NWFP over the last ten years were *Thymus* (aromatic plant), followed by *Capparis* (edible fruit), edible mushrooms (oyster mushroom, desert truffle, black truffle), pine nuts (*Pinus pinea*), *Laurus leaves* (laurel), *Castanea* (chestnut) and *Ceratonia siliqua* (carob). Less important NWFP are

- with an export value between 1.4 percent and 2.3 percent of all NWFP: Liquorice (*Glycyrrhiza sp.*), bulbous plants (ornamentals), *Foeniculum* (wild fennel), *juniperus cones* (medicines), *Cerasus mahalep* (edible fruits) and *Salvia* (sage); and
- with an export value below 1 percent of all NWFP: *Tilia flowers* (*Tilia tomenosa*), nut-gall (*Quercus sp.*), sweet gum (*Liquidambar orientalis*), tragacanth gum (*Astragalus sp.*), resin, *Rhus* (medicinal plant, textile dye), bark mushrooms, *Orchis*, camatina, bushes and *Myrtus* (medicinal plants).

Turkey exported NWFP to 113 countries. Main destinations were USA (21 percent of exports from 1990 to 1999), Germany (14 percent), Italy (12 percent), France (9 percent) and Spain (5 percent). Some 60 percent of the Turkish exports are sold to these countries, 40 percent is exported to other countries such as (e.g. Saudi Arabia) (Koc et al., 2000, see table 4).



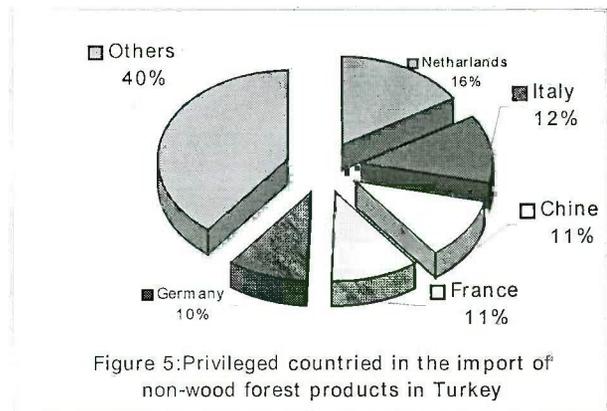
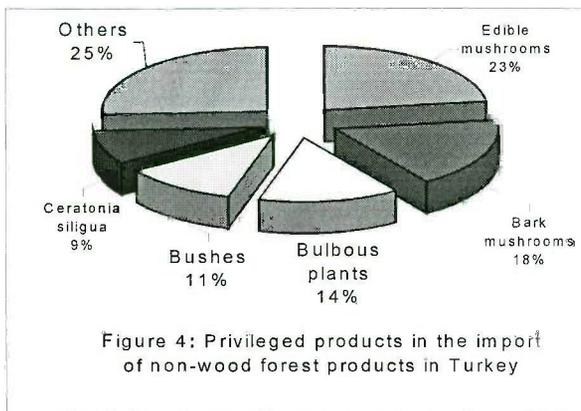
Source: Koc et al. (2000)

22 NWFP are imported to Turkey. The most important imported NWFP over the last ten years were edible and bark mushrooms, ornamentals (bulbous plants), bushes and *Ceratonia siliqua* (carob) and Thymus (aromatic plant). Less important imported NWFP are

- with an import value between 3.3 percent and 1.1 percent of all NWFP: Resin (*Pinus brutia*), liquorice (*Glycyrrhiza sp.*), *Foeniculum* (wild fennel), *juniperus cones* (medicinal plant), *Salvia* (sage), *Pinus pinea* (pine nuts), nut-gall (*Quercus sp.*) and *Capparis* (edible fruits); and
- with an import value below 1 percent of all NWFP: *Castanea* (chestnut), sweet gum (*Liquidambar orientalis*), *Tilia flowers* (*Tilia tomentosa*), *Laurus leaf* (laurel), tragacanth (*Glycyrrhiza sp.*), *Myrtus* (medicinal plant), *Rhus* (medicinal plant, textile dye), *Cerasus mahaleb* (edible fruits) and *Silene* (Koc et al., 2000; see annex, table 5).

The import of *Foeniculum*, *juniperus cones*, *Salvia*, pine nut, *Tilia flowers*, *Laurus leaf*, tragacanth, *Myrtus*, *Rhus* and *Cerasus mahaleb* has begun in the recent years.

Importation links have been established with 64 countries in the last decade. Most important importers in this period were the Netherlands (16 percent), Italy (12 percent), China (11 percent), France (11 percent) and Germany (10 percent). The share of the other countries was 40 percent (see table 6).



Source: Koc et al. (2000)

Negative environmental impacts of NWFP utilization in Turkey are caused by the increasing demand for medicinal and aromatic plant production. This high demand

lead to overexploitation and to the use of incompatible production techniques. Thus the destruction of species is increasing rapidly and some important endemic species are consequently in danger of extinction. As a result, some regulations have been introduced related to production techniques and effective protection and control of excessive production, including certificates for collection and export (Kizmaz, 1997).

Another problem regarding the use of NWFP in Turkey is the low level of industrial processing of medicinal and aromatic plants. These plants are exported as raw material whereas most of the finished products are reimported as industrial goods. As a result, the followings problems arise:

- The selling price of the raw products is low, while the cost of the imported finished products is high;
- Labor-intensive payment is low;
- The companies involved in import/export and processing of the raw materials gain more benefit than the producers;
- Imported products are more expensive due to the fact that they are processed abroad (Kizmaz, 97).

Regarding the market chain, GDF (1989) reports that Turkish villagers are in general quite well organized through existing cooperatives. However, due to lack of broad-based cooperative organization focused on NWFP, forest villagers tend to be at the mercy of the middleman in marketing such products. In most cases, the marketing chain is not seriously convoluted: gatherers usually sell to a local buyer who then trucks the good to processor/exporter. Nevertheless, the proportion of final product value that accrues to the producer may be minimal. Cooperatives should therefore be created to help producers increase the value of the products they are selling. For example, in the bay leaves sector, a large proportion of the raw material received by the processors consist of stems, stones, and other impurities that must be removed before shipment. Cooperatives of producers could thus be set to carry out improvements in collection, cleaning and selection of bay leaves.

## PLANTS AND PLANT PRODUCTS

### Food

The use of **mushrooms** such as *Boletus*, *Morchella*, *Lactarius* and *Cantharellus cibarius* is well documented in Turkey (Pacioni, 1991).

*Morchella sp.* is the most popular mushroom in Turkey. More than 47 tonnes were traded in 1989 in the domestic and foreign markets. Almost all the production (46 tonnes) is concentrated in south-western Anatolia.

About 22 tonnes of *Boletus* and 10.5 tonnes of *Cantharellus* were exported in 1989. These figures increased respectively to 730 tonnes and 160 tonnes in 1990. The main production areas are located in the Marmara and Black Sea regions (Kastamonu, Bursa, Bolu, Istanbul, Amasya, Giresun, Sinop, Balikesir, Zonguldak, Ordu, Artvin, Erzurum), but small quantities are also produced in South-West Anatolia (Mugla, Denizli, Antalya, Izmir, Isparta). The fresh natural production of *Boletus* and *Cantharellus cibarius* is mainly exported to Italy, Germany and other European countries. During 1989, in the regions of Istanbul, Giresun, Amasya, Erzurum, Zonguldak, Balikesir, Bursa and Bolu, a production of almost 22 tonnes *Boletus sp.* was recorded for exportation (Pacioni, 1991).

Some wild mushrooms, notably the desert truffles *Terfezia boudieri*, are frequently found and collected from the forest areas. Most of the wild mushrooms collected are

consumed in the village households and the surplus is sold at the market both in fresh and dried form.

The cultivation of *Terfezia boudieri* represents a valuable resource for the inhabitants of villages in the Anatolian plateaux. From spring to summer, the desert truffles are harvested and a significant amount are sold to the local traders. Successful cultivation has also been reported for black (*Tuber aestivum*) and white (*Tuberborchii*) truffles, due to favourable soil and climatic factors of western Anatolia.

*Rhizopogon* and *Lactarius sp.* are mycorrhizal guests of coniferous trees such as *Pinus*, *Picea*, *Abies*, *Cedrus* and are very appreciated as food in Turkey.

Originally avoided by villagers and town dwellers due to the fear of being poisoned, the domestic market of the oyster mushroom (*Pleurotus ostreatus*) is now steadily expanding. The know-how on cultivation of *Pleurotus ostreatus* is also increasing as shown by successful experiments carried out in the Laboratory of Mycology at the Institute of Poplar and Exotic Fast Growing Trees in Izmit.

Important **fruit** trees include almond (*Prunus amygdalus*) and pistachio (*Pistacia terebinthus*). Almond is one of the most important multipurpose trees growing in the region. Fruits of the tree are collected by the villagers while still green or after maturing and are sold on the market. The pistachio is another multi-purpose tree, which provides fruits (as a raw material for the production of pistachio oil) and gum, which can be obtained from its stem. It is also used as medicine (see below) (Yazici, 1997).

*Capparis spinosa* can grow in dry and bare soils where agriculture crop growing is not profitable. The plant gives fruit in the first year. Villagers collect the green buds of the plant before blooming. They keep them in 20-23% salty water for preservation. (Kizmaz, 1997).

### **Fodder**

Because of existing limited and degraded range areas, young shoots and leaves of trees such as *Quercus sp.* and *Pinus nigra* are used by the villagers for winter feeding when the other feeding resources run out. It can be said that roughly 70% of the goat feeding and 30% of the sheep feeding needs are supplied from the forest areas. Around 2.3 million of fodder is annually obtained from forest pastures and rangelands which amounts to 508 million ha (FSR Draft Report, 1998).

### **Medicines**

Important medicinal and aromatic herbs include *Rhus cariaia*, *Thymus seryllum*, *Salvia officinalis*, *Nepeta cataria* and *Cistus aurifolius*. These plants are mostly used for traditional health treatment, making tea and flavoring dishes. Among these, *Rhus cariaia* and *Pistacia terebinthus* seeds are collected in large amounts and have a market value.

Liquorice is obtained from the dried roots and rhizomes of several *Glycyrrhiza sp.* in particular *G. glabra*. The main active ingredients in the plant are saponin-like glycosides, of which glycyrrhizin is the most important. In crude extract form liquorice is used as expectorant and anti-inflammatory, and it is common in cough syrups, sweets and pastilles. Many non-medicinal foods and drinks are flavored with liquorice, as well as tobacco, toothpaste and breath fresheners.

Sumac (*Rhus cotinus*) is resistant to poor soil and grows on hillsides to prevent soil erosion. The leaves and fruits are very rich in myristicin, oil and organic acids. After collection, the leaves are dried and sold on the market. In industry, it is mainly used for processing of hides. Local people also use its leaves and fruits as medicine and spices.

*Sideritis* species (Labiatae) are used as herbal (mountain) tea in Turkey. Entire crop is obtained by wild crafting. They are sold and also exported mainly to Germany. As dried inflorescences they are used to make tea, plants are collected while flowering. (Yazici, 1997)

### **Perfumes and cosmetics**

Aromatic plants are considered as one of the most important categories of NWFP in Turkey. *Thymus* products for example are the most valuable exported NWFP in Turkey, worth US\$17 million, which corresponds to one fourth of the value of all exported NWFP (Koc et al., 2000, see table 5).

Kekik (Oregano) is another important export commodity of Turkey. Annually, Turkey exports 5 000-7 500 tonnes of dried oregano for return of US\$13-15 million. Commercial oregano species are collected mainly in the Aegean and Mediterranean regions of Turkey. Turkish oregano (*Origanum onites*) tops the list of commercial oreganos. The biggest threat to wild growing oregano is early harvest. Some collectors are known to start harvesting of very young oregano plants in February in contrast to its more usual harvesting period of July-September. Due to low content of carvacrol in essential oil of these early harvests, such consignments are rejected by the buyers (Baer, 2000).

Laurel (*Laurus nobilis*) (Lauraceae) is a bush, which grows along the entire coastline of Turkey. Laurel leaves are harvested for export or essential oil production in most parts of Turkey. In 1996, some 7 000 t of leaves were collected. (Kizmaz, 1997). However, in Cel and Hatay provinces, fruits are harvested and an aromatic fixed oil (Laurel berry oil) is obtained by boiling the crushed berries in water followed by scooping out the floating oil. This oil has excellent frothing properties used in locally made soaps, and exported mainly to Arab countries and Germany (Baer, 2000).

### **Ornamentals**

Bulbous plants are collected from the wild or cultivated in situ for export. In addition, they are used by the pharmaceutical and cosmetic industry. The export of flowers earned US\$2.4 million in 1995 (Kizmaz, 1997) and US\$1.5million in 1999 (Koc et al., 2000). Some of the most important bulbous plants are: *Eranthis hyemalis*, *Anemone blande*, *Leucozum aestivum* and *Cyclamen hederifolium* (Kizmaz, 1997).

### **Exudates**

Tragacanth **gum** is the dried exudates produced by tapping the tap root and branches of certain shrubby species of *Astragalus*. Turkey and Iran have been the only significant producers of tragacanth for some years.

The gum is exported in ribbon or flake form, and has a rather horny texture. Unlike many other gums, solutions of tragacanth have a very long shelf life without loss of viscosity. The most important applications of tragacanth are now in foods and pharmaceuticals (FAO, 1992).

## ANIMALS AND ANIMAL PRODUCTS

### Honey and beeswax

Honey production is very important for domestic consumption and export. "Anzer honey", for example is very valuable and made by the bees from *Thymus sp.* around Artvin and Erzurum regions. Also "pine honey" or honeydew is obtained by worker bees at the end of the *Marchallina hellenica* Genn secretion. This locally produced honey called as "Basyra" in Turkey. Pine Honey production is about 7 500 (3 500-12 000) tonnes at fethiye and Marmris (Muola region) (Kizmaz, 1997).

### REFERENCES

- Agaoglu.** 1993. A preliminary inventory of non-wood forest products in certain villages of Vezirkporu, Duragan and Uzndere districts. GCP/TUR/SWI Consultancy Report. Turkey.
- Baer, K.H.C.** 2000. Sustainable wild harvesting of medicinal and aromatic plants: an educational approach. Seminar on "Harvesting of non-wood forest products", Menemen/Izmir (Turkey), 2-8 October 2000.
- Chang, S. T.** 1978. Volvariella Volvacea. *The biology and cultivation of edible mushrooms.* Academic Press. N Y.
- FAO.** 1983. Growing mushrooms: Oyster Jew's Ear and Straw Mushroom Regular Program. RAPA, No. 75. Bangkok.
- FAO** 1992. Tragacanth gum [published in FAO Food and Nutrition Paper 34, 1986]. pp 225-227. In Compendium of Food Additive Specifications. FAO Food and Nutrition Paper 5 (Joint FAO/WHO Expert Committee on Food Additives. Combined Specifications from 1<sup>st</sup> through the 37<sup>th</sup> Meetings, 1956-1990). Rome: Food and Agriculture Organization.
- General Directorate of Forestry.** 1989. The Turkish forestry in the 150<sup>th</sup> year of its establishment. Publication n. 673. Serial n. 30. Ankara, Turkey.
- Guler, M.**1994. The status of past and current, edible mushroom cultivation in Konya: Its problems and recommendations. FAO project, GCP/INT/539/ITA, Consultancy Report for Turkey.
- Government of Turkey.** 1998. National forestry report of Turkey. Near East Forestry Commission. Thirteenth Session. Damascus, Syria (6-9 December, 1998).
- Kizmaz, M.** 1997. Medicinal, culinary and aromatic plants production in Turkey. *Proceedings of the International Expert Meeting on Medicinal, Culinary and Aromatic plants in the Near East.* Cairo, Egypt, 19-21 May 1997.
- Kizmaz, M.** 2000. Policies to promote sustainable forest operations and utilization of non-wood forest products. Seminar on " harvesting of non-wood forest products", Menemen/Izmir (Turkey), 2-8 October 2000.
- Koc, H., Aksu, B. and Kurtoglu, A.** 2000. Turkey's foreign trade of the non-wood forest product. . Seminar on " harvesting of non-wood forest products", Menemen/Izmir (Turkey).
- May, P.** 1991. Mission report of Turkey. FAO.
- Muthoo, M.K.** 1997. Forests and forestry in Turkey. FAO.
- Pacioni, P.** 1991. Consultancy report on truffles. FAO project TCP/TUR/8852(T)
- Turker, F., PAK, M. and Ozturk, A.** 1999. The Review of non-wood forest products management in Turkey as from the five year development plans and forestry main plan. Karadenis technical University, Faculty of forestry, Department of Forest Engineering.
- Yazici, E.** 1997. NWFP production in the project villages in Turkey (Beykavagi, Dulgerler, Kupluce). Forestry and Food Security in the Mediterranean and Near East Region. *Proceedings of the International Expert Meeting on Medicinal, Culinary and Aromatic plants in the Near East.* Cairo, Egypt.

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## QUANTITATIVE DATA ON NWFP OF TURKEY

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				
<b>Plants and plant products</b>											
<b>Food</b>	1	Pine nuts	<i>Pinus pinea</i>	nu	F	W	I	Export worth US\$6.09 million in 1999		Koc et al., 2000	
		Edible mushrooms	<i>e.g. Terfezia boudieri, Boletus sp., Morchella sp., Cantharellus cibarius</i>	pl	F	W, (C)	I	Export worth US\$9.5 million in 1999		Koc et al., 2000	
			<i>Boletus</i>	pl	F		I	Export of 730t in 1990		Pacioni, 1991	
			<i>Cantharellus</i>	pl	F		I	Export of 160t in 1990		Pacioni, 1991	
				<i>Ceratonia siliqua</i>	fr	F,O	W	I	Export worth US\$1.06 million in 1999		Koc et al., 2000
				<i>Castanea sativa</i>	fr	F	W	I	Export worth US\$8 million in 1999		Koc et al., 2000
				<i>Cerasus mahalep</i>	fr	F	W		Export worth US\$562 000 in 1999		Koc et al., 2000
		<i>Capparis</i>	fr	F	W,C	N,I	Export worth US\$8.5 million in 1999		Koc et al., 2000		
<b>Fodder</b>	2				F	W	N	Production of 2.3 million t		Kzmaz 2000	
<b>Medicines</b>	1		<i>Myrtus</i>	le	F, P	W, P	N, I	Export worth US\$52 000 in 1999		Koc et al., 2000	
			<i>Juniperus Communis</i> L.	oi	F	W	N,I	Export worth US\$1.8 million in 1999		Koc et al., 2000	
		Liquorice	<i>Glycyrrhiza glabra</i>	ro	F	W	N,I	Export worth US\$7 611 000 in 1999		FAO, 1997	
		Linden blossom	<i>Tilia tomentosa</i>	fl			N,I	Export worth US\$588 000 in 1999		Koc et al., 2000	
		Bark mushrooms		pl	F	W	N,I	Export worth US\$47 000 in 1999		Koc et al., 2000	
		Camatina			F	W	N,I	Export worth US\$27 000 in 1999		Koc et al., 2000	

<b>Perfumes, cosmetics</b>	1		<i>Pinus brutia</i>	re				Export worth US\$57 000 in 1999		Koc et al., 2000
	1	Laurel	<i>Laurus nobilis</i>	le, fr		W,C	N, I	Production of 7 000 t in 1996 (Kizmaz, 1997) and export worth US\$7.7 million in 1999 (Koc et al., 2000)		Kizmaz, 1997; Koc et al., 2000
	2	Rosemary leaves	<i>Rosmarinus officinalis</i>	le, fl		W, C	N	Production of 450t in 1996		Kizmaz, 1997
	2	Kekik	<i>Origanum sp.</i>	le	F	W	N,I	Export of 5 000-7 500t worth US\$13-15 million		Baer, 2000
	1		<i>Thymus sp.</i>	le	F	W	N	Export worth US\$17.3 million in 1999		Koc et al., 2000
	1	sage	<i>Salvia sp.</i>	le	F	W	N,I	Export worth US\$2.3million in 1999		Koc et al., 2000
	2	Incense	<i>Liquidambar orientalis</i>	oi	F	W	N	Production worth 800kg in 1996		Kizmaz, 1997
<b>Dying, Tanning</b>	2		<i>Rhus L.</i>	fr,le			N, I	Export worth US\$86 000 in 1999		Koc et al., 2000
<b>Ornamentals</b>	1	Bulbous plants		fl	F, P	W,C	N,I	Export worth US\$1.5million in 1999		Koc et al., 2000
<b>Exudates</b>	1	Gum tragacant	<i>Astragalus sp.</i>	ro	F,O	W	N,I	Export worth US\$101 000 in 1999	Turkey and Iran are the biggest world exporter	Koc et al., 2000
	1	Sweet gum	<i>Liquidambar orientalis</i>	oi	F	W	N,I	Export worth US\$25 000 in 1999		Koc et al., 2000
		storax		re	F	W	N	Production worth 1 000kg in 1996		Kizmaz, 1997
<b>Animals and animal products</b>										
<b>Honey, beeswax</b>	1	Basyra	<i>Marchallina hellenica</i>	ho, bw	O		N	Annual production of 7 500 t		Kizmaz, 2000

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## ANNEX

Table 2. Main NWFP of Turkey

	PLANT NAME	PRODUCT	USES
1.	<i>Pinus brutia</i> Ten	resin	paint, polishing paper, chewing gum
2.	<i>Liquidambar orientalis</i> Mill	styrox	Medicine, perfume
	<i>Liquidambar orientalis</i> Mill	incense	used in mosques
3.	<i>Laurus nobilis</i> L.	leaves	foods, perfume, leather and alcohol
4.	<i>Pinus pinea</i> L.	fruit	foods
5.	<i>Quercus infectoria</i> Oliv. Subsp. <i>Infectoria</i>	gall	Paint, textile dyes, medicine, leather, ink
6.	<i>Quercus thaburensis</i> Decne	fruit	medicine, leather, textile dyes
7.	<i>Juniperus Communis</i> L. Subsp. <i>Naa.</i>	fruit	medicine, alcohol
8.	<i>Tilia tomentosa</i> moench <i>Tilia platyphyllos</i> scop <i>Tilia rubra</i> DC.	flower barks	foods, medicine, cosmetic, rush mat
9.	<i>Betula pendula</i> Roth	leaves, barks, twigs	medicine
10.	<i>Eucalyptus</i> sp.	leaves, barks	medicine, foods (liquor)
11.	<i>Ceratonia siliqua</i> L.	fruit seeds	foods, medicine, textile dye, cosmetics, alcoholic drinks, paper
12.	<i>Castanea sativa</i> Mill	fruit, bark	Foods, medicine leather, textile dye
13.	<i>Rhamnus petiolaris</i> Boiss	fruits	foods, paints, medicine, textile dye
14.	<i>Cerasus mahaleb</i> L.	fruits, seeds	foods, cosmetic, medicine, textile dye
15.	<i>Pistacia terebinthus</i> L.	gum turpentine, wood, fruits, gull	medicine, textile dye, alcoholic drinks
16.	<i>Pistacia lentiscus</i> L.	gum	foods, medicine, perfume, alcoholic drink, paints, polish, chewing-gum
17.	<i>Rhus</i> L.	leaves fruits	medicine, textile dye, leather, foods,
18.	<i>Erica arborea</i> L.	twig with flowers, roots, twig	medicine, tobacco pipe

19.	<i>Astragalus spp.</i> L.	gum	Pharmaceutics, medicine, textile, glue
20.	<i>Glycyrrhiza glabra</i> L.	roots, rhizomes	medicine, beer, foods
21.	<i>Salvia officinalis</i> L.	leaves	medicine, cosmetics
22.	<i>Centiana lutea</i> L.	roots of 4 – 5 years old plant	medicine
23.	<i>Dryopteris-flix-mas</i> (L) schott	rhizomes	medicine
24.	<i>Viburnum opulus</i> L.	breaks, leaves, fruits	alcoholic drinks, medicine
25.	<i>Atropa belladonna</i> L.	leaves roots fruits	medicine, chemistry
26.	<i>Althea officinalis</i> L.	flowers leaves roots	medicine
27-	<i>Ricinus communis</i> L.	seeds oil of seed	medicine, plane engine oil
28-	<i>Vitex agnus-castus</i> L.	flowers with twig seeds	medicine, textile dye
29-	<i>Simmondsia chinensis</i> (Link) schneied	seeds	foods, cosmetic, shoe polish oil, car polish oil
30-	<i>Galanthus</i> L.	corn herbaceous stem	medicine
31-	<i>Rhamnus frangula</i> L.	barks flowers	medicine
32-	<i>Capparis ovata</i> , <i>C. spinosa</i> L.	buds	foods, medicine, alcoholic drinks
33-	<i>Laurocerasus officinalis</i> Roemer	fresh leaves fruits	foods, medicine, alcoholic drinks
34-	<i>Foeniculum vulgare</i> Mill Subsp vulgare	seeds	foods, medicine, perfumes, alcoholic drinks
35-	<i>Origanum heracleoticum</i> L.	branch flowers leaves	medicine
36-	<i>Matricaria chamomilla</i> L.	flowers	medicine, cosmetic
37-	<i>Rosmarinus officinalis</i> L.	leaves flowers	medicine, cosmetic
38-	<i>Lavandula officinalis</i> L.	flowers	medicine, cosmetic
39-	<i>Valeriana officinalis</i> L.	rhizomes, roots	medicine

40-	<i>Gypsophilla</i> L.	roots	foods, medicine, cleaning material
41-	<i>Thymus</i> sp.	flowers, leaves	medicine, chemistry, perfume, cosmetic, foods
42-	<i>Digitalis grandiflora</i> L.	leaves	medicine

Source: Kizmaz (1997).

Table 3. Shares of products in the export of NWFP in Turkey

Num	PRODUCTS	YEARS											TOTAL
			1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	
1	Thymus	000\$ %	6 290 10.6	8 078 12.6	10 786 16.8	13 065 24.0	16 108 26.1	13 697 20.3	15 532 19.3	14 538 18.1	16 196 20.0	17 293 25.7	132 124 19.4
2	Capparis	000 \$ %	11 064 18.7	10 232 15.9	10 046 15.6	11 626 20.5	12 093 19.6	12 069 17.9	13 298 16.5	14 108 17.6	10 741 13.3	8 502 12.6	113 778 16.7
3	Edible mushrooms	000 \$ %	10 717 18.1	14 363 22.3	11 749 18.3	6 986 12.3	9 035 14.7	12 777 19.0	14 143 17.6	12 036 15.0	11 063 13.6	9 541 14.2	112 411 16.5
4	Pine nut	000 \$ %	6 568 11.1	10 333 16.1	8 400 13.1	4 699 8.3	2 558 4.2	1 717 2.5	5 649 7.0	11 586 14.4	16 408 20.2	6 094 9.0	74 014 10.8
5	Laurus leaf	000 \$ %	4 196 7.1	7 461 11.6	8 438 13.1	6 282 11.1	6 548 10.6	6 563 9.7	7 375 9.2	8 475 10.6	7 696 9.5	7 747 11.5	70 781 10.4
6	Castanea	000 \$ %	5 651 9.5	3 571 5.6	4 010 6.2	4 714 8.3	5 250 8.5	8 966 13.3	10 033 12.5	8 602 10.7	7 729 9.5	7 963 11.8	66 490 9.7
7	Ceratonia sillgua	000 \$ %	4 250 7.2	2 708 4.2	4 338 6.8	4 181 7.4	2 905 4.7	3 475 5.2	4 935 6.1	3 215 4.0	2 098 2.6	1 055 1.6	33 160 4.9
8	Licorice	000 \$ %	4 472 7.6	2 273 3.5	1 347 2.1	999 1.8	854 1.4	1 123 1.7	1 269 1.6	1 607 2.0	933 1.2	761 1.1	15 638 2.3
9	Bulbous plants	000 \$ %	1 591 2.7	1 843 2.9	1 950 3.0	1 538 2.7	1 498 2.4	2 153 3.2	228 0.3	390 0.5	1 587 2.0	1 573 2.3	14 349 2.1
10	<i>Foeniculum</i> , Juniperus cones	000 \$ %	611 1.0	712 1.1	688 1.1	623 1.1	577 0.9	852 1.3	2 307 2.9	1 896 2.4	1 156 1.4	1 809 2.7	11 232 1.6
11	Cerasus mahalep	000 \$ %	782 1.3	1 303 2.0	1 130 1.8	774 1.4	861 1.4	548 0.8	1 563 1.9	1 178 1.5	1 275 1.6	562 0.8	9 975 1.5
12	Salvia	000 \$ %	- -	- -	- -	- -	838 1.4	1 121 1.7	1 477 1.8	1 604 2.0	2 104 2.6	2 358 3.5	9 501 1.4
13	Tilia flowers	000 \$ %	- -	- -	- -	- -	1 633 2.7	1 737 2.6	1 529 1.9	- -	797 1.0	588 0.9	6 285 0.9
14	Nut-gall	000 \$ %	1 032 1.7	424 0.7	503 0.8	440 0.8	259 0.4	87 0.1	676 0.8	456 0.6	457 0.6	622 0.9	4 957 0.7
15	Sweetgum	000 \$ %	357 0.6	330 0.5	521 0.8	- -	456 0.7	329 0.5	50 0.1	67 0.1	14 0.0	25 0.0	2 150 0.3
16	Tragacanth	000 \$ %	706 1.2	249 0.4	254 0.4	62 0.1	58 0.1	69 0.1	110 0.1	69 0.1	3 0.0	101 0.1	1 681 0.2
17	Resin	000 \$ %	22 0.0	189 0.0	1 0.0	10 0.0	17 0.0	13 0.0	113 0.1	301 0.4	415 0.5	579 0.9	1 449 0.2
18	Rhus	000 \$ %	618 1.0	308 0.5	4 0.0	20 0.0	8 0.0	30 0.0	50 0.1	7.4 0.1	77 0.1	86 0.1	1 275 0.2
19	Bark mushrooms	000 \$ %	119 0.2	14 0.0	11 0.0	76 0.1	17 0.0	52 0.1	58 0.1	28 0.0	281 0.3	47 0.1	705 0.1
20	Orchis	000 \$ %	105 0.2	94 0.1	55 0.1	84 0.1	28 0.0	35 0.1	33 0.0	9 0.0	2 0.0	4 0.0	450 0.1
21	Camatina	000 \$ %	19 0.0	27 0.0	24 0.0	21 0.0	17 0.0	1 0.0	19 0.0	42 0.1	26 0.0	27 0.0	223 0.0
22	Bushes	000 \$ %	50 0.1	2 0.0	1 0.0	- -	3 0.0	125 0.0	9 0.0	18 0.0	0.390 0.0	8 0.0	93 0.0
23	Myrtus	000 \$ %	272 0.0	135 0.0	218 0.0	10 0.0	- -	- -	5 0.0	- -	4 0.0	52 0.1	71 0.0
TOTAL		000 \$ %	59 198 100.0	64 326 100.0	64 256 100.0	56 750 100.0	61 621 100.0	67 414 100.0	80 463 100.0	80 300 100.0	81 063 100.0	67 398 100.0	682 789 100.0

Source: Koc et al. (2000)

Table 4 . Privileged countries in the export of NWFP in Turkey

YEARS	1 %	2 %	3 %	4 %	5 %	Other %	Total 000 \$
1990	Germany 17.9	Italy 17.0	USA 14.9	France 6.2	S.Arabia 5.1	38.8	59 198
1991	USA 20.8	Germany 17.0	Italy 13.7	France 9.9	Netherlands 9.0	29.6	64 326
1992	Germany 20.3	USA 18.1	Italy 13.3	France 6.8	Switzerland 3.9	37.6	64 256
1993	USA 22.5	Germany 15.9	Italy 9.0	Spain 6.9	France 5.9	39.7	56 750
1994	USA 25.3	Germany 13.9	Italy 10.0	France 8.1	Spain 4.8	37.9	61 621
1995	USA 19.0	France 13.8	Germany 12.9	Italy 10.5	Spain 7.2	36.5	67 414
1996	USA 20.5	Germany 13.5	Italy 12.8	France 9.6	Spain 6.3	37.3	80 463
1997	USA 21.6	Germany 12.0	Italy 10.7	France 8.2	Spain 7.4	40.0	80 300
1998	USA 20.0	Italy 16.1	Germany 10.3	France 8.4	Spain 6.0	39.2	81 063
1999	USA 24.1	Germany 11.6	Italy 9.5	France 7.3	Netherlands 5.3	42.2	67 398
<b>Total</b>	USA 20.7	Germany 14.3	Italy 12.3	France 8.5	Spain 5.4	38.8	682 789

Source: Koc et al. (2000)

Table 5. Shares of products in the import of NWFP in Turkey

Num	YEARS PRODUCTS		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	TOTAL
1	Edible mushrooms	000 \$ %	216 7.6	193 11.1	588 21.4	529 12.9	629 15.8	1 402 22.3	1 715 27.1	2 290 35.3	1 849 30.2	1 690 20.5	11 100 22.7
2	Bark mushrooms	000 \$ %	578 20.2	367 21.1	422 15.4	694 16.9	344 8.6	734 11.7	1 953 30.8	1 806 27.8	- -	1 785 21.6	8 684 17.8
3	Bulbous plants	000 \$ %	1 322 46.3	575 33.1	444 16.2	506 12.3	250 6.3	542 8.6	389 6.1	890 13.7	1 028 16.8	921 11.2	6 867 14.0
4	Bushes	000 \$ %	308 10.8	139 8.0	203 7.4	1 045 25.5	612 15.4	1 664 26.5	95 1.5	51 0.8	472 7.7	813 9.9	5 400 11.0
5	Ceratonia sillgua	000 \$ %	268 9.4	328 18.9	606 22.1	670 16.3	1 078 27.0	1 099 17.5	34 0.5	114 1.8	93 1.5	- -	4 290 8.8
6	Thymus	000 \$ %	1 0.0	1 0.1	225 8.2	376 9.2	676 17.0	280 4.5	1 123 17.7	199 3.1	618 10.1	438 5.3	3 937 8.1
7	Resin	000 \$ %	156 5.5	134 7.7	171 6.2	184 4.5	137 3.4	106 1.7	268 4.2	218 3.4	97 1.6	140 1.7	1 612 3.3
8	Licorice	000 \$ %	395 0.0	- -	59 2.2	71 1.7	53 1.3	72 1.1	110 1.7	227 3.5	410 6.7	454 5.5	1 457 3.0
9	<i>Foeniculum,</i> <i>Juniperus cones</i>	000 \$ %	- -	- -	- -	1 0.0	1 0.0	4 0.1	11 0.2	72 1.1	430 7.0	747 9.1	1 266 2.6
10	Salvia	000 \$ %	- -	- -	- -	- -	- -	- -	111 1.8	278 4.3	402 6.6	299 3.6	1 090 2.2
11	Pine nut	000 \$ %	- -	- -	20 0.7	1 0.0	135 3.4	218 3.5	80 1.3	20 0.3	29 0.5	453 5.5	957 2.0
12	Nut-gall	000 \$ %	3 0.1	- -	- -	5 0.1	- -	95 1.5	115 1.8	34 0.5	216 3.5	163 2.0	631 1.3
13	Capparis	000 \$ %	1 0.0	- -	- -	- -	- -	2 0.0	65 1.0	148 2.3	249 4.1	84 1.0	549 1.1
14	Castanea	000 \$ %	238 0.0	- -	3 0.1	13 0.3	4 0.1	8 0.1	84 1.3	36 0.6	88 1.4	46 0.6	282 0.6
15	Sweetgum	000 \$ %	4 0.0	2 0.1	3 0.1	5 0.1	17 0.4	6 0.1	51 0.8	41 0.6	54 0.9	81 1.0	264 0.5
16	Tilia flowers	000 \$ %	- -	- -	- -	- -	30 0.8	19 0.3	36 0.6	- -	43 0.7	81 1.0	209 0.4
17	Laurus leaf	000 \$ %	- -	- -	- -	- -	- -	- -	63 1.0	1 0.0	28 0.5	39 0.5	130 0.3
18	Tragacanth	000 \$ %	- -	- -	- -	- -	- -	14 0.2	18 0.3	15 0.2	3 0.0	15 0.2	85 0.2
19	Myrtus	000 \$ %	- -	- -	- -	- -	- -	- -	5 0.1	39 0.6	- -	- -	44 0.1
20	Rhus	000 \$ %	- -	- -	- -	- -	- -	- -	2 0.0	7 0.1	15 0.2	- -	23 0.0
21	Cerasus mahalep	000 \$ %	- -	- -	- -	- -	- -	- -	11 0.2	3 0.0	3 0.0	- -	17 0.0
22	Silene	000 \$ %	- -	- -	- -	- -	- -	4 0.1	- -	4 0.1	- -	- -	8 0.0
TOTAL		000 \$ %	2 856 100.0	1 740 100.0	2 745 100.0	4 101 100.0	3 986 100.0	6 269 100	6 339 100.0	6 492 100.0	6 127 100.0	8 249 100.0	48 903 100.0

Source: Koc et al. (2000)

Table 6. Privileged countries in the import of NWFP in Turkey

YEARS	1 %	2 %	3 %	4 %	5 %	Other %	Total 000 \$
1990	Netherlands 52.6	Italy 9.9	Portugal 7.7	Germany 6.8	Chine 5.1	17.9	2 856
1991	Netherlands 34.8	Italy 11.2	Switzerland 10.1	Germany 9.4	Chine 8.4	26.0	1 740
1992	Germany 19.9	Netherlands 18.9	Chine 9.7	Switzerland 9.7	Italy 8.7	35.5	2 745
1993	Italy 27.9	Netherlands 16.0	Germany 8.2	China 7.9	France 5.8	34.2	4 101
1994	Albania 14.1	Netherlands 12.6	Italy 10.9	Spain 10.4	China 9.7	42.3	3 986
1995	Italy 23.4	China 14.9	Netherlands 14.1	Germany 14.0	France 5.6	28.0	6 269
1996	Germany 14.4	Portugal 12.6	France 12.4	China 9.5	Albania 8.6	42.5	6 339
1997	Netherlands 14.7	China 14.5	Portugal 13.2	Italy 12.6	France 8.5	36.5	6 492
1998	Netherlands 17.6	France 17.2	China 11.6	Italy 8.7	Germany 6.9	38.0	6 127
1999	France 21.5	China 13.0	Portugal 9.4	Netherlands 9.3	Italy 7.5	39.2	8 249
Total	Netherlands 16.1	Italy 12.4	Chine 12.2	France 10.8	Germany 9.8	39.5	48 903

Source: Koc et al. (2000)

## **3.15 United Arab Emirates**

### **INTRODUCTION**

#### **Main Non-Wood Forest Products**

No information is available on non-wood forest products (NWFP) in the United Arab Emirates.

### **ACKNOWLEDGEMENT**

Additional information on NWFP in the United Arab Emirates would be appreciated and duly acknowledged.

## 3.16 Yemen

### INTRODUCTION

#### Main Non-Wood Forest Products

The main non-wood forest products (NWFP) of Yemen are honey and fodder.

Other NWFP include edible plants (e.g. fruits such as *Ziziphus spina-christi*), ornamental plants (*Begonia socotrana*), medicinal plants, colorants (e.g. henna), resins (e.g. *Euphorbia arbuscula*) and utensils (e.g. fish traps).

In addition, a variety of multipurpose trees integrated in agroforestry systems are used for consumptive and ecological functions (e.g. shelter belts).

#### General information

Several traditional agroforestry systems exist in the different ecological zones of Yemen. These systems represent a form of integration of woody species with crop cultivation or animal rearing, which increases overall revenue and protects soil productivity. The indigenous species most commonly used in these traditional agroforestry systems are: *Acacia negrii*, *A. tortilis*, *Cordia abyssinica*, *Dobera glavra*, *Ficus vasta*, *Tamarix nilotica*, and *Zizyphus spina-christi*. *Tamarix nilotica* and *Zizyphus spina-christi*, although not indigenous species, are also widely used.

Recently, the Yemenite farmers have started to introduce fast growing exotic species used as shelterbelts and for the fixation of sand dunes in Tihama and Maareb. The most commonly used exotic species are: *Azadirachta indica*, *Cononcarpus lancifolius*, *Melia azedaracht*, *Parkinsonia aculeata*, *Prosopis chiliensis*, and *Prosopis juliflora* (Nahhal, 1989).

### PLANTS AND PLANT PRODUCTS

#### Food

Yemen's vegetation is an important food resource, providing a valuable nutritional supplement to an otherwise rather restricted diet.

Important **fruits** are provided by *Ziziphus* sp., *Sterculia* sp. (large fruits are collected and their sizeable kernels extracted), *Tamarindus indica* (offering vitamin-rich fruits which are very popular in Yemen), *Ficus* sp.; *Rhus* sp.; and *Cordia* sp. (RBGE, 2000).

#### Fodder

Even more important as the search for wild foods is the provision of fodder for livestock. Many Yemenite households depend on livestock production and great efforts are expended on procuring fodder for animals.

Cattle represent a high labor investment for their owners. In bad years, herders are compelled to cover vast areas in search of foliage to carry home for their famished beasts as a substitute for the grazing which has withered and died. *Sterculia* is an important drought fodder. The herder climbs up into the crown of the tree and cuts off the long, curly leaves. Another good fodder for cattle is the foliage of *Boswellia ameero*: in the areas where it grows in profusion, its leaves are the main constituents of livestock drought fodder. The Dragon's Blood tree, *Dracaena cinnabari*, retains its spiky leaves throughout the severest drought, and these are

lopped off and then roughly chopped to fracture the tough outer casing and reveal the edible fibrous material within. This tree also produces a multitude of berries, which are collected and carried home in sacks to feed to livestock. Other species provide valuable feed for cows, one in particular, *Commiphora soqotrana*, is noteworthy since it provides besides a rich foliage, a liquid which can be extracted from its bast or underbark which can be given to young livestock as a substitute for milk.

In the dry season, goats are fed on the foliage of *Acacia*, *Carphalea*, various *Commiphora*, *Grewia* and *Vernonia* among others. In periods of drought, goats too are fed on *Dracaena* leaves.

### **Medicines**

In Yemen, various plants are used traditionally for medicinal purposes. Examples include *Jatropha unicostata* (liquid used as antiseptic), *Commiphora socotrana* (liquid derived from bark used as antiseptic, twigs are used as tooth stick), and *Euphorbia arbuscula* (latex used to treat skin complaints) (RBGE, 2001).

### **Dying and tanning**

The dried leaf of *Lawsonia inermis* provides a **dye** called Henna that can range in color from black to red through to blonde. *Lawsonia inermis* is a shrub or small tree, indigenous to the area between the Islamic Republic of Iran and northern India and introduced widely throughout the tropics and subtropics. From ancient times, henna has been employed as a cosmetic dye for hair, skin and nails and has acquired a particular significance in Islamic culture. More recently, there has been an increase in its usage as a hair dye in Western Europe and North America. Prior to the widespread availability of synthetic dyestuffs, henna was also employed as a dye for textiles and leather (FAO, 1995a).

Some 9 000t of dried leaves are traded worldwide per year. Many countries in the Middle East and North Africa have a domestic production of henna but require supplementation by imports. The largest individual importer in this region is Saudi Arabia (approximately 3 000 tonnes). The main suppliers to the Middle East market are India and Pakistan. Yemen is considered as smaller producer (FAO 1995).

### **Utensils, handicrafts and construction material**

The whippy slim branches of *Flueggea* are woven into fish traps; *Tamarindus* or *Grewia* wood is fashioned into intricate but strong locks, while a paste of *Daemia* or *Pergularia* removes the hair from skins and hides (RBGE, 2001).

### **Exudates**

*Dracaena cinnabari*, the "Dragon's Blood Tree", provides a red colored **resin**, which is used as medicine, dye or ornamental. Domestic consumption in Yemen, where dragon's blood is popular as a traditional medicine, is difficult to estimate. Resin from plants growing in Yemen are not believed to enter world trade. Dealers quoted US\$33/kg for No. 1 grade and US\$5/kg for No. 2 grade, both of Middle Eastern origin (FAO, 1995b).

Exudation can be induced by boiling chunks of bark and underbark in a little water and then crushing them to a paste which is spread out on a flat rock surface to cool and dry. The resin most appreciated on the Soqatra Island, however, is that which exudes naturally from the tree itself when it comes into flower. It can only be collected by climbing into the tree and picking off the droplets where they have oozed from the base of the flowering shoots (RBGE, 2000).

## ANIMALS AND ANIMAL PRODUCTS

### Honey and beeswax

One of the most important NWFP of Yemen is bee **honey** of which the country produces several natural varieties, depending on which tree the bees feed. The most famous of these varieties is the Siddr or Elb (*Zizyphus sp.*) honey followed by Samur honey from *Acacia tortilis*.

Bee honey is accorded high official interest in Yemen by virtue of its socio-economic and nutritive value. The interest is reflected in the various studies conducted on the producer bees, pollen sources, honey varieties, the economics, packing, export and constraints thereof.

The main findings of these studies show that (Costin, 1990):

- Of the recorded 40 000 colonies in Yemen most are found in Lahaj and Hadramawt, mainly of the yellow strains (*Apis spp.*).
- The most famous Yemeni honey is the "Dwani and Jurdani" produced from *Zizyphus*. The price of 1 kg of this honey can exceed Yd50 (US\$100).
- Yemen may produce up to 5 000 tonnes per year, which is mainly exported to Saudi Arabia and the Gulf States and the revenues from these exports reaches approximately US\$40 million per year.

### REFERENCES

- Costin, E.** 1990. Arid Zones Examples of Shelterbelt Establishment and Management, FAO. Yemen
- El Gack, N.E., Ugool, M.E.M.** 1993. Socio-economic Study on Rural Women and Natural Forests: Case Study of Jebel Bura, Yemen. FAO Forestry Development Project (GCP/YEM/015/SWI)
- Ellatifi, M.** 1993. Forestry nurseries and agroforestry Expert, GCP/YEM/015/SWI.
- FAO.** 1995a. Colourants and dyestuffs by C.L. Green. Non-wood forest products No. 4, Rome.
- FAO.** 1995b. Gums, resins and latexes of plant origin. by J.J.W. Coppen. Non-wood forest products No. 6, Rome.
- Herzog, M.** 1997. Forests in Yemen: A short guide for tourists.
- Nahal, I.** 1989. L'Agroforesterie et les Possibilités de la Developper en République Arabe Yemenite. (GCP/YEM/015/SWI).
- RBGE (Royal Botanic Garden Edinburgh) Home.** 2001. Plants and People/Soqatra. Internet: [www.rbge.org.uk/Arabia/Soqtra](http://www.rbge.org.uk/Arabia/Soqtra), viewed on 14 May 2001.

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Additional information on NWFP in Yemen would appreciated and duly acknowledged.

## QUANTITATIVE DATA ON NWFP OF YEMEN

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			
<b>Animals and animal products</b>										
Honey, beeswax	1		<i>Ziziphus sp.</i>	ho		W,C	N,I	Annual production of 5 000t and annual export revenue worth US\$40 million		Costin, 1990

Importance: 1- high importance on the national level; 2 – high importance on the local/regional level; 3 – low importance

Part used: an – entire animal; ba – bark; bw – beeswax; le – leaves; nu – nuts; fi – fibres; fl – flowers; fr – fruits; gu – gums; ho – honey; la – latex; oi – oil; pl – entire plant; re – resins; ro – roots; sa – sap; se – seeds; st – stem; ta – tannins

Habitat: F - natural forest or other wooded lands; P - plantation; O – Others: Trees outside forests (e.g. agroforestry, homegardens)

Source: W - wild, C - cultivated

Destination: N - national; I – international

## 4. Institutions and resource persons on NWFP in the Near East region

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Afghanistan	Save the Environment-Afghanistan (SEA)	Ghulam Mohd Malikya, Executive Director				<a href="mailto:ghlm_save@yahoo.com">ghlm_save@yahoo.com</a>		
Afghanistan	The Society for Afghanistan Volunteer Environmentalists (SAVE)		House No. 514, ST. 15, E2, Phase I, Hayatabad, Peshawar, Pakistan.	92 91 813838	92 91 813838	<a href="mailto:adl@save.psh.brain.net.pk">adl@save.psh.brain.net.pk</a>		SAVE is an independent institution working and campaigning for the environmental well-being and sustainable development of Afghanistan.
Cyprus	Cyprus Association of Professional Foresters (CAPF)	George Pattichis, Chairman*	4 Navariou Str. CY - 1100 Lefkosia Cyprus	(+357) 2303833 (+357) 2305019	(+357) 2780428 (+357) 2305019	<a href="mailto:management@cytanet.com.cy">management@cytanet.com.cy</a>		
Cyprus	Foresters' Association - Graduates of the Cyprus Forestry College	Marios Christodoulou, Chairman*	P.O.Box 20708 CY - 1662 Lefkosia Cyprus	(+357) 5332968	(+357) 5923222	<a href="mailto:dasoponos@agrino.org">dasoponos@agrino.org</a>	<a href="http://agrino.org/dasoponos/">http://agrino.org/dasoponos/</a>	
Cyprus	Greenpeace Cyprus	Irene Constantinou		05-345051		<a href="mailto:ckaitis@spidernet.com.cy">ckaitis@spidernet.com.cy</a>		
Cyprus	Cyprus Forestry College		CY-4841 Prodromos Cyprus	357-5-462048	357-5-462646	<a href="mailto:Forcollege@cytanet.com.cy">Forcollege@cytanet.com.cy</a>		
Cyprus	Agriculture Department	Mr. George Georgio, Agricultural Officer, Aromatic Plants	Nicosia, Cyprus	02992141	022361425			

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Cyprus	Agriculture Department	Mr. Antonios Gavrilides, Agricultural Officer Aromatic Plants	Nicosia, Cyprus	02992141	022361425			
Iran	CENESTA	Taghi Farvar	West 10 Juybar Street, Fatemi Square, 14157 Teheran		+98-21-655901			
Iran		Mr. Mohammed Ali Hajyimir-Sadeghi, High Consult in Forest*		(98) 212446505 (98) 212446551		<a href="mailto:Faro@mavara.com">Faro@mavara.com</a>		
Iran	Ministry of Jihad-E-Sazandegi Forestry And Range Organization	Mahdipour Damir Hassan, Head of High Council for Forest	Vali-Asr and Taleghani Cross Road 10, Tehran, Iran					
Iran	Forest and Range Organization, Logging Department, NWFP Division	Mr. Gholizadeh M. GH. Forest Expert	P.O. Box 46615-185 Chaluse, Iran					
Iran	Research Institute of Rangelands	Dr. M. Jafari, Director	PO Box 13185-116, Tehran, Iran					

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Iran	Ministry of Agriculture Horticulture Section Flower, Ornamental Plants, Medicinal Plants and Mushroom Affairs	Mr. Seyed Yahra Riazi	Tehran, Iran					
Iran		Mr. Shams-Din*				<a href="mailto:Desert@Mavara.com">Desert@Mavara.com</a>		
Iran		Mohsen Esperi, Counselor*		(212) 687-2020 (212) 897-7086		<a href="mailto:Mesperi@un.int">Mesperi@un.int</a>		
Iran	Higher Education Center For Desertification Control		P.O. Box 13145-498 Tehran, Iran	0098216402528	0098216409417			
Iran	Higher Education Centre of Kelarabad		P.O. Box 54 Kelarabad Mazandaran Iran	0098-1945- 2401-3	0098-1945- 2401			Main teaching areas: forest management, forest industries.
Iran	University of Mazandaran, College of Agricultural Sciences, Department of Natural Resources		P.O. Box 578 Sari Iran Iran					

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Iran	University of Tehran	Mr. Daroud Prsa Pajoh, Director, College of Natural Resources	Karadj Iran	0098-261-23044	0098-261-8007988			
Iraq	Mosul University	Hammam Al-Ail, College Of Agriculture And Forestry, Department of Forestry	Mosul, Iraq					
Iraq	Ministry of Agriculture	Dr. Ahmed Shehab Shaker, Director General Of Forestry	Al Andalus Square, Baghdad, Iraq	00964-1-7732245	00964-1-7184125			
Iraq	State Board for Agricultural Research	Dr. Amal N. Youssef, Secretary, MAB National Committee	P.O. Box 25 Abu Gharib Baghdad					
Jordan	Ministry of Agriculture, Department of Forestry.	Mousa Al Wadi Al Abbadi, Director of Forests						
Jordan	The National Information Center		P.O.Box 259 Jubeiha1 1941 Amman, Jordan	+96265337184	+96265337184	<a href="mailto:info@nic.gov.jo">info@nic.gov.jo</a>		
Jordan	The Royal Society for the Conservation of Nature		P.O. Box 6354, Amman	+962605337931 /2	+9626537411	<a href="mailto:wenforcement@rscn.org.jo">wenforcement@rscn.org.jo</a>		

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Jordan	Ministry of Municipal, Rural Affairs and Environment		P.O. Box 1799, Amman, Jordan	464 1393	464 0404			
Lebanon	American University of Beirut, Faculty of Agricultural and Food Sciences	Dr. Riad Baalbaki, Associate Professor, Chairman of Plant Sciences Department		961-1-350000/4507		<a href="mailto:riadbaal@aub.edu.lb">riadbaal@aub.edu.lb</a>	<a href="http://www.aub.edu.lb/">http://www.aub.edu.lb/</a>	
Lebanon	American University of Beirut, Plant Sciences Department	Dr. Salma Talhouk, Associate Professor Faculty of Agricultural and Food Sciences		961-1-350000/4508		<a href="mailto:ntsalm@aub.edu.lb">ntsalm@aub.edu.lb</a>	<a href="http://www.aub.edu.lb/">http://www.aub.edu.lb/</a>	
Lebanon	Ministry of Agriculture	Mr. Fadi Asmar, Forestry Department	Bld. Camille Chamoun, LB-Chyiah/Beirut	9615455622	9615455622	<a href="mailto:fady@xnet.com.lb">fady@xnet.com.lb</a>		
Lebanon	Ministry of Agriculture	Mr. Ghattas Akl, Director of Rural Development and Natural Resources Department	Bld. Camille Chamoun, LB-Chyiah/Beirut	961-5-455622	961-5-455622			
Lebanon	American University of Beirut, Plant Sciences Department	Mr. Nabil Nemer		961-1-350000/4509			<a href="http://www.aub.edu.lb/">http://www.aub.edu.lb/</a>	

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Lebanon	American University of Beirut, Plant Protection Department	Dr. Efat Abou Fakhr Assistant Professor, Faculty of Agricultural and Food Sciences		Tel: 961-1-350000/4493		<a href="mailto:efat@aub.edu.lb">efat@aub.edu.lb</a>	<a href="http://www.aub.edu.lb/">http://www.aub.edu.lb/</a>	
Lebanon		Mr. Michel Khuzami, Forestry Consultant		961-1-329821	961-1-393860			
Lebanon	Ministry of Environment	Ms. Elsa Satout, Forestry Consultant	Jdeideh, Beirut	961-4-355555				
Lebanon	The Association for Forest Development and Conservation (AFDC)		Dennawi st. Beirut, Lebanon	961-3-848412	961-4-418911	<a href="mailto:mbg@moe.gov.lb">mbg@moe.gov.lb</a>		
Lebanon	University of St. Esprit	Mr. Jihad Noun	Kaslik BP 446 Jounieh, Lebanon	961-3-292252				
Lebanon	ARI-Fanar (Agriculture Research Institute)	Dr. Michel Abi Antoun	Jdeidet El Metn Beirut, Lebanon	961-1-882123	961-882124			
Oman	Ministry of Regional Municipalities and Environment		P.O. Box 323 PC 113 Muscat, Sultanate of Oman	(968) 69 64 41/4	(968) 69 64 60			

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Pakistan		Dr. Mohammad Iqbal, Conservator of Forests	EI.No. 212, sector CI, (FDC Colony), Phase V Hayabad, Peshwar Pakistan	92-522-3750	92-521-814002			
Pakistan	Pakistan Forest Institute (PFI)	Mr. Hakim Mirza, Director of Biological Sciences	PFI, Pakistan					Forestry research in Pakistan is conducted at both the federal and provincial levels. Federal forest research is conducted, mainly, by the <i>Pakistan Forest Institute (PFI)</i> . The institute provides guidance to provincial research organizations whenever needed including other organizations, departments, NGO's, individuals etc. interested in forestry and related disciplines as well as extending advisory services. Within the context of NWFP, the PFI principally carries out research on medicinal plants.
Pakistan		Shakil Haider Zaidi, Medicinal Plants Consultant	PFI, Peshawar Pakistan					
Pakistan	Govt. Jehanzeb college, Swat	Mr. Habib Ahmad, Ethnobotanist, Botany department*				<a href="mailto:habibnor@brain.net.pk">habibnor@brain.net.pk</a>		

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Pakistan		Dr. Muhammad Mumtaz Malik, Conservator, Wildlife and NWFP	Peshawar Pakistan					
Pakistan		Mr. Abdul Hamid*, NRM Specialist, NRCP, Abbottabad.				<a href="mailto:fpm@galiat.sdn.pk.undp.org">fpm@galiat.sdn.pk.undp.org</a>		
Pakistan	IUCN	Mr. Saleemullah	Peshawar					
Pakistan	WWF	Mr. Ashiq Ahmad Khan, Conservation Director*				<a href="mailto:snowleop@brain.net.pk">snowleop@brain.net.pk</a>		
Pakistan	SEA (Save the Environment-Afghanistan)	Ghulam Mohd Malikya, Executive Director*				<a href="mailto:ghlm_save@yahoo.com">ghlm_save@yahoo.com</a>		
Pakistan	WWF	Mr. Ateeq -ur-Rehman, Divisional Forest Officer*				<a href="mailto:AREhman@WWF.ORG.PK">AREhman@WWF.ORG.PK</a>		

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
Pakistan	Pakistan Agricultural Research Council (PARC)							The Pakistan Agricultural Research Council (PARC), is the national federal apex organization for agricultural research in Pakistan. Two of PARC's institutions are of interest to this study: the National Agricultural Research Centre (NARC), which has programmes in land and water use, range management, honeybee management and biological nitrogen fixation related to forest, tree and range management, and the Arid Zone Research Institute (AZRI), which amongst others, conducts research on the propagation of exotic fodder grasses and trees and outplanting of successful species in the field.

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Pakistan	Punjab Forestry Research Institute (PFRI)							Provincial forest research exists in all provinces, and is carried out, with varying intensity, by different institutions. The Punjab Forestry Research Institute (PFRI), for example, is a good research institute and includes activities such as developing wild lands for the production of one or more goods and services, associated with forest areas such as timber, fuelwood, water, wildlife, forage and "minor forest products" (Reid, Collins and Associates, Canada, 1991).
Qatar	Ministry of Municipal Affairs and Agriculture		P.O. Box 7634 Doha, Qatar	(974) 320825	(974) 415246			
Saudi Arabia		Dr. Khaled Saeed Aseri, Community Medicine Specialist	PO Box 50234 Jeddah 21523 Saudi Arabia					
Saudi Arabia	Ministry of Agriculture and Water		Airport road, Riadh 11195	(9661) 401-6666	(9661) 403-1415			
Saudi Arabia	King Abdul Aziz City for Science and Technology (KACST)		P.O. Box 6068, Riadh 11442	(9661) 478-8000	(9661) 488-3756			

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Saudi Arabia	National Commission for Wildlife Conservation and Development		P.O.Box 61681 Riadh-1 1575	(9661) 4418700	(9661) 4410797			
Syria	IPGRI/CWANA	Mr. Tom Bazuin	Aleppo, Syria			<a href="mailto:T.BAZUIN@CGIAR.ORG">T.BAZUIN@CGIAR.ORG</a>		
Syria	IPGRI/CWANA	Mr. R. Khalil	Aleppo, Syria			<a href="mailto:R.KHALIL@CGIAR.ORG">R.KHALIL@CGIAR.ORG</a>		
Syria	IPGRI/CWANA	Dr. Stefano Padulosi	Aleppo, Syria			<a href="mailto:P.PADULOSI@CGIAR.ORG">P.PADULOSI@CGIAR.ORG</a>		
Syria	Ministry of Agriculture	Mr. Samir Madi Forestry department	Damascus, Syria					
Syria	Ministry of Information		Damascus, Syria			<a href="mailto:moi@net.sy">moi@net.sy</a>		
Syria	National Information Center	Dr. Abdul Majeed Al-Rifai	Damascus, Syria			<a href="http://www.niceonline.org">www.niceonline.org</a>		
Syria		Abdusalam Hayel, National Coordinator, Agri-engineer	P.O. Box 2805 - Sana'a, Yemen	967 1 25 09 76	967 1 20 88 52			
Syria	The Yemeni American League (YAL)	Mr. Martin Herzog	YAL Headquarters, Shaker Alashwal, 198 Court Street # 6, Brooklyn, NY 11201					

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Turkey	Aegean Agricultural Research Institute	Dr. Ayse Kitiki, Plant Breeder	PO Box 9, Menemen, 35661 Izmir, Turkey					
Turkey	Bogazici University	Assoc. Prof. Dr. Ugur Akman, Department of Chem. Eng.	Bebek, 80815 Istanbul, Turkey					
Turkey	TEMA- Turkish foundation for Combatting Soil Erosion	Mr. Talin Erarslan azar	PK 213, Levant 80620 Istanbul, Turkey					
Turkey	Anadolu University	Prof. Dr. K.H.C. Baer/Dr. Berrin Bozan, Medicinal and Aromayic Plant and Drug Research Center (TBAM)	26470 Eskisehir, Turkey					
Turkey	Anadolu University	Assoc. Prof. Dr. Yasemin Yazan, Faculty of Pharmacy, Pharmaceutic Technology Department	26470 Eskisehir Turkey					

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Turkey	Ege University	Dr. Emine, Bayram Faculty of Agriculture, Field Crops Department	Bornova, Ismir, Turkey					
Turkey	Ege University	Assoc. Prof. Dr. Nermin Kaya, Faculty of Agriculture, Field Crops Department	Ismir, Turkey					
Turkey	Ege University	Ege Ormancilik Arastirma *	Ismir, Turkey			<a href="mailto:efri01@egenet.com.tr">efri01@egenet.com.tr</a>		
Turkey	Ege University	Mr.Fevzi Bilgin *	Ismir, Turkey					
Turkey	Ege University	Mss.Dr.Sevinç Gül*	Ismir, Turkey			<a href="mailto:gulse@yahoo.com">gulse@yahoo.com</a>		
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Turkey	Ankara University	Dr. Belma Konuklugil, Faculty of Pharmacy, Pharmacognosy Department	Tandogan, Turkey					
Turkey	ALTES Ltd.	Mr. Namik Mumcuoglu	Sehit Muhtar Cad. 36-4 80090 Taksim, Istanbul, Turkey					
Turkey	University of Istanbul	Mr. Neriman Ozhatay, Faculty of Pharmacy, Department of Pharmaceutical Botany	34452 Istanbul, Turkey					

Country	Organization	Contact person	Address	Tel.	Fax	E-mail	Internet	Remarks
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Turkey		Mr. Mustafa Demir	Koy hiz. Arozti Enst, P.K. 46, Tokat					
Turkey	Karadenis Technical University	Assist. Prof. Onder Barli, Faculty of Forestry, Department of Forest Engineering*	61080 Trabazon, Turkey			<a href="mailto:barli@ktu.edu.tr">barli@ktu.edu.tr</a>		
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Turkey		Mr. Geray *	80895 Bahceköy, Isatnbul, Turkey			<a href="mailto:ugeray@istanbul.edu.tr">ugeray@istanbul.edu.tr</a>		
Yemen	The Environment Protection Council		P.O.Box: 19719, Sana'a	(9671)262350/1	(9671) 264062	<a href="mailto:yemen-info@y.net.ye">yemen-info@y.net.ye</a>		

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