Sub-study of the India country study of the international collaborative research project: Instruments for sustainable private sector forestry

INDIA COUNTRY SUB-STUDY

The *ayurvedic* medicine industry: Current status and sustainability

Niraj Subrat
Meera Iyer
Ram Prasad

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Rajendra's Mahaveer Tower-I
B-2, Local Shopping Complex
MMTC/STC Colony, Geetanjali Enclave
New Delhi 110 017, India
Tel. +91 11 669-1091, 669-2092, 669-1793
Fax +91 11 6691794
e-mail ecotech@del2.vsnl.net.in

Forestry and Land Use Programme
International Institute for Environment and Development
3 Endsleigh Street
London WC1H 0DD, UK
Tel. +44 20 7388 2117
Fax +44 20 7388 2826
e-mail forestry@iied.org
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Acronyms

AP	Andhra Pradesh
APEDA	Agricultural Processed Food Product Export Development Authority
APFD	Andhra Pradesh Forest Department
AVS	Arya Vaidya Sala
FRLHT	Foundation for Revitalisation of Local Health Traditions
GHNP	Great Himalayan National Park
HP	Himachal Pradesh
ISM	Indian Systems of Medicine
IUCN	International Union for the Conservation of Nature
JFM	Joint Forest Management
MoEF	Ministry of Environment and Forests
MP	Madhya Pradesh
MPCA	Medicinal Plants Conservation Areas
NGO	Non-governmental Organisation
NTFP	Non-timber Forest Produce
TN	Tamil Nadu
UP	Uttar Pradesh
VFDC	Village Forest Development Committee
VSS	Van Suraksha Samiti

Preface

The present study is part of a wider international project entitled 'Instruments for Sustainable Private Sector Forestry' which is being co-ordinated by the International Institute for Environment and Development (IIED), London. The overall aim of the project is to identify effective market and regulatory instruments that ensure private sector produces social and environmental benefits from forest management and to promote these instruments.*

In the first phase of the project, a **Global Review of Private Sector Participation in Sustainable Forest Management** was undertaken. This provided a snapshot of status and trends regarding private sector participation in sustainable forest management in 23 countries from all regions of the world.

In the second phase of the project, detailed country specific studies were carried out in five countries: **Brazil, China, India, Papua New Guinea** and **South Africa**. The present study forms a part of the India Country Study, which is being co-ordinated by Ecotech Services (India) Pvt. Ltd. (ETS), New Delhi. The India Country Study is funded by the Department for International Development (DFID), India.

* In this project, the term 'private sector' is interpreted broadly such that it includes all those who engage in commercial activity concerning forest goods and services—be they individuals, community groups, informal sector groups or the large-scale corporate sector.

The broad objectives of the India Country Study are to understand the current situation, trends and potentials with respect to private sector participation in sustainable forest management; to review the impact of sectoral and extra-sectoral policies on private sector participation; and to explore strategic options for the private sector to contribute to sustainable forest management in India. The country study is divided into three broad themes: emerging new private sector players; policy provisions for private sector participation in sustainable forest management; and market-based instruments to encourage the private sector's contribution to sustainable forest management (see pages xi–xii for a list of the 6 sub-studies).

The present study is part of the theme **market-based instruments to encourage the private sector's contribution to sustainable forest management** and looks at the potential for applying criteria and indicators for the sustainable management of medicinal plants. The report also presents information on the *ayurvedic* industry. It is hoped that the insights gained from this study would help policy makers in initiating necessary policy changes to further strengthen sustainable forest management in the country.

The Directors of ETS would like to formally acknowledge the institutional support by IIED, financial support by DFIDI, individual efforts made by our consultants Mr. Niraj Subrat, Ms. Meera Iyer and Mr. Ram Prasad in completing this report, Ms. Hema Arora for her efforts in editing it and Mr. Sushil Saigal in assisting CTD for co-ordinating this sub-study.

R. P. Mattoo
Chief Technical Director
Ecotech Services (India) Pvt. Ltd.

Sub-studies under the India Country Study

The New Foresters: the role of private enterprise in the Indian forestry sector is the India country study prepared under the project **Instruments for sustainable private sector forestry**. This study derives from a series of sub-studies that were commissioned under the project. The sub-studies are:

1. *Policies affecting private sector participation in sustainable forest management*. Daman Singh. Ecotech Services (India) Pvt. Ltd. 2002.

   The private sector's participation in forestry activities is determined by policies at the central and state levels, not only those directly related to forests but also policies and legislation introduced for other sectors e.g. land ceiling on agriculture lands, export-import policies, tax laws etc. This study provides an overview of the policy environment for the private sector participation in forestry activities.

2. *Potential for commercial production from forests under Joint Forest Management*. Hema Arora, Anjali M. Bhatia and Snigdha Chakraborty. Ecotech Services (India) Pvt. Ltd. 2002.

   Around 15 per cent of India's forestland is already under joint forest management (JFM). Given the considerable area under JFM, these forests could well be important sources of raw material in future. This study examines the potential for commercial production from JFM forests by analysing the situation in Haryana and West Bengal—two states where the JFM programme first started and has reached a level of maturity.

3. *New hope for private forestry: Policy and practice of Lok Vaniki in Madhya Pradesh*. S. Raghavan and P. Srivastava. Ecotech Services (India) Pvt. Ltd. 2002.

   The state of Madhya Pradesh has recently introduced significant policy changes to encourage private sector participation in forestry. This study analyses the process of policy change and attempts to highlight the factors that made positive policy change possible.

4. *The ayurvedic medicine industry: Current status and sustainability.* Niraj Subrat, Meera Iyer and Ram Prasad. Ecotech Services (India) Pvt. Ltd. 2002.

Ayurvedic industry is an important forest-based industry, which uses a large quantum of medicinal plants that are mainly procured from the wild. The domestic market for *ayurvedic* formulations is expanding rapidly and the government is planning to substantially increase exports. There is danger of overexploitation of the medicinal plant resources if corrective steps involving the industry are not taken. This study examines the potential of application of certain market-based instruments to promote sustainable utilization of these resources.

5. *Review of company-farmer partnerships for the supply of raw material to wood-based industry.* Sushil Saigal and Divya Kashyap. Ecotech Services (India) Pvt. Ltd. 2002.

   The national forest policy clearly indicates that forest-based industry should meet its raw material needs by establishing direct relationships with farmers. This study analyses the experience with partnership schemes started by four companies and provides suggestions for improvement.

6. *The second green revolution: Analysis of farm forestry experience in western Tarai region of Uttar Pradesh and coastal Andhra Pradesh*. Sushil Saigal and Divya Kashyap. Ecotech Services (India) Pvt. Ltd. 2002.

   Farm forestry was actively promoted by the government during the 1970s and 1980s, and farmers in several states planted trees on a large scale. Due to a variety of reasons, tree planting by farmers declined by the end of the 1980s. In recent years, farm forestry has again become popular among farmers. This study documents the farm forestry experience in the '70s and '80s and, through detailed case studies of two districts, analyses the reasons behind the popularity of farm forestry among local farmers.

These studies are available from Ecotech Services (India) Pvt. Ltd. and the Forestry and Land Use Programme of IIED (contact details are given behind the title page).

Executive summary

The Indian forestry sector is currently undergoing a significant transition. There is an increased focus on conservation and subsistence needs of forest dependent communities, reflected in the latest forest policy; and there is an ongoing debate regarding the role of the corporate private sector, individual farmers and communities. The government is trying various means to ensure that forests are sustainably managed: most of these involve the use of policy and economic instruments. The concept of using market-based instruments for promoting sustainable forest management is new to India. There are currently no such instruments in use in the country. However, a couple of initiatives have been developed in the recent past. One of these, called the 'Bhopal-India Process', aims to develop country level criteria and indicators for sustainable forest management. This study develops further the initiative taken under the 'Bhopal-India Process'.

The broad objective of this study is to determine whether market-based instruments might enable the *ayurvedic* industry to contribute to the sustainable management of medicinal plants. It aims at identifying the potential application of mechanisms and instruments to assure a sustainable supply of high-quality medicinal plants of known origin to the industry; to ensure economic benefits for producers or collectors; and to encourage sustainable management of these plants and forests. The report also includes a synthesis of

existing information on the *ayurveda* industry, supplemented by original research and data collection.

Ayurveda is an ancient health system of India, thought to have originated in the Vedic times around 5000 years ago. *Ayurvedic* formulations use combinations of a selection of around 1200 species, about 500 of which are commercially traded. *Ayurveda* uses medicinal plants in various forms, some of which can be gathered only by destructive harvesting: in 30 per cent cases only the roots are used, in another 13 per cent only the bark and it is only in about 16 per cent that the whole plant is used. In other cases, medicines use the fruits, leaves, flowers, rhizome, seeds etc. It is commonly thought that medicinal plants are mainly herbs, but in fact about one-third are trees—this has implications for conservation and management of supplies to the industry. The majority of plants used in *ayurveda* are procured from the wild, though around 10 per cent are cultivated on private lands.

Ayurveda has a 70 per cent share in the formal medicine market in the country. There are around 6,000 licensed units and an equal number of unlicensed units manufacturing *ayurvedic* drugs. The origin of most of these companies can be traced back to a *vaidya* (a practising *ayurvedic* expert) who used to prepare some formulations for dispensing. The gradual acceptance of these medicines led to the growth of such units. The presence of a large number of small, unorganised micro-manufacturing units and pharmacies makes it very difficult to estimate the overall turnover of the industry, but rough estimates put it at around Rs. 45 billion for the year 1998.

In general, the medicinal plants trade in India may be described as extremely complex, secretive, traditional, badly organised, highly under-estimated and unregulated. There is no macro level information available for assessing the nature and full extent of the trade; there are only 'guesstimates' based on local inventories and micro studies. Identification of species and volumes traded is further com-

plicated by the fact that there is no reliable correlation between trade names and botanical names, and names used for particular species may change along the supply chain. Conversely, the same trade name is at times used for several species, especially if they are used for similar purposes. Hence, for the purposes of this study, twelve of the most representative species were selected for detailed research into the conservation, collection, cultivation and trade of medicinal plants. These are *Aloe vera, Chlorophytum borivillianum, Commiphora wightii, Embelia ribes, Emblica officinalis, Nardostachys grandiflora, Picrorrhiza kurroa, Rauwolfia serpentina, Saraca indica, Swertia chirata, Terminalia chebula* and *Withania somnifera*.

Medicinal plants are traded in 6 major, 21 medium and 37 minor markets spread across the country. The major centres, located at the heads of the routes taken by the medicinal plants, are big cities, including the four metros. Major exports take place from Delhi, Mumbai, Chennai and Tuticorin. In terms of total volume of the 12 species traded in 1999–2000, Mumbai tops the list with about 3,300 tonnes, followed by Delhi with about 2,000 tonnes. The survey identified a number of factors that affect the final price. Volumes traded are directly proportional to the prices of the raw material, which in turn are proportional to the abundance/availability of the species. There is also a connection between the part used and prices, so that species that are destructively harvested seem to be more expensive. High altitude species such as *Nardostachys grandiflora, Picrorrhiza kurroa, Swertia chirata* also are high value species. Price also increases with the distance of the source of raw material from the market.

The supply channel runs from the minor to the medium to the major markets before being exported. There is a long chain between primary collectors and end-users, and the supply channels for each species are different, depending on availability of the individual

species and many other factors. The main players include collectors, local traders or agents, commission agents at the state level, commission agents in the major markets (like Delhi, Mumbai etc.), wholesale merchants in the major markets, retailers in the major markets, and exporters and industrialists. On average, the share of the collectors in the final price paid by the consumer ranges between 10 and 58 per cent. In most of the species, the share of the collectors is lower than 33 per cent. Other than cleaning and grading, there is little scope for value-addition at the collector level.

The demand for *ayurvedic* formulations is increasing both in the domestic market as well as internationally. According to some estimates, the domestic sales are growing at an annual rate of 20 per cent while the international market for medicinal plant-based products is estimated to be growing at 7 per cent per annum. However, India has a very insignificant share of the international herbal medicine market although it is one of the biggest reservoirs of plant resources.

Given the rapidly increasing demand, there is tremendous pressure on the supply base. This has reached crisis point for some species. It is reported that certain species of medicinal plants have already become extinct through over-harvesting, and other species are endangered. Drug manufacturers make use of alternative species when the 'first choice' is no longer available. However, there are reports that even some of the 'second best' alternatives are now facing extinction. Further, there are concerns about maintaining the quality of supplies.

There are a number of potential (and some actual) responses to this demand-supply gap. These include substitution of raw material, import of medicinal plants, cultivation of plants by the corporate *ayurvedic* industry, cultivation of plants by farmers and enhancing production from natural habitats. In addition to these

attempts to address the demand-supply crisis, there is a long-established response, which represents an unofficial, illegal response by sections of the industry, that is the use of adulterants. For 6 out of the 12 species selected for the study, some or the other form of adulteration is known to occur. This poses major challenges to any market-based intervention in the trade, as well as to any attempts to integrate traditional medicine into the mainstream health services.

Short-term solutions to the supply crisis appear to be limited: cultivation is appropriate for only certain species and will not, in any case, prevent collection from the wild by those who depend on such activities for their livelihoods. Apart from shortage of supply, the industry's primary concern is the quality of raw material: this presents a major challenge given the prevailing secrecy in the *ayurvedic* industry and the adulteration of raw material.

The potential for organisation at the community/collector level needs to be explored, as also the possibility of ensuring better returns to primary collectors through value addition at the local levels. Organisation and control of production may also be encouraged if consumers or retail buyers express preference for supplies that derive from socially and environmentally sustainable production. While it may be some time before the extent of such preferences encourages large-scale changes in production, this paves the way for the introduction of market-based instruments as a mechanism for meeting consumer demand while ensuring sustainable production.

In order to move towards a system of sustainable management of medicinal plants, there is a need to address a number of issues, including the following:

- better information on the current status and potential production of medicinal plants, to provide a baseline from which strategies for sustainable production may be developed;

- more transparent supply chain information in order to improve the bargaining power of those near the start of the chain, and to help ensure good quality materials for the ultimate consumers;
- organisation of collectors at the local level that might help to put in place mutually enforced codes of collection and sharing of marketing benefits.

The development of criteria and indicators for the sustainable management of the forests or other landscapes in which medicinal plants are found can help to define good practice, and can be applied to measure progress towards sustainable management. Application of criteria and indicators for sustainable management and supply of medicinal plants to industry may help to address some of the needs identified above; but it has to be driven—by voluntary approaches of the collectors (generally the weakest party); by regulations (dependent on enforcement capacity) or by buyers (who will probably want proof of sustainable management through third party certification).

The application of criteria and indicators for certification of raw material and products would primarily benefit the collector and the end-user. The market value—or more probably, market access—for certified products would be greater if the industry could ensure sustained supply. So, while overall volumes of plants harvested under sustainable management would likely be lower, the price and market access would be enhanced.

At present it is unlikely that certification of medicinal herbs will be feasible in India, except where collection/cultivation areas are subject to control by a recognised 'manager'. If, in due course, it is applied, it may add to the cost of raw materials and may be reflected ultimately in the price of the products. However, this will ensure ecological, social and economic sustainability.

Initially, there could be scope for a voluntary code of practice,

complemented by education of both consumers and producers. Criteria and indicators can help to show what is good practice, and can be applied as a means of measuring progress towards that good practice. However, the current extent of the illegal trade seems to be so great that application of criteria and indicators would not make significant difference to the overall trade, unless it is market-driven.

These constraints aside, the report identifies 8 criteria and 32 indicators that can be applied to the sustainable management, development and use of medicinal plant resources. These have been selected from the set of 8 criteria and 43 indicators developed for sustainable forest management in India, as part of the 'Bhopal-India Process'. The criteria include: increase in the extent of forest and tree cover; maintenance, conservation and enhancement of biodiversity; maintenance and enhancement of ecosystem function and vitality; conservation and maintenance of soil and water resources; maintenance and enhancement of forest resource productivity; maintenance and enhancement of social, cultural and spiritual benefits; optimisation of forest resources utilisation; and adequacy of policy, legal and institutional framework.

The set of criteria and indicators are potentially a reliable tool for measuring the success of conservation and development measures, as it will simultaneously indicate the social, economic and ecological contribution of medicinal plants. Despite the great contribution medicinal plants are making in local health care and the economic benefit flowing through trade and exports, not much of this contribution is documented. With the use of tools like criteria and indicators, the value of medicinal plants would be highlighted, as would their contribution to India's gross national product. This would provide an opportunity to increase sustainable production of medicinal plants.

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Authors

1. Introduction

This study is part of a wider international project **Instruments for Sustainable Private Sector Forestry**, co-ordinated by the London-based International Institute for Environment and Development. The international project aims to understand the current situation, trends and potentials with respect to private sector participation in sustainable forest management; to review the impact of sectoral and extra-sectoral policies on private sector participation and to explore strategic options for the private sector to contribute to sustainable forest management.

One of five country case studies, the India country study: *The New Foresters: the role of private enterprise in the Indian forestry sector*, is organised into three themes: emerging private sector players; policy provisions for private sector participation in sustainable forest management; and market based instruments to encourage the private sector's contribution to sustainable forest management. This report describes the outcome of research in the latter theme, with particular reference to medicinal plants. The broad objective of this study is to determine whether market-based instruments might enable the *ayurvedic* industry to contribute to the sustainable management of medicinal plants. It aims at identifying the potential application of mechanisms and instruments to assure a sustainable supply of high-quality medicinal plants of known origin to industry; to ensure economic benefits for producers or collectors; and to encourage sustainable management of these plants and forests. The report also includes a synthesis of existing information on the

ayurveda industry, supplemented by original research and data collection. The terms of reference for the study are given in Annex 1.

The study was divided into three phases:

Phase I: An overview of the *ayurvedic* industry in India, especially in relation to its consumption of raw material (i.e. medicinal plants).

Phase II: Study of pricing, value addition and information flow mechanisms at different points in the supply chain ranging from the primary collector/cultivator to the processing industry.

Phase III: Investigation of the potential application of market-based instruments to ensure both supply of sustainably managed medicinal plants to the *ayurvedic* industry and better returns for primary collectors/cultivators.

1.1 Methodology

Data and information presented in this study was collected through personal interviews with representatives of industry and research institutions, and responses to a questionnaire sent to major manufacturers. The questionnaire is given in Annex 2.[1] Information was also collected from secondary sources: the study draws extensively upon literature review, and much information was obtained from medicinal plants related websites.

The organisations consulted for the purpose of the study include the Union Ministry of Environment and Forests (MoEF), Union Ministry of Health (Departmant of Indian Systems of Medicine), TRAFFIC-India, and the Madhya Pradesh Minor Forest Produce Federation, Bhopal, as well as industry and research bodies.

[1] Although the questionnaire was sent to many industries, only Baidyanath industries responded.

Detailed investigations were carried out with respect to the main raw material catchment of the Baidyanath industries unit located in Jhansi, Uttar Pradesh.[2] The field work location was decided after the identification of the medicinal plant species to be studied in detail (see section 4). Primary market information regarding volumes and prices of selected medicinal plants was collected from Delhi, Mumbai, Bangalore and Shivpuri. First hand information from these markets was provided by other on-going studies. Field investigation was carried out in Sagar district of Madhya Pradesh (MP): this included collection of information regarding medicinal plant collection, market(s) and cultivation models, and visits to the Joint Forest Management (JFM) group in village Bagoda. This district was selected as it offered the opportunity to interact with representatives of all major players in the medicinal plants supply chain: collector, cultivator, trader and traditional practitioner.

For the purposes of Phase II of this study, 12 medicinal plants were selected for detailed investigations. These species were selected carefully in order to ensure that they were broadly representative of those used in the *ayurveda* trade; details of how the selection was made are described in section 4.

Major companies manufacturing *ayurvedic* medicines and herbal cosmetics and the medicinal plant markets in and around Delhi were visited to learn about raw material consumption, processes and perceptions involving industry, mechanisms of distribution and its economics.

1.2 Outline of report

This report is organised into nine sections. Broadly, Phase I is addressed in sections 2, 3 and 6, Phase II is addressed in sections 4

[2] Baidyanath is one of India's largest *ayurvedic* manufacturers.

and 5, and Phase III is addressed in section 8. Section 2 describes briefly the basic principles of the ancient system of *ayurvedic* medicine and the wealth of the resource base within India. Section 3 presents a summary of the *ayurvedic* industry in India, including the extent of its infrastructure and how it is organised. Section 4 describes the criteria used for selecting the 12 species for detailed research. Section 5 describes the salient features of India's medicinal plants trade, from the many minor trading centres to the four major urban markets, and attempts to estimate the scale of the transactions by volume and prices of plants traded. It also identifies the main actors in the chain of supply, from collectors to major manufacturers and exporters. Finally this section considers the scope for semi-processing and value addition at the local level. Section 6 considers the current and predicted demand for *ayurvedic* plants and plant parts both within India and internationally. It assesses broadly the demand-supply gap that exists and the various ways that are being explored to cope with it. It also discusses whether cultivation is a feasible means of meeting the demand for some species, given that the livelihoods of the traditional collectors, often tribals, depend on collection of medicinal plants from the wild. Section 7 outlines the institutions and interventions in the medicinal plants sector. Section 8 identifies the various aspects of medicinal plants and their trade that need to be addressed in order to move towards a system of sustainable management. It goes on to examine the relevance and application of criteria and indicators for the sustainable management of the forests or other landscapes in which the medicinal plants are found and further identifies a set of criteria and indicators that can be applied to this sector. Finally, section 9 presents overall conclusions.

2. *Ayurveda*: the science of life

This section describes the basic principles of the ancient system of *ayurvedic* medicine, thought to have originated in the Vedic times around 5,000 years ago. It describes the wealth of the resource base within India, where more than 8,000 plants have already been found to be of medicinal value. Combinations of a selection of these plants are used in *ayurvedic* formulations. The section goes on to describe how the therapeutic properties of a plant depend on the growing conditions and seasonal variations. The majority of plants used in *ayurveda* are procured from the wild, though around 10 per cent are cultivated on private lands.

2.1 *Ayurvedic* system

Health systems based on knowledge and availability of plants with medicinal properties are part of the ancient wisdom and culture of India. Such knowledge has been passed within and across generations, and developed and amended with the benefit of scientific advance. These traditional health systems (such as *ayurveda*, *unani, siddha* and *yoga*) have always been recognised as the formal health system in India, except during the colonial period. This study considers the *ayurvedic* system in particular. An introduction to *unani* and *siddha* systems is given in Annex 3.

Ayurveda is thought to have existed for over 5,000 years, and the

wisdom of healthy living in harmony with nature has been passed from generation to generation. The growth of this health system suffered setbacks due to foreign invasions, which led to the growth of *unani* and allopathy. However, the efficacy, acceptance and availability of the *ayurvedic* system of medicine kept it alive, and there was a revival in the early years of the 20th century. Growing awareness of harmful side effects of modern medicine has led to interest in *ayurveda* at the international level as well as within India. *Ayurveda* treats the whole person, addressing the body, mind and spirit. In *ayurveda*, a healthy person is defined as one for whom the three *doshas* (elements)—*vata*, *pitta* and *kapha*—are in equilibrium (see Box 2.1). Traditionally this equilibrium is characterised by proper digestion, correct nerve and muscle activity, and tranquility of mind and spirit.

Box 2.1: Basic principles of *ayurveda*

The name *ayurveda* comes from two Sanskrit words: ayur meaning 'life' and *veda* meaning 'knowledge'. According to *ayurvedic* teaching, everyone and everything in the universe consists of three basic forces or elements. In Sanskrit they are called *vata*, *pitta* and *kapha* (also spelled as *vat*, *pit* and *kaph*). They are thought to control all physical and mental processes and are compared to the workings of the wind, the sun and the moon:

- *Vata* is linked to the wind, which is constantly on the move, and controls the central nervous system.
- *Pitta* is like the sun, a source of energy. It controls the digestive system and all biochemical processes.
- *Kapha* governs the balance of tissue fluid, controlling cell growth and the firmness of the body—rather as the moon governs the tides.

Good health is believed to result from the three forces being in harmony—not unduly stronger or weaker than each other. Bad health is said to occur when they are out of balance. Maintaining a harmony between the different elements is the key to the *ayurvedic* concept.

2.2 Use of medicinal plants in the *ayurvedic* industry

The prescribed reference texts of *ayurveda*, namely *Charak*, *Sushruta*, and *Bagbhatta* describe use of 1,100, 1,270 and 1,150 medicinal plants respectively in drug formulations (Gupta 1993). Annex 4 lists some of the most important medicinal plants used in *ayurveda* and the conditions they are used to treat. *Ayurveda* uses medicinal plants in various forms: fruits, leaves, flowers, rhizome, bark, roots and seeds, etc. (see Table 2.1). Sometimes whole plants are used, but mostly, the various parts are used to prepare the formulations. Estimates suggest that about 16.5 per cent of the usage requires whole medicinal plants while in the rest one or a combination of plant parts is used (FRLHT 1997). Roughly, one

Table 2.1: Analysis of plant parts used in *ayurvedic* industry

Part used	*Percentage*
Roots	29.6
Rhizome	4.0
Leaves	5.8
Flowers	5.2
Fruits	10.3
Seed	6.6
Stems	5.5
Bark	13.5
Wood	2.8
Whole plant	16.5

Source: FRLHT 1997.

third of medicinal plants are trees: this corrects a commonly held misconception that medicinal plants are mainly herbs. This has major implications for conservation as tree species are much more difficult to conserve than smaller plants.

Ayurvedic formulations generally involve the use of combinations of plants/plant parts that work in conjunction with each other. A formulation may contain numerous species, as illustrated in Table 2.2.

Table 2.2: Selected formulations with the number of species being used

Formulation	*Number of species used in the formulation*
Chyawanprash	3
Dashmoolarisht	56
Ashokarisht	14
Arjunarisht	4
Mahanarayan oil	43

2.3 Resource base

India is a 'mega-biodiversity' country, having over 45,000 plant species. India's diversity is unmatched due to the presence of 16 different agroclimatic zones, 10 vegetative zones and 15 biotic provinces. There are 15,000–18,000 flowering plants, 23,000 fungi, 2,500 algae, 1,600 lichens, 1,800 bryophytes and 30 million microorganisms (Kamboj 2000). Occuring in diverse habitats, many of these medicinal plants are endemic, exhibiting variability in the form of morphotypes, ecotypes and chemotypes existing amongst the populations. The variability in such economically important species is an insurance for continuing research for productivity

upgradation (Gupta 1993). The Botanical Survey of India estimates that out of the 45,000 plant species so far recorded, at least two-thirds are potentially of medicinal value.

Out of India's more than 17,000 higher plants, about 50 per cent i.e. 8,000 have already been inventoried to be of medicinal value (GoI 1997). Of these, more than 1,500 species are collectively used by the four classical systems of medicine prevalent in India, *viz. ayurveda*, *siddha*, Tibetan and *unani*. Of these, around 500 species are commercially traded.

In *ayurveda*, the analysis of the nature and property of the medicine is based on their elemental composition (*dravya*), quality (*guna*), taste (*rasa*), potency (*virya*), the after-taste following digestion (*vipaka*), and their specific actions (*prabhava*). The manifestation of the *rasa* is dependent on the nature of the matter (particular species), as well as geographical location where the substance originates, time and combination of different plant species. *Haritaki* (the fruit of *Terminalia chebula*) can be cited as an example—seven varieties of the species originating in different parts of India are known to have different therapeutic properties. Seasonal variation, as well as age, has a bearing on the composition of drugs. In winter, plants produce drugs that are sweet in taste and in the monsoons, those that are sour. The concentration of the required chemical constituents in a plant is strongly influenced by the stage of growth of the plant.[3] Classified *ayurvedic* literature accords great importance to the period of collection and the stage of growth of a required plant or plant part. In a majority of cases stress is laid on the collection of ripe parts.

[3] A study of the total alkaloid content of the leaves of 'Vasaka,' (*Adhatoda vasica*) during different periods of the year revealed that the highest yield (2.5 per cent) is obtained during the months between July and October when the flowering period is over and the fruits are at different stages of maturation (Sarkar, 1996).

Ayurveda classifies ecological zones/habitats according to soil conditions, and identifies the source of a particular medicinal plant from a specific ecological zone. It thus distinguishes and attaches significance to the natural habitat of a particular species. All the different agroclimatic zones of India contribute to medicinal plants requirement with its area-specific species. The Himalayas—which include diverse climatic zones such as tropical, sub-tropical, temperate, alpine and sub-alpine regions—are endowed with diverse medicinal flora. The propounder of *ayurveda* in his *Charak Samhita* says '*Aushadhinam parabhumi himwan shaila sattana*' which translates as 'the Himalayas are the store house of medicinal wealth' (Suma 1998). The forests of Himachal Pradesh, in the central Himalayas, are said to have been the birthplace of *ayurveda*, and are known to supply a very large proportion of the medicinal plant requirements of India, with one estimate quoting figures as high as 80 per cent of all the *ayurvedic* drugs (Aryal 1993). The Western Ghats, one of the mega-biodiversity 'hotspots', form another major source of supply. The tropical forests of Vindhyas, Chhotanagpur plateau and Aravalis also contribute substantially to the resource base for the *ayurvedic* industry.

Each ecosystem produces a set of medicinal plants which is determined by the local health traditions. There is very little knowledge about folk medicine and the plants used by them, which is distinct from the codified, classical systems of medicine. The debate and discussions about conservation and sustainable use of medicinal plants completely bypasses millions belonging to this user group, for their plants are not important from the commercial angle.

Of the around 500 medicinal plant species used by the contemporary *ayurvedic* industry, around 80 per cent are procured from wild areas, mostly notified as forest land (Gupta 1993; Ahmed 1993; FRLHT 1997). The habit-wise breakup of these medicinal plants

from the wild shows that around 24 per cent of species occur as trees, 20 per cent as shrubs and 56 per cent as herbs (FRLHT 1997). Another category of medicinal plants consists of tree species which grow in the wild as well as in agricultural lands, on the boundaries of farmlands, and planted as avenue trees such as *Butea monosperma*, *Mangifera indica*, *Sapindus emerginatus*, *Tamarindus indica* etc. Thus, in total, the tree species (grown in the wild as well as other areas) account for roughly one-third of the total medicinal plants.

Medicinal plants procured from cultivated private fields account for 10 per cent of the total medicinal plants in active trade. These consist of species grown exclusively for meeting the demand of the *ayurvedic* industry and those grown to meet demand of industry as well as for household use as spices and vegetables. The former category includes *Gloriosa superba* that is grown in Tamil Nadu, *Mucuna pruriens* grown in Maharastra and *Plantago ovata* grown in Gujarat. The latter category includes *Coriandrum sativum*, *Allium sativum*, *Allium cepa*, *Curcuma longa*, *Curcuma aromatica*, *Zingiber officinale* etc. Annex 5 indicates the scale of consumption of particular medicinal species and their source of supply, whether cultivated or collected from the wild.

3. Profile of the *ayurveda* industry

This section presents a summary of the *ayurvedic* industry in India, including the extent of its infrastructure and how it is organised. The presence of a large number of small, unorganised micro-manufacturing units and pharmacies makes it very difficult to estimate the overall turnover of the industry, but it appears that the export potential is significantly higher than the amounts currently traded.

3.1 Extent of infrastructure

Since Independence, successive five year plans have made efforts to develop the Indian traditional medical system. The 1982 Health Policy tried to dovetail the functioning of traditional health practitioners and their health services with the total health care system of India. While far from adequate, such efforts have led to significant growth in the infrastructure of the 'Indian Systems of Medicine' (ISM), as the traditional systems such as *ayurveda*, *unani* and *siddha* are known collectively. The extent of this infrastructure is indicated in Table 3.1 and Annex 6. The country has over 8,000 licensed *ayurveda* pharmacies with over 30 per cent of them located in the state of Uttar Pradesh alone and an equal number of unlicensed manufacturing units.

Table 3.1: Indian traditional system of medicine: infrastructure

Facilities	*Ayurveda*	*Unani*	*Siddha*
Hospitals	2,068	177	115
Beds	241,308	2,990	1,241
Dispensaries	13,325	954	311
Colleges	109	26	2
Seats	4,316	845	150
Postgraduate institutes	25	2	1

3.2 Organisation of the *ayurveda* manufacturing industry

Ayurveda is predominant among India's traditional health systems. It runs parallel to the modern health care sector and has a seventy per cent share of the formal medicine market. *Ayurveda* manufacturing units can be broadly classified into the organised and the unorganised sectors. The organised sector consists of both large and small manufacturing units.

- The *large manufacturing units* comprise the well-established manufacturers who operate in both domestic and international markets. They are the flag bearers of industry and are mainly responsible for the revival and growth of *ayurveda*. The largest of these, in terms of sales, is Dabur India Ltd., while Shree Baidyanath Ayurved Bhawan Ltd. (referred to as Baidyanath in short) claims to manufacture the largest range, with over 700 *ayurvedic* formulations (see Table 3.2). Other major players in the industry include: Himalaya Drug Company Ltd., Charak

Table 3.2: Sales figures of major *ayurveda* manufacturers[4]

Company	*Sales in 1998–99 (in million Rs.)*
Dabur India Ltd.	3,220
Himalayan Drugs Co.	1,400
Baidyanath Ayurved Bhawan	1,360
Zandu Pharmaceuticals	1,200
Maharishi Group	800
Arya Vaidya Sala	570
Ajanta Phamaceuticals	200
Nagarjun Herbal Concentrates	120
Vaidyaratnam Oushadha Sala	105
Multani Pharmaceuticals Ltd.	73
Kerala Ayurved Pharmacy Ltd.	64
S.D. Pharmacy	40
Dehlvi Remedies Pvt. Ltd.	18
George Herbals Pvt. Ltd.	3
Ayurved Vishwa Bharti	2

Source: ITCOT 1999.

[4] These figures refer to total sales including exports (which are quite marginal compared to domestic sales).

Pharmaceuticals, Zandu Pharmaceuticals Ltd., Unjha Ayurvedic Pharmacy and Arya Vaidya Sala. Many more companies have diversified into *ayurveda*. These include pharmaceutical companies such as Cadila Healthcare Pvt. Ltd., Albert David Ltd., Cipla Ltd. as well as corporates from other sectors such as Bajaj Group, Velvette International, etc.

- *Small manufacturing units* manufacture a few medicines and operate in a small area. Nonetheless, at times such units are quite strong in their area of operation. There are certain small manufacturing units who cater to export markets only.

The *unorganised sector* includes practising *ayurvedic* experts (*vaidyas*) and micro-units manufacturing only a few products and operating at local level. A reputed *vaidya* generally prepares his own formulations for treatment. The large number of units manufacturing *ayurvedic* medicines can be attributed to the comparatively low infrastructure cost, access to raw material, simple manufacturing process and lack of standardisation of quality and efficacy of medicines.

The total annual turnover of the industry was estimated to be Rs. 25 billion in 1998 (ITCOT 1999). However, this figure accounts for the registered manufacturers only. It is estimated that the micro-units spread across India comprise a market bigger than the organised sector and the total *ayurveda* market including such units is around Rs. 45 billion.

3.3 Nature of the *ayurveda* industry

Ayurvedic drug manufacturing companies, whether in the organised or unorganised sector, are mostly family owned businesses. The origin of most of these companies can be traced back to a *vaidya* who used to prepare some formulations for dispensing, and

the gradual acceptance of medicines led to growth of such units. Many such companies are now being run by third generation owner-managers. The ownership pattern has helped in the transfer of knowledge from one generation to other, thereby enriching the knowledge base of families. But it has also brought conservatism and secretive attitudes into the sector, which has affected its amalgamation with the general stream of development. This observation is most evident in the case of standardisation of raw material as well as medicines.

3.4 *Ayurvedic* formulations

Ayurvedic medicines can be classified as *ayurvedic* classical formulations and patent and proprietary formulations. The *ayurvedic*

Table 3.3: Frequency of occurrence of medicinal plants in herbal formulations in India

Common name	*Botanical name*	*No. of herbal formulations*
Harra	*Terminalia chebula*	Harra, behera and
Behera	*Terminalia belerica*	aonla together used
Aonla	*Emblica officinalis*	in 219 formulations
Yashtimadhu	*Glycyrrhiza glabra*	141
Pipali	*Piper longum*	135
Vasaka	*Adhatoda vasica*	110
Ashwagandha	*Withania somnifera*	109
Mastak (Motha)	*Cyperus rotundus*	102
Guduchi	*Tinispora cordifolia*	88
Daruharidra	*Berberis aristata*	65
Gokshura	*Tribulus terestris*	65
Kutja	*Holarrhena antidysenterica*	59
Punarnava	*Boerhavia diffusa*	52

Source: Biotech Consortium India Ltd 1996.

classical formulations include those medicines that are manufactured according to prescriptions given in one of the ancient *ayurvedic* texts, while the patent and proprietary medicines are the outcome of research and development efforts of manufacturing companies. The concept of combination of *tridosha* of persons has led to a number of combinations of ingredients and hence formulations in *ayurveda*. Table 3.3 indicates the extensive range of formulations in which particular species may occur.

4. Criteria for selection of medicinal plants to be studied in detail

For the purposes of this study, 12 of the most representative species were selected for detailed research into the conservation, collection, cultivation and trade of medicinal plants. Given that about 8,000 higher plants found in the Indian sub-continent are recorded to be used for medicinal purposes and more than 1,500 species are recorded to be in use in the ISMs, the selection of just 12 species that could be considered 'representative' of the entire medicinal plants trade was extremely difficult. The following criteria were used to make the selection:

Habit of the medicinal plant: Contrary to general perception, 'medicinal plants' do not refer to only herbs but also include shrubs, climbers, lianas and trees. In fact, roughly one third of all medicinal plants are trees. The habit of a medicinal plant has major implications for conservation/cultivation strategies: trees are much more difficult to conserve in their natural habitats than shrubs or herbs. As far as possible, medicinal plants representing the different habit types were selected.

Plant part used for medicinal purposes: The profile of parts used may range (according to species) from leaves, fruits, flowers, seeds, gum, resin, roots, rhizomes, stem or bark to the whole plant. Clearly those plants whose roots/rhizomes or entire plant is used are almost always destructively harvested and therefore more vulnerable in the wild unless replaced by grown/cultivated varieties. Even those

species whose bark is used succumb to indiscriminate debarking. As far as possible, medicinal plants were selected such that the whole range of plant parts used was represented.

Environmental factors: The selection also took into account the abundance or scarcity of the species; natural populations of the species and their regeneration status in wild; and their reported cultivation. However, these parameters are not used in the strict academic sense as no scientific assessments for the entire country have been made so far.[5]

Economic factors: These include the price and volume traded of the medicinal plants. As Ved and Mudappa (1999) point out 'an appropriate criterion for ranking the medicinal species would be total annual turnover in trade i.e. the total value of raw drug material traded annually'.[6] However, in the absence of reliable estimates of total volumes traded annually, even for few important species at country level, Ved and Mudappa have taken the information relating to only price as an indicator of market value of the species—though this also fluctuates across markets, seasons and over time periods—to short-list top 20 species in trade (Annex 7). Out of these, 7 find their way in the selection for the current study. To select species traded in high volume, a list of species consumed (in descending volumes) by the Baidyanath *Ayurvedic* Medicine Production Unit at Jhansi—which can be considered to be a fairly good representative of a large production unit—was drawn up. Out of the top 17 in this list (Annex 8), 6 are in the final selection. Another list referred to was that of the species taken up for detailed

[5] Five Conservation Assessment and Management Plan (CAMP) workshops using the IUCN criteria for assessment of status in wild of medicinal species have been conducted (three by FRLHT, Bangalore for south Indian medicinal plants; one in Kullu, Himachal Pradesh and one by IIFM, Bhopal for NTFP species). However, they are all regional assessments and therefore not applicable for the entire country.

[6] From an article in the December 1999 issue of *Amruth*.

Table 4.1: List of medicinal plant species selected for the current study

	Botanical Name	*Trade Name*	*Common name*	*Habit*	*Part used*	*Criteria for selection**								
						Habit	*CG*	*V*	*P*	*U*	*Po*	*Ab*	*LR*	*EG*
1	*Aloe vera*	Ghee Kunwar	Ghee Kunwar	Herb	Whole	|	|	|			|	|		|
2	*Chlorophytum borivillianum*	Safed Musli	Biskandri, Safed Musli	Herb	Tuberous roots	|		|	|		|		|	
3	*Commiphora wightii*	Guggul	Guggul	Tree	Resin	|			|					
4	*Embelia ribes*	Baibaranga	Baibiranga, Vavrung	Shrub	Fruits/ Seeds	|			|	|			|	
5	*Emblica officianlis*	Amla	Anola, Amla	Small tree	Fruits	|	|	|		|	|	|	|	
6	*Nardostachys gradiflora*	Bal Chad	Bal chir, Jatamansi	Herb	Rhizomes	|			|		|		|	
7	*Picrorrhiza kurroa*	Kutki	Kuru, Kutki	Herb	Roots & rhizomes	|			|					

	Botanical Name	*Trade Name*	*Common name*	*Habit*	*Part used*	*Criteria for selection*								
						Habit	*CG*	*V*	*P*	*U*	*Po*	*Ab*	*LR*	*EG*
8	*Rauwolfia serpentina*	Sarpagandha	Chandrabhaga, Chota-chand	Under shrub	Roots									
9	*Saraca indica*	Ashok	Ashok	Tree	Bark									
10	*Swertia chirata*	Chiraiyita	Chirayita	Herb	Whole plant									
11	*Terminalia chebula*	Harra	Harra	Large tree	Fruits, bark									
12	*Withania somnifera*	Ashwagandha	Asgandha	Shrub	Roots									

*CG: suitable for community growing/collective marketing; V: traded in high volumes; P: high price; U: used in many formulations therefore in high demand; Po: potential due to increasing demand; Ab: perceived to have fairly large wild populations; LR: perceived to have low natural regeneration; EG: easy to grow.

market study by TRAFFIC, India (Annex 9).[7] Five of these are in the final selection.

Social factors: From the social point of view, species that are easy and inexpensive to cultivate and have a large market were selected. This led to the inclusion of *Embilica officinalis*, *Terminalia chebula* and *Aloe vera*, as these species are collected/cultivated in such large quantities despite their low price, that they are potentially suitable for community-based interventions.

Logistical feasibility: Finally, the study was limited to the spatial area that it was feasible to cover in terms of markets and sites of cultivation/collection, in the given time and financial resources.

Table 4.1 gives the final selection, along with the criteria used to select each one of them. These 12 selected species are used in the study of supply chain issues, described in the following sections.

[7] TRAFFIC is a joint programme of the World Wide Fund for Nature (WWF) and the World Conservation Union (IUCN), whose objectives are to monitor the wildlife trade in order to ensure that it is at sustainable levels and in accordance with domestic and international laws and agreements.

5. Trade in medicinal plants in India

This section describes the salient features of India's medicinal plants trade, from the many minor trading centres to the four major urban markets, and attempts to estimate the scale of the transactions by volume of plants traded. It also identifies the main actors in the chain of supply, from collectors to major manufacturers and exporters. The supply chains for the 12 selected plants studied are traced with respect to actors involved and prices at each stage of the chain. Finally, this section considers the scope for semi-processing and value addition at the local level.

Adjectives that most readily come to the mind while attempting to describe the nature of the medicinal plants trade in India are 'extremely complex', 'secretive', 'traditional', 'confusing', 'badly organised', 'highly under-estimated' and 'unregulated'. There is no macro level data/information available for assessing the nature and extent of the trade; whatever is available comprises 'guesstimates' or extrapolations based on micro studies. There is no systematic local, regional or national level data regarding number of species traded, volumes, prices etc. with any one agency. Most of the data is disjointed, scattered, grossly inadequate and incomparable.

Estimates vary a lot. While one estimate puts the economic value of medicinal plant related trade in India in the order of Rs.10 billion/year and the world trade over US $ 60 billion (Srivastava, Lambert and Vietmeyer 1996), another puts it at Rs. 25 billion for

1998 (ITCOT 1999). To understand the reason for this, one has to understand the enormity and complexity of the task at hand.

5.1 Identification crisis: co-relation of trade name and botanical name

There are no all-India inventories of medicinal plants; there are local and regional inventories, but no national level inventory. The report of the All India Coordinated Research Project on Ethnobiology of the Government of India 1997, only gives the number of species used, but the actual list is not in the public domain.

Identification of plants in trade is complicated by the fact that there is no reliable system of matching trade names to botanical names. In the trade, a species is known by its local name, which can change from one market to another, or from one region to another. A species which is identified by a particular name by the collectors, might be traded under a totally different name. On the other hand, the same trade name may be used for more than one species, often representing a set of species belonging to the same genus or including very different species used for similar purposes. For instance, for the trade name *ashok* there are two botanically different species, *Saraca indica* (syn. *Saraca asoka*) and *Polyalthia longifolia*. Similarly, for the trade name *chirayata* the two botanical species are *Andrographis paniculata* and *Swertia chirata*. Another example is the name *safed musli*, which traders assign to a variety of species including *Chlorophytum borivillianum* and *C. tuberosum*. Yet establishing the correct botanical identity of traded species is a prerequisite to studying those species in the field.

This presents a major problem in identification as soon as the species leaves its natural habitat. The medicinal plants are harvested and traded in their raw form, whether as leaves, fruit, flower, seeds, gum/

resin, roots, rhizomes, stems, bark or the whole plant. Since most raw drugs are traded in dried forms, long after their harvest, only the most experienced people in the trade (most often not a botanist, researcher or a forester) are able to recognise the species by their parts used. This is one of the reasons why it is very difficult to study, monitor or regulate the extraction and trade of medicinal plants. Assessment of the species extracted from the wild, and their quantities, is also extremely difficult.

Given the above conditions, it is not surprising that data and information regarding medicinal plants is somewhat inadequate. However, the following sections try to capture the salient features of the medicinal plants trade in India and the related aspects of conservation and use in order to explore possibilities of private sector intervention, which would address the twin objective of sustainability of the resource as well as a better stake for the collectors/growers.

5.2 Distribution of the medicinal plants trade across the country

There are 6 major, 21 medium and 37 minor markets of medicinal plants spread across the country (see Table 5.1). A major market is taken to be one that has more than 25 big traders of medicinal plants with an individual turnover of Rs. 5 million or more per annum; a medium market is one where there are 25 to 50 big traders whose turnover ranges between Rs. 2.5 to 5 million per annum; the rest of the centres with smaller numbers of big, exclusive traders and lower turnover are classified as minor markets. The minor markets also include centres that have a greater volume of trade but where only a few species are traded, like Dhamtari in Madhya Pradesh where a few species such as Aonla, Harra and Beheda are traded in huge volumes.

The major centres, located at the heads of the routes taken by the medicinal plants, are big cities, including the four metros. Centres like Raksal, Sidhpur, Unjha, Thrissur, Shivpuri, Dhamtari, Neemuch, Katni, Virudhunagar, Tuticorin, Tanakpur and Siliguri are specifically medicinal plants markets. Major export takes place from Delhi, Mumbai, Chennai and Tuticorin. The supply channel runs from the minor to the medium to the major markets before being exported. A general representation of a supply channel is shown in Figure 5.1.

Figure 5.1: General representation of supply chain

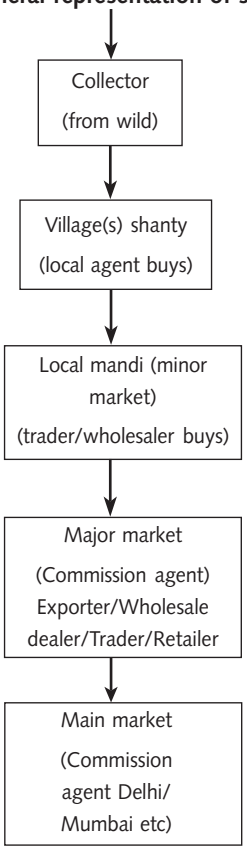

Table 5.1: Zone and state-wise classification of important medicinal plants market in India

Zone	*State*	*Name of cities/towns*		
		Major market	*Medium market*	*Minor market*
Northern	Delhi	Delhi		
Kashmir	Jammu and		Baramulla	Jammu,
	Himachal Pradesh			Bilaspur
	Bihar		Patna, Raksal	Ranchi
	Uttar Pradesh		Dehradun, Lucknow, Kanpur, Tanakpur	Hardwar, Varanasi, Saharanpur, Barabanki, Muzaffarnagar
	Haryana			Ambala
	Punjab	Amritsar		Hoshiarpur, Chandigarh
Central	Madhya Pradesh	Raipur	Shivpuri, Dhamtari, Neemuch, Katni	Indore, Dewas
	Rajasthan			Ajmer, Jaipur
Southern	Andhra Pradesh		Hyderabad	Visakhapatnam, Kakinada
	Karnataka		Bangalore	Mysore, Bijapur
	Kerala		Thrissur	Thiruvananthapuram, Palghat, Ernakulam

Zone	*State*	*Name of cities/towns*		
		Major market	*Medium market*	*Minor market*
	Tamil Nadu	Chennai	Madurai, Virudhnagar, Tuticorin	Dharmapuri, Pudukottai
Eastern	Assam			Kokrajhar, Barpeta Road, Dibrugarh, Guwahati
	Orissa			Bhubaneswar
	Meghalaya and other north-eastern states			Shillong
	West Bengal	Calcutta	Siliguri	Serampur
Western	Gujarat		Sidhpur, Unjha, Ahmedabad	Palanpur, Mehsana
	Maharashtra	Mumbai	Nagpur	Ratnagiri, Vashi (New Mumbai), Pune
	Total	6	21	37

None of these markets have any formal organised body for transactions of business, nor is there any authority that regulates the trade at any point. As a result, only estimates are available about the trade that takes place at each level. However, right from the *mandis* at the minor market levels, the traders are extremely well organised, though in an informal way. They are well aware of the prices and trends in the markets and have very strong business networks. There is also no data regarding the number of people engaged in this trade at various levels.

As part of this study, an attempt was made to study the volumes and prices of the 12 selected species across two major markets (Delhi and Mumbai), and two medium markets (Bangalore and Shivpuri), in order to get some insight into the variation across the markets. It was not possible to acquire demand and supply data over a period of several years from the traders: as mentioned above, information about volumes and prices is held in utmost secrecy, and even if traders maintain records, they are not willing to share this data. However, for the Delhi market it was possible to obtain comparative figures for the year 1998–99 and 1999–2000. While inadequate for tracing any trend, they do provide some insights into the unstable nature of the trade (see Table 5.2).

In order to understand the geographical distribution of the markets, the country can be divided into 5 zones depending on the catchments or the main areas of medicinal plant source from the wild. The salient features of trade in each of these zones is summarised in the following sections.

5.2.1 Northern zone

The major market is located in Khari Baoli, Delhi. This could well be one of the biggest regional markets in south Asia, with raw material from Nepal, Bhutan, Bangladesh, Pakistan and Afghanistan finding its way here. Each of the states falling in this zone has its own medium and minor markets, which feed into the major market of Delhi. Uttar Pradesh and Bihar are also transit routes for the material imported into India from Nepal. An estimated 98 per cent of the entire medicinal plants collected in Nepal are exported to India (Olesen and Hellens 1997).

Delhi Market: Khari Baoli

Delhi is the biggest medicinal plants market both in terms of volume as well as value. More than 500 species are traded here. Table 5.2 shows that the volume of the selected species traded has more

Table 5.2: Volumes and prices for the years 1998–99 and 1999–2000: Delhi market

Botanical name	*Trade Name*	*1998*		*1999*		*Price variation*
		Volume (in tonnes)	*Price Rs/kg.*	*Volume (in tonnes)*	*Price Rs/kg.*	
Aloe vera	Ghee Kunwar	No Sale	No Sale	No Sale	No Sale	
Chlorophytum borivillianum	Safed musli	10–25	150–1800	10–25	150–200	Steep decline
Commiphora wightii	Guggul	50–100	100–135	50–100	80–160	Decrease
Embelia ribes	Baibaranga	50–100	80–160	50–100	80–110	Slight decrease
Emblica officinalis	Aonla/Amla	500–1000	22–65	500–1000	32–45	Increase
Nardostachys grandiflora	Jatamansi	50–100	110–150	50–100	110–150	None
Picrorrhiza kurroa.	Kutki	NA	NA	100–500	90–110	NA
Rauwolfia serpentina	Sarpagandha	10–25	110–175	10–25	110–200	Slight increase
Saraca indica	Ashok	100–500	8–28	100–500	10–42	Increase
Swertia chirata	Chirayata	50–100	110–150	50–100	220–280	Sizeable increase
Terminalia chebula	Harra	100–500	15–20	100–500	17–24	Slight increase
Withania somnifera	Ashwagandha	100–500	35–100	100–500	0–90	Slight decrease

or less remained stable over the years 1998–99 and 1999–2000. However, there has been considerable price variation over the same period.

Three species, *safed musli*, *guggul* and *baibaranga*, have shown a drop in prices. The reasons for this are different in each case:

- Many big farmers in Madhya Pradesh and Maharashtra have taken up cultivation of *safed musli*, which has stabilised supplies somewhat. Prices are reported to have come down because of this.
- In the case of *guggul*, large-scale unsustainable tapping is resulting in greater supply in the market, bringing the prices down.
- The rates of *Embelia ribes* or *baibaranga* seeds have seen much variation in the last few years. At the time the research was undertaken (April 2000), they were being sold in the Khari Baoli market at prices ranging from Rs. 60 to Rs. 110 per kg. The demand for *baibaranga* seeds saw a steep increase in the first half of the 1990s, as its export market, especially to Middle Eastern countries, increased tremendously and rates went up as high as Rs. 200 per kg. It was reportedly used in production of mineral water for its germ-killing properties. However, the last two years have seen a decline in demand in the market and the traders attribute it to the decline in export orders. This decline in export orders is traced to the detection of widespread 'adulteration'. Camilla seeds, used in the dyeing industry to make fast colours, and which look very similar to *baibaranga* seeds (camilla seeds are slightly darker and bigger) were mixed with or sold as *baibaranga*, until this was discovered. It is amazing to note that within a span of a few years when export demand increased, an 'adulterant' was not only found, but also a parallel market was established. But as soon as the adulteration was discovered, demand fell sharply. All this happened within a fairly short span of four-five years (mid 1990s to late 1990s). This

clearly brings out the potential as well as the sensitivity of the export market, particularly with respect to the quality of medicinal plants.

5.2.2 Southern zone

The major southern market is located in Chennai, Tamil Nadu, and the port of Tuticorin, also in Tamil Nadu, is one of the major export points for medicinal plants. A lot of smuggling of medicinal plants (especially banned items like *Drosera peltata*, a red-listed species) is thought to be routed through this port. The main areas from where medicinal plants are collected are the south Western Ghats, the Javadi Hills in the Eastern Ghats and the Nilgiris. Bangalore is one of the medium sized markets, and was studied for the volumes and prices of the selected medicinal species.

Bangalore

Around 400 to 500 species are traded in the Bangalore market. *Embelia ribes, Emblica officinalis, Saraca indica, Terminalia chebula* and *Withania somnifera* are species traded in fairly large volumes, estimated between 50 and 100 tonnes per annum. *Rauwolfia serpentina* ranks next with volumes between 25 to 50 tonnes per annum while the two high altitude Himalayan species, *Nardostachys grandiflora* and *Swertia chirata* are traded in relatively lower quantities, ranging between 2 and 5 tonnes. *Aloe vera* and *Commiphora wightii* are traded in lower volumes ranging between 1 and 2 tonnes per annum. The total volume of trade of the 12 species is estimated to be worth more than Rs. 15 million.

Prices are lower than in the Delhi and Mumbai markets except for species originating from extreme north/north-east, e.g. *Nardostachys grandiflora* and *Swertia chirata*.

5.2.3 Central zone

The central zone almost completely comprises the densely forested (almost 33 per cent forest cover) state of Madhya Pradesh, which

has one major market at Raipur; four medium sized markets at Shivpuri, Dhamtari, Neemuch and Katni; and two minor markets at Indore and Dewas.[8] Two other minor markets, at Ajmer and Jaipur in the adjoining state of Rajasthan, are also included in this zone. These act mainly as transit markets rather than a source of medicinal plants, except for a few arid zone species like *Acacias*.

In Madhya Pradesh, the Bundelkhand area, Chindwara and Bastar are densely forested and rich in medicinal plants. Most of the supplies of *Chlorophytum borivillianum* or *safed musli* come from these forests. Another significant aspect about Madhya Pradesh is that it has one of the highest percentages of tribal population in the country. A large proportion of the tribals in Bastar region are reported to be solely dependent on collection of medicinal plants for their incomes. The role of non-wood forest products, especially medicinal plants, in enhancing livelihoods, therefore assumes great significance.

5.2.4 Western zone

The main centre in the western zone is Mumbai. It has the largest number of exporters of medicinal plants as well as the maximum value of imports as compared to the other markets. The majority of the raw material is collected in the mega-biodiversity 'hot-spot' of the Western Ghats. Other important markets that feed into this include Nagpur, Sidhpur, Unjha and Ahmedabad. The minor markets are located in Ratnagiri, Vashi and Pune, all in Mahashratra.

5.2.5 Eastern zone

The main centre for the medicinal plants trade is located at Kolkata. A considerable bulk of raw material collected from eastern Nepal, Bangladesh and Bhutan finds its way to this centre. Assam, with its

[8] Most of the medicinal plants traded in the major market of Madhya Pradesh travel further north to Delhi or westwards to Mumbai, depending on their proximity to these centres.

four minor markets, Guwahati, Dibrugarh, Kokrajhar and Barpeta, is an important regional market. Interestingly, the material that originates from the north-eastern Himalayas finds it way first to Kolkata (through the regional markets) before returning back to the retailers and traders of Assam and adjoining states.

5.3 Analysis of volume and price of selected species across four markets

In terms of total volume traded in 1999–2000, Mumbai tops the list with about 3,300 tonnes, followed by Delhi with about 2,000 tonnes. As compared to these two major markets, the volumes traded in the medium market of Bangalore are quite small at around 400 tonnes. However, in Shivpuri, another medium market, the volume of trade in two low value species, *viz.*, *Emblica officinalis* and *Terminalia chebula* is quite high bringing the overall volume of trade to around 1900 tonnes.

Aloe vera, a small succulent herb selected for the study because of its increasing demand by the herbal cosmetic industry, is not traded in any form in any of the markets surveyed, except for very low amounts in Bangalore. Since the juice of the succulent leaves is used, a manufacturer procures the fresh leaves, as and when required, from an agent, who in turn organises collection by villagers/farmers; often for as low an amount as Re. 0.10 to Re. 0.20 per plant. The manufacturer's rate is around Rs. 1 per kg of wet leaves. It is a low value species but required in huge quantities as it is used in a wide range of cosmetic products including face creams, gels, lotions and shaving creams. There is even a tetra-packed Aloe drink, which is marketed by Chinese manufacturers.

As is evident from Table 5.3, the volumes traded are directly proportional to the prices of the raw material, which in turn are proportional to the abundance/availability of the species. Low

Table 5.3: Estimated volumes and prices of selected species across four markets in April 2000

Botanical Name	*Trade Name*	*Delhi*		*Mumbai*		*Bangalore*		*Shivpuri*	
		Volume (tonnes)	*Price (Rs./kg)*	*Volume (tonnes)*	*Price (Rs./kg)*	*Volume (tonnes)*	*Price (Rs./kg)*	*Volume (tonnes)*	*Price (Rs./kg)*
Aloe vera	Ghee kunwar	No Sale	No Sale	NA	NA	1–2	NA	NA	NA
Chlorophytum borivillianum	Safed musli	10–25	150–200	NA	NA	NA	NA	2–5	300–500
Commiphora wightii	Guggul	50–100	80–160	100–500	130–170	1–2	100–125	2–5	100–120
Embelia ribes	Baibaranga	50–100	80–110	100–500	130–170	50–100	60–100	5–10	70–90
Emblica officinalis	Aonla/Amla	500–1000	32–45	500–1000	30–75	50–100	12–30	> 1000	32–37
Nardostachys grandiflora	Bal chad	50–100	110–150	50–100	130–170	2–5	200–250	2–5	90–100
Picrorrhiza kurroa	Kutki	100–500	90–110	50–100	NA	2–5	NA	2–5	100–120
Rauwolfia serpentina	Sarpagandha	10–25	110–200	25–50	100–150	25–50	70–90	2–5	90–110
Saraca indica	Ashok	100–500	10–42	50–100	25–35	50–100	10–15	NA	NA
Swertia chirata	Chirayata	50–100	220–280	100–500	130–170	2–5	90–150	< 1	280–300
Terminalia chebula	Harra	100–500	17–24	500–1000	20–30	50–100	5–10	500–1000	14–16
Withania somnifera	Ashwagandha	100–500	40–90	500–1000	60–90	50–100	20–30	50–100	32–40

price species: *Emblica officinalis*, *Saraca indica*, *Terminalia chebula* and *Withania somnifera*, all show high volumes of trade across the four markets.

The connection between the part used and prices is evident. Those species that are destructively harvested are more expensive. *Chlorophytum borivillianum* (roots), *Commiphora wightii* (resin), *Embelia ribes* (seeds), *Nardostachys grandiflora* (roots), *Picrorrhiza kurroa* (roots), *Rauwolfia serpentina* (roots), *Swertia chirata* (whole plant) are all high value species, whose price often exceeds Rs. 100 per kg.

High altitude species such as *Nardostachys grandiflora*, *Picrorrhiza kurroa*, *Swertia chirata* are also high value species.

It is seen that the further the market from the source where the raw material is collected, the higher is the price. This of course results from the addition of transport cost in the final price. For example, *Nardostachys grandiflora* or *Jatamansi*, which originates in Nepal and adjoining areas, is costliest in the southern markets.

In general, the prices in Mumbai are the highest (except for the high altitude species which are traded at higher prices in the southern markets), probably because it is the largest and one of the most organised markets, thus accounting for higher and more stable prices.

5.4 Stakeholders and supply channels

Given that medicinal plants are sourced from many different biogeographic zones within India, tracing the supply chains of all the species in trade (if it were possible) would produce a most intricate web across the country.

There is a long chain between primary collectors and end-users,

and the supply channels for each species are different, depending on availability of the individual species and many other factors. However, the following set of players involved in the supply channels can be identified:

- Collectors;
- Local traders or agents;
- Commission agents at the state level;
- Commission agents in the major markets (like Delhi, Mumbai etc.);
- Wholesale merchants in the major markets;
- Retailers in the major markets;
- Exporters and industrialists.

Table 5.4 shows the price obtained by each of these players for the different species. The difference between remuneration paid to primary collectors and the market rate of the product is considerable. For example, the middlemen in Panna, Satna, Sagar and Damoh districts of Madhya Pradesh distribute cash/kind advance to the gatherers at Re. 0.75–1 per kg for green *aonla* as against the prevailing market price of Rs. 3 per kg. In Sheopur, Madhya Pradesh, middlemen offer an advance of Rs. 5–8 per kg of dry *aonla* during July-August. After the collection starts in November, the market price goes to Rs. 20–25 per kg. While *aonla* matures in December, the middlemen encourage villagers to collect from October onwards. Apart from premature harvest, the fruits are almost completely harvested, mostly by lopping and pollarding of branches. In addition, 15–20 per cent of trees are actually felled to collect maximum *aonla* fruit. This practice is also prevalent for *chironji*, where fruits are collected before they ripen. In the case of *safed musli*, one of the most expensive medicinal plants, it is totally uprooted leaving little in the soil for future regeneration.

Table 5.4: Prices paid at different levels in the supply chain (Rs./kg.)

Name of species	*Collector/ Villagers*	*Agent/ Middleman*	*Commission Agent*	*Commission Agent at Delhi*	*Wholesaler*	*Trader/ Retailer (final price)*	*Collector share of final price*
Aloe vera	1.5–2	5	—	—	—	12	13–17%
Chlorophytum borivillianum	300	—	800	1100	—	1500	20%
Commiphora weightii	70	—	—	—	100	120	58%
Embelia ribes	30–40	60	70	90	100	120	25–33%
Emblica officinalis	3–4	5–6	17–18	20	23–24	25–30	12–13%
Nardostachys grandiflora	45	65	75–85*	110	125	150	30%
Picrorrhiza kurroa	15–30	40–60	100–120	125	135–150	150–165	10–18%
Rauwolfia serpentina	50	75–80	150–200	220–275	280–300	300–310	16–17%
Saraca indica							
Dehradun	3–4	6	8–10	—	7–12	20	15–20%
Calcutta	10–12	15–20	25–30	—	30–40	60	17–20%
South India	4–5	7	10	—	15–22	30	13–17%
Swertia chirata							
Nepal	125	175	200	—	250	270	46%
India	100–150	190	225	240	270	290	35–52%
Terminalia chebula	7–8	9	12	15	20–22	27	26–30%
Withania somnifera	20	—	25–30	35–40	45–50	65–70	29–31%

*Wholesale rate in Nepal

Source: Based on personal interviews

5.4.1 Collectors

Collectors are usually tribals and the rural poor, who are most dependent on the forests for their basic needs like fuel and fodder. Most often, those who go into the forests for fuelwood and fodder collection also collect seasonal medicinal herbs except for a few species. Collection from wild or 'wildcrafting' is a labour intensive activity, often involving entire families. Studies show that women and children form the major chunk of the rural poor most actively involved in herb collection from the wild. For example, in a study conducted in the Great Himalayan National Park in Himachal Pradesh, it was found that in 70–85 per cent of rural households involved in collection of medicinal plants, most of the collectors were women and children (Tandon 1996). It is also seen that women largely carry out the collection of leaves, fruits and flowers whereas men generally collect roots and bark and the species that are difficult to collect (as in some high altitude species).

Generally, in tribal pockets like Bastar in Madhya Pradesh, collection and sale of medicinal plants is the only source of cash income. Apart from such tribal pockets, this activity provides supplementary incomes to the families involved and is not generally a full-time economic activity.

As stated earlier, the rates paid to the collectors of herbs are extremely low, often just a fraction of the price paid by the final consumer. Payment to the collectors seems to be based upon the prevalent daily wage rate (or a slightly higher amount) in the area, for whatever quantity and number of species of medicinal plants are collected. The agent who engages the collectors, based on the perceived availability of the species and current wage rate, fixes the price for different species, which at the end of the day generally totals to a day's wages. This rate has usually no correlation with the final rate of the raw material paid by the consumer. On average,

the share of the collectors in the final price paid by the consumer ranges between 10 and 58 per cent. For most species, the share of the collectors is lower than 33 per cent. Unless a mechanism is put in place to secure the stake of the collector, their interest in sustainable harvest and conservation of these plants will remain doubtful.

The connection between rural poverty and the potential for generating livelihood security through collection and growth of medicinal plants has to be understood in order to be able to formulate strategies for the conservation and sustainable use of medicinal plants. To illustrate the enormous potential for generating incomes for the local communities: a study conducted in the eco-development zone of the Great Himalayan National Park (GHNP) revealed that medicinal plants formed the biggest component of the non-wood forest products traded by the households in the area and earned them over Rs. 7,000 per household per year—despite the fact that they received only a fraction of the final price paid by the consumer (FRLHT 1997). A recent study in Mandi district of Himachal Pradesh reveals that for rural households engaged in medicinal plants collection, the average annual income from this came to about Rs 16,600 (ISST 1996 quoted in Tandon 1996).

This commercialisation of medicinal plant extraction has resulted in large scale, indiscriminate harvesting of the resource by the rural poor, whose main interest is obviously to earn additional income. However, this was not the case till a few decades ago, when the extraction of medicinal plants was done on a very limited scale for use by local traditional healers who also possessed specialised knowledge about their extraction, resulting in limited impact on the resource.

Two important interventions which can address the issue of ensuring fair share for the collectors are: a) organising the collectors and

b) collective bargaining by the organised body of collectors. An effort is underway in GHNP to form savings and credit groups of herbalists who can be involved in conservation activities promoting sustainable harvest, growing selected species and collectively marketing the raw drug for better returns.

The legal and administrative structure pertaining to medicinal plants can also play an important role in ensuring a fair share for the primary collectors/growers. The decision to nationalise *Emblica officinalis* by the Madhya Pradesh Government and the Forest Department's determination to implement it fully have resulted in two-fold benefits of better regeneration of the species due to improved harvesting methods and more returns for the collectors (see Box 5.1).

Box 5.1: Legal intervention enhances community benefits and boosts conservation measures in Madhya Pradesh

Emblica officinalis, commonly known as *aonla* (gooseberry in English), is one of the non-wood forest products extracted by local communities from the forest areas of Madhya Pradesh. The fruits are one of the three main ingredients along with fruits of *Terminalia chebula* and *T.belerica* in *Triphala*, one of the most common *ayurvedic* products manufactured in the country. It is also used in *Chyawanprash*, a popular *ayurvedic* general-purpose preparation. This makes it one of the high volume medicinal species to be extracted from the forest areas.

The fruits mature in October-November, which is the best collection time. However, local people started collection of the unripe fruits in early July. The harvesting was often destructive, hacking off the branches laden with fruits indiscriminately. This impacted regeneration adversely. Moreover, the collectors received very low rates for the fruits, only about Re. 0.40 per kg.

Field researchers from the Indian Institute of Forest Management, Bhopal, reported the prevailing conditions along with recommendations for regulating the collection of unripe fruits, adoption of non-destructive harvesting techniques

and ensuring fair price to the collectors. Subsequently, legislation was brought into force on 1 December 1998, nationalising *Emblica officinalis*. This meant transit permit (issued by the Forest Department) became mandatory for transportation of commercial quantities of the fruits. This acted as automatic regulation on when the fruit was harvested. The Forest Department personnel, who had already been oriented about the importance of proper time/method of harvesting, refused to issue transit permits before the right time. This measure was further strengthened by offering a rate of Rs. 4 per kg to the collector's cooperative instead of the Re. 0.40 per kg, which was earlier being offered to the collectors by the agents. This was a strong enough incentive for the collectors to desist from plucking the fruits too early or from selling it to the agents.

However, the plan did not work as smoothly as hoped. In the following year, 1999, the biggest *ayurvedic* factory in the state, owned by Dabur, was unprepared for the shortage in the market from July to November 1999. They protested strongly against the measure, stating that precious foreign exchange being earned by them through export of *ayurvedic* medicines was being adversely affected by the legislation. But the argument did not hold water against the wider benefits to conservation as well as enhanced incomes for the local people. The collectors too went along with the government regulation as they stood to gain much better prices for the fruits than those offered by the factory agents. Clearly, increasing the economic stake of the local communities from medicinal plants and organising the collectors (in this case into a cooperative) can serve as important first steps in a long-term strategy for conservation and sustainable use of medicinal plants.

A further threat to conservation derives from the fact that many people who have no experience or knowledge about medicinal plants are becoming involved in their collection and have gradually dominated the scene in many forest areas. These casual labourers harvest medicinal plants in the most unscientific manner. For the trader this arrangement is more profitable than buying from traditional herb gatherers since the trader only pays a minimal wage, whereas if he bought from the local people the price he paid would

have to reflect (albeit a small proportion of) the value of the plants. (*Down to Earth* 2001).

5.4.2 Local agents/traders

The second in the supply chain after the collectors are the local agents or traders who buy the raw material from a number of collectors in the village and often operate in a group of villages simultaneously. Local agents and traders are always men, mostly belonging to the Vaishya caste or a scheduled tribe. In south India, Muslim traders control a considerable proportion of the trade.

Different kinds of procurement and payment arrangements are evident at this level. One is where the local shopkeeper (there are often just one or two in a village), who supplies the general stores, also deals in medicinal plants on a seasonal basis. During the lean season, when the poor villagers are cash strapped, he provides supplies on credit or sometimes even lends cash to them. Later, through the rest of the year, the villagers pay back their credit, often in kind, including medicinal plants collected from the wild. It is important to emphasise the hold that the agent/trader exercises over the villagers by virtue of the credit facility that he is able to extend during the lean season. This has implications for any intervention that aims at removing the middlemen from the supply chain. The problems of rural indebtedness and lack of access to micro-credit by the poor are inextricably woven into the overall picture of medicinal plants collection and trade. It is in this context that involving women's savings groups in medicinal plants collection, growing, value addition and marketing seems to be a good strategy.

In the second instance, an agent who receives an advance order from a commission agent at the state level organises the collection through the villagers, by advancing a part of the payment in turn.

Yet another modality is that the collectors bring the raw material

to the local *haat* or weekly village markets, where along with other agricultural products and vegetables, fresh medicinal plants are also sold, from where the agents make bulk purchases. This is a fairly common method by which the agent procures raw material.

5.4.3 Stockists or agents at state level

The agents, referred to as stockists, operate from major/medium markets or *mandis* in the state and are the proverbial 'big fish' in the supply chain. They are well organised and it is at this level that the trade takes on truly commercial overtones. The agents are aware of the rates across the different *mandis* as well as in the final markets. Theirs is often a specialised business, although even at this level medicinal plants might be just one of the commodities that they deal in. The stockist or the agent at the state level is often in touch with his counterpart in the major markets like Delhi, and may specialise in supply of a certain set of medicinal plants. The secrecy regarding the prices, quantities traded, profits made and the quality of material supplied begins to assume impenetrable dimensions from this level onwards. Information is shared only with those who are considered as insiders in the trade.

The local agent/trader mentioned in section 5.4.2 sells all the available medicinal plant raw material to the stockist at a specified rate (depending on the market). The stockist then 'brokers' a deal with his counterpart in the major market for which he charges a commission.[9] He receives the full payment once the raw material is sold to the commission agent in Delhi. None of the transaction is carried out with written contracts; everything is informal, on mutual trust.

The stockists generally have storage facilities to store the raw

[9] In April 2000 this commission rate was 8%.

material, which they procure in bulk and keep brokering the deals throughout the year as and when they get good prices.

5.4.4 Commission agents

Commission agents are located in the major markets at Delhi, Mumbai, Chennai and Kolkata and buy the raw material from the stockists located in the medium/state level markets. They are extremely well organised and often have their own storage facilities. Many of the Delhi commission agents, for example, own their own cold storage facilities, an indicator of how lucrative the trade is. They supply the raw materials to exporters, manufacturers and wholesale dealers.

5.4.5 Suppliers

These are another set of players, mainly found in the major centres and specialising in supplying to one or two major manufacturers like Dabur or Zandu. They procure raw material from the commission agents or the stockists and then supply to a single large manufacturer.

5.4.6 Wholesale traders

Wholesale traders are located at the final major markets in the big cities like the four metros of Delhi, Mumbai, Kolkata and Chennai and make the final purchases before supplying to the manufacturers and retailers in the cities, and other petty traders. In fact, they are often the initiators of the business, in the sense that their placing the orders with the commission agents results in a backward chain of reactions reaching up to the collector level.

5.4.7 Exporters

Often wholesale dealers and commission agents are also exporters. At times even some exporters who deal in other items export medicinal plants/products on demand.

5.4.8 Manufacturers

The manufacturers can be classified into the small, medium and large industries, apart from thousands of cottage level production units (see section 2.3). The practitioners and the public at large are the consumers of the finished product brought out by the manufacturers.

5.4.9 Summary of stakeholders

There is no inventory of the number of people at each level that are involved in this trade. However, Table 5.5 gives a rough estimate of the number of players at the Delhi and Mumbai markets.

Table 5.5: Estimate of number of players in the medicinal plants trade in Delhi and Mumbai

Players	*Delhi*	*Mumbai*
Commission agent	100	100
Exporter	15–20	>50
Wholesale dealer	0–35	30–35
Trader	30–35	30–35
Retailer	>100	About 100

Source: Author's estimate based on survey

Information flow between the different players in the supply chain is linear with no direct contacts between the collectors/growers and final consumers. Apart from a few species like *Aloe vera* or *Tinospora cordifolia*, which are generally used fresh, all other species reach the final consumer through one or more middlemen. The collectors are usually unaware of the prices (other than what is offered by the local agent), the final destination of the material, the final value of

the material, or the form that the medicinal plant takes. In other words, they are unaware of the wealth (in monetary terms) that is stored in medicinal plants.

Each level of middleman holds on to its privileged information and operates on a secretive and suspicious mode. They are not formally organised and personal profit is the sole motivating force. As a rule, there is no awareness or concern whatsoever about the issues related to the medicinal plants, conservation, sustainable use, etc., though most of them agree that it is becoming more difficult to find medicinal plants in the wild. They accept that demand, and hence prices for many species, has seen a phenomenal increase in the last decade, but that is good news for their business.

5.5 Scope for semi-processing

Semi-processing of raw materials at the village level would ensure better returns to the primary collectors and growers, and has the potential to generate wage employment for women. Some of the measures are discussed below.

5.5.1 Cleaning and grading

Cleaning and grading are simple measures that can be easily undertaken at the level of the collectors, which would enhance the price as well as quality of the raw material. There is tremendous scope for negotiating a higher price if the raw material is cleaned and graded.

Cleaning involves washing and drying or simply removing mud and other impurities depending on the part extracted. Collectors do not carry out even these simple steps because they are unaware of the possibilities of negotiating higher prices; they often have absolutely no idea about the actual value of the raw drug.

Grading involves separating the different quality classes. This, again, can greatly enhance the price received. For instance: the price of *safed musli* or *Chlorophytum borivillianum* roots ranges from Rs. 200 to Rs. 1800. Such a wide range is due to the fact that there are varying qualities of *safed musli* available in the market and the rate depends on the grade of the raw drug. Broadly, three grades of musli are available:

- 3–4 inch long roots called *badi* (bigger) *musli* that get the highest price.
- 3 inch and smaller roots called *choti* (or smaller) *musli* that get intermediate prices.
- Broken frament or *chura* that get the lowest price.

If the harvested material is sold as it is, with all the grades mixed together, the collectors get a much lower return. This is what happens in practice.

One of the major difficulties faced after harvesting the medicinal plant part is to protect it from fungal infection during the process of cleaning, grading and drying before sale. Many species are harvested during the monsoon months, and the moisture in the atmosphere makes the harvested raw material susceptible to fungal attacks. Using fungicide for protection is not advisable as it could adversely affect the drug quality. Currently there are no facilities or methods that would prevent the raw drug from a fungal attack and often the infected material is used as it is in the final formulations. This problem needs to be researched and any positive results will help in improving the shelf life of the raw drug.

5.5.2 Value addition

Currently, there seems to be limited scope for semi-processing/value addition, as far as medicinal plants are concerned. The main reasons for this are discussed below.

- The production processes involved in making the formulations include drying, powdering, making aqueous extracts, boiling, distilling and cooking. Most of these are done in sequence and are logistically best done in a central place.
- If semi-processed material in the form of powders, extracts, pulp, etc. is purchased, it will be very difficult to ascertain the quality (whatever little quality standards are being maintained) of the raw drug being used.
- There is little difference in terms of cost-effectiveness; hence there is little incentive for manufacturers to explore such an arrangement.

Table 5.6 lists possible semi-processing that might be suitable at the collector level, provided there is an assured buy-back arrangement with an industry or exporter. However, there seems to be more scope for promoting semi-processing catering to the herbal cosmetic industry as compared to the pharmaceutical industry. Hair conditioners like henna powder, face packs, scrubs, soap nut powder for washing hair are all traditional beauty care products which have come to command a huge market worldwide. Small production units with very low capital investment can be established at village level as community enterprise activities involving organised groups like women's savings and credit groups.

Simple equipment like knives, pruning scissors, drying trays etc. along with some training for the collectors/growers on the required specifications of the raw drugs, are steps that could result in better quality of raw drugs as well as ensure better bargaining power for the collectors. However, even seemingly simple activities like drying/cleaning in hygienic conditions are difficult in many villages. The poorest families engaged in medicinal plant collection often live in cramped conditions that makes it impossible for them to even carry out the most primitive processing activities. A solution

Table 5.6: Semi-processing/value addition for selected species

Botanical name	*Trade name*	*Part used*	*Semi-processing/ value addition*
Aloe vera	Ghee kunwar	Whole plant	Cutting the succulent leaves into 2 inch pieces. Extracting juice out of the leaves.
Chlorophytum borivillianum	Safed musli	Rhizome	Washing, cleaning, peeling the skin, drying, grading.
Commiphora wightii	Guggul	Gum/resin	Cleaning, grading.
Embelia ribes	Baibaranga	Seeds	Cleaning, drying, grading.
Emblica officinalis	Aonla/Amla	Fruit	Washing, boiling.
Nardostachys grandiflora	Jatamansi	Root	De-seeding, drying.
Picrorrhiza kurroa	Kutki	Root	Cleaning, drying, grading.
Rauwolfia serpentina	Sarpagandha	Root/seeds	
Saraca indica	Ashok	Bark	
Swertia chirata	Chirayata	Whole plant	
Terminalia chebula	Harra	Fruit/bark	
Withania somnifera	Ashwagandha	Root	

could be to support organised groups to construct storage-cum-working sheds where women—for such low paying tasks like cleaning/grading/drying, are traditionally exclusively carried out by

them—could do the required semi-processing. For example, Rural Education And Development Services (READS), an NGO located in Hosur district of Tamil Nadu, implementing a community based income generation programme involving tamarind processing, provided assistance to its womens' savings and credit group members to build a working shed for de-seeding, grading and packing the raw material in each of its village clusters.

However, while semi-processing units at the village level seem to be viable enterprises, full fledged, community owned and managed units producing finished products are extremely difficult to run on a long-term basis.

6. The demand supply gap

This section considers the current and predicted demand for *ayurvedic* plants and formulations, both within India and internationally. It goes on to examine the demand supply gap, how it is endangering some of the species found in the wild, and the response of the industry, government and NGO sector to the supply crisis and resource degradation. There is widespread use of traditional medicines in India and this is predicted to increase. Internationally, western Europe, USA, Japan and south east Asia represent significant markets, and there is sizeable potential for increase. However, the requirement for registration, based on clinical trials, impedes the potential for export of formulations, and many medicinal plants are exported in their crude form or as food supplements. The absence of standardisation of methods is adversely affecting growth in exports. Although there are a number of initiatives to develop new sources of supply, these are largely pilot projects. Further interventions will be required to help bridge the widening demand-supply gap and ensure sustainable supplies for the future. This section also discusses whether cultivation is a feasible means of meeting the demand for some species, given that the livelihoods of the traditional collectors, often tribals, depend on collection of medicinal plants from the wild.

6.1 Demand trends in trade

6.1.1 Domestic market

It is estimated that seventy per cent of India's population uses traditional medicine (ITCOT 1999), and the rural poor, particularly tribal and other forest-dependent populations have little or no access to other systems of medicine.[10] The success of Dabur, Baidyanath, Himalaya Drugs and Zandu bear testimony to the growing demand for *ayurvedic* medicines (see Table 6.1). The *ayurvedic* industry has witnessed a steady increase in market share during the last two decades. The major reasons for the expanding domestic market are continous use by the ever-increasing population and, to a certain extent, a resurgence of faith in traditional and natural *ayurvedic* concepts.

Table 6.1: Growth in sales of major manufacturers[11]

Company	*Sales (Rs. million)*	
	1993–94	*1998–99*
Dabur India Ltd.	2610	3220
Zandu Pharmaceuticals	390	1200
Himalayan Drugs Co.	310	1400
Baidyanath Ayurved Bhawan	–	1360
Ajanta Phamaceuticals	170	200

Source: ITCOT 1999

[10] Their access to *ayurvedic* formulations, which are costly and may not be available locally, is also limited. Therefore they use plants in crude form for treatment.

[11] These figures refer to total sales including exports. However, since exports are very little compared to domestic sales and have not grown dramatically over these years, the growth in sales can be considered as representative of the growth in domestic sales.

A survey of agents and manufacturers done by the authors indicates an annual compound growth rate in domestic sales of 20 per cent.[12] Considering the estimation of Rs. 25 billion domestic market size in 1998 (ITCOT 1999), the market size and demand for *ayurvedic* medicine in the year 2004 is predicted to be about Rs. 75 billion.

In terms of the quantum of demand, though no comprehensive estimates are available, the Task Force Group on Pharmacies linkages compiled the following figures:

- A 1991 survey conducted by Vaidya Khadiwale of Pune estimated that 509.4 tonnes of raw drugs of 120 species were required for the state of Maharashtra. With an annual growth rate of 18 per cent, the industry figure works out to 8,655.72 tonnes for the year 2000.
- Arya Vaidya Sala, Kottakal, the most popular of one of the 1,000 odd pharmacies of Kerala, has an annual demand of 3,000 tonnes of raw material comprising 700 species of medicinal plants worth Rs. 300 million.
- The Medicinal Plants Farm Project, a feasibility study done by the Agricultural Finance Corporation in 1995, estimated the raw drug requirement of Kerala to be 92,994 tonnes per annum; this was expected to double by the year 2000.
- CHEMXCIL puts the demand estimates at 31,689 tonnes per annum for 55 species for the whole of India.
- ADMA estimates demand of 29,413 tonnes of 110 species for the whole of India.

Large variation in the figures from different agencies makes the

[12] The estimate is based on personal discussions with dealers and market information gathered from marketing personnel.

estimation of demand of medicinal plants at the national level a difficult task, re-affirming the need for a systematic survey.

6.1.2 International market

The World Health Organisation estimates that over 80 per cent of the world's population relies on traditional plant-based medicine for their primary health care needs (Bannerman et al 1983). During the last decade the demand for medicinal plants has grown significantly in Europe and elsewhere. The international market for medicinal plant-based products is estimated to be US$ 60 billion (Kamboj 2000) and is growing at the rate of 7 per cent per annum (see Tables 6.2 and 6.3).

In Germany and France many herbs and herbal extracts are used as prescription drugs and their sales in the European Union were around US$ 6 billion in 1991 (and probably over US$ 20 billion now). In USA, herbal drugs are currently sold in health food stores and had a turnover of around US$ 4 billion in 1996, which was anticipated to double by the turn of the century.

Nutraceuticals (nutritionally or medicinally enhanced foods with

Table 6.2: Annual percentage growth rates by region of the medicinal plant market

Region	*1985–91*	*1991–92*	*1993–98*
European Union	10	5	8
Rest of Europe	12	8	12
South East Asia	15	12	12
Japan	18	15	15
India/Pakistan	12	15	15

Table 6.3: Herbal medicine sales in major consumer countries

Country/region	*Herbal medicine sale (US$ billion)*
Europe (1991)	
Germany	3.0
France	1.6
Italy	0.6
Others	0.8
Europe (1996)	~10.0
USA (1996)	4.0
India (1996)	1.0
Other countries (1996)	5.0
All countries (1998)	~30.0–60.0

health benefits) are in great demand in the developed countries particularly USA and Japan. The nutraceutical market in USA alone is about US$ 80–250 billion, with a similar market in Europe. The Japanese market is worth US$ 1.5 billion (Brower 1998). Such huge markets have arisen because of the Dietary Supplement Health Education Act passed by USA in 1994 that permits unprecedented claims to be made about food or the dietary supplements' ability to bring health benefits including prevention and treatment of diseases. The annual Herbal Supplement Usage Study for 1997 found out that one in five adults in USA takes herbal supplements (Wood 1997).

Export trends and potential

The global demand scenario provides a sizeable market potential for the Indian *ayurvedic* industry. The major exports from India take place in crude forms. Herbal medicine can be sold in processed

form only if the formulation/medicine is registered in the country of import. Registration requires technical and clinical evidence, which is a lengthy and costly process—hence most *ayurvedic* drugs are either sold as para-medicine or food supplements. Table 6.4 presents the sales value of some of the major medicinal plants/plant parts exported from India.

Table 6.4: Reported sale values of the top medicinal plant exports, 1990–94 (in million Rs.)

Plant/plant part	*1990*	*1991*	*1992*	*1993*	*1994*	*1996*
Agarweed	6.2	7.4	2.3	1.7	1.8	–
Psyllium husk	581.0	620.0	–	692.0	1,060.0	793.9
Psyllium seed	56.9	65.5	65.7	62.9	77.1	185.5
Senna leaves and pods	37.3	112.0	122.0	82.0	85.1	138.0
Tukmaria	2.9	–	2.5	2.2	18.9	6.3
Ayurvedic/Unani herbs	35.2	56.7	99.4	85.3	99.8	170.1
Other roots	75.3	58.7	83.8	77.5	13.2	53.0
Other herbs	45.8	103.0	145.0	102.0	75.4	104.0

Source: APEDA (1995) and Monthly Statistics of Foreign Trade of India.

During 1986–87 India exported crude drugs valued at about Rs. 660 million.[13] During the last decade exports reached the value of Rs. 4.5 billion. A recent Planning Commission report estimates

[13] The crude *ayurvedic* plant species being exported are covered mainly under the heading of 'vegetable drugs' in the monthly statistics of Foreign Trade of India.

that this volume can be raised to Rs. 30 billion by 2005 and to Rs. 100 billion by 2010 (Planning Commission 2000).

USA, Germany, UK, France and China/Taiwan are major importers of Indian medicinal plants, together accounting for 75 per cent of total exports (see Table 6.5).[14] The total export value of medicinal plants products in 1991/92 was US$ 3.56 million and in 1994/95 US$ 4.38 million (APEDA 1995).[15] However, these statistics do not account for a huge volume of undocumented illegal medicinal plant trade.

Table 6.5: Value of exports of Indian medicinal plants to top eleven destinations (in million Rs.)

Country	*1990*	*1991*	*1992*	*1993*	*1994*
Bangladesh	11.7	15.5	21.0	8.7	2.07
China/Taiwan	69.4	131.0	96.6	105.0	54.5
France	50.9	53.5	58.7	55.6	55.5
Germany	90.7	124.0	127.0	88.7	130.0
Italy	16.0	16.4	29.8	22.2	32.6
Japan	48.4	49.3	36.8	36.9	0.0
Pakistan	36.3	28.9	45.9	51.6	31.9
Saudi Arabia	18.2	34.0	330.0	150.0	11.4

Source: APEDA 1995.

[14] One of the recent studies, Lange's 'Trade Survey of Medicinal Plants of Germany' (1997), gives an idea of the volume of medicinal plants exported from India to Germany. It identifies 1,543 medicinal plant species in trade in Germany; 70 to 90 per cent of which are collected from the wild; and India as the main source of raw material. It also demystifies the earlier impression that the international trade is mainly confined to cultivated species. No such country level study has been undertaken for India.

[15] The values quoted are the returns to India only. In reality, the plant materials sell in foreign markets at significantly higher prices.

Country	*1990*	*1991*	*1992*	*1993*	*1994*
UAE	15.1	22.1	17.9	14.8	22.7
UK	73.7	54.9	87.6	80.9	97.0
USA	49.7	548.0	683.0	600.0	653.0

Source: APEDA 1995.

The main medicinal plant species exported from India are listed in Annex 10. India has a monopoly over *psyllium* (*Plantago ovata*) (see Box 6.1) and senna (*Cassia ovata*). These two drugs constitute

Box 6.1: Psyllium seed and husk: production and export

Isabgol, or psyllium, is the seed or husk of *Plantago ovata*. Of the 10 species of *Plantago* grown in India, *Plantago ovata* is the most important. Infusions and decoctions of whole seeds or the husk are used as bulk laxatives. Raised as an exclusively cultivated crop on a commercial scale, production is concentrated in Gujarat (15 districts), Rajasthan (5 districts), and to a limited extent in Haryana (Rewari district) and Bihar (Sasaram district). In Gujarat it is a regulated commodity under the 'Market Produce Committee Act'. At present, approximately 30,000 hectares of land is under the crop with an annual production of 25,000 to 30,000 tonnes of *psyllium* seeds and husk. About 80 to 85 per cent of the total produce is exported, bringing in substantial foreign exchange. *Psyllium* is generally grown by large and medium farmers. Studies in Gujarat have indicated that processors are not able to procure directly from *psyllium* producers in any significant manner, and so tend to rely on traders to meet their processing requirements. The small quantities that were purchased directly by the processors did not bring substantial improvements in income for the farmers.

In the domestic market almost all the major *ayurvedic* companies sell it in packages of 50g,100g and 200g. It is not sold as a processed product in the international market because registration of the product is required in the country of import. In the international market, marketing of *psyllium* is in the hands of Searle, now owned by Proctor and Gamble. India has a monopoly on *psyllium* in the international market and, given its dry nature and easy to store properties, export takes place throughout the year.

more than 60 per cent value of total export of medicinal plants. Interestingly, both the crops come from cultivated fields.

Although India can boast of being one of the biggest reservoirs of plant resources as well as home to a number of traditional health care systems, its share of the world herbal market is quite insignificant. The reason can be largely attributed to the lack of organisation both at cultivator/collector as well as industry level. The absence of standardisation methods of both the plants and formulations is adversely affecting the growth of exports. The state of Indian exports can be gauged from the fact that while India earns a meagre Rs. 4.5 billion from exports, countries like China and Thailand are exporting to the tune of Rs. 220 billion and Rs.100 billion respectively.

Exports were further affected by a Government of India notification, issued in 1998, banning the export of 53 plants or their parts or formulations, as it was perceived that the exports of these was resulting in their destruction. This was a step towards conservation of these endangered species. However, now the list of plants banned for export as raw drug has been reduced to 29 species, and export of formulations using these species has been allowed (see Annex 11).

6.2 The supply crisis

The increasing demand for *ayurvedic* formulations, both domestically and internationally, is putting considerable pressure on the existing resource base. Various studies have indicated the risk of extinction of valuable species due to industrial demand. Jain (1987) identifies 120 medicinal plants as endangered or rare. FRLHT 1997 has identified a priority list of 285 medicinal plant species of south India; Gupta and Chadha (1995) list 35 important endangered spe-

Photo: Neeraj Subrat

Often ayurvedic preparations are multi-ingredient products.

Photo: Neeraj Subrat

Herbal garden of a leading ayurvedic manufacturer.

Photo: Neeraj Subrat

Photo: Neeraj Subrat

Traditional knowledge and modern manufacturing processes give ayurveda its edge.

Achlys triphylla

Aloe vera

Embelia ribes

Saraca indica

Photo: Neeraj Subrat

Asparagus

cies among the medicinal and aromatic plants of India (quoted in Lambert, Srivastava and Vietmeyer 1997).

The north west Himalayas, an important source of medicinal plants, are under considerable pressure due to high demand, and are a case in point. Commercial exploitation is cited as one of the significant reasons for extinction of many species in this area, notably *Arnebia benthamii* and *Aconitum violaceum*.[16] Table 6.6 presents the demand and supply gap for some of the important species found here.[17] Of particular concern here is the fact that

Table 6.6: Demand and supply of medicinal plants in north west Himalayas

Botanical name	*Demand (tonnes)*	*Supply (tonnes)*
Orchis latifolia	More than 5000	Less than 100
Rauwolfia serpentina	More than 5000	Less than 1000
Gentiana kurrroo	More than 5000	Less than 100
Aconitum heterophyllum	More than 1000	Less than 100
Plumbago zeylanica	More than 1000	Less than 100
Onosma bracteatum	More than 5000	Less than 100
Picrorrhiza kurroa	More than 5000	Less than 100
Dioscorea deltoids	More than 5000	Less than 100

Source: Ministry of Health, New Delhi. Quoted in Jain 1987.

[16] This was brought out in a workshop 'Conservation Assessment and Management Plan' (CAMP) organised in April 1998. *Arnebia benthamii* is traded under the name of *Ratanjot* and is used in *unani* and *ayurvedic* medicines. *Aconitum violaceum* is traded under the name of *Bachnag*, whose roots are used as tonic for fever and root pieces used for filling tooth cavities.

[17] This has, in all probability, worsened over the last decade.

since many species are endemic to the region and grow in specific agroclimatic conditions, the possibility of meeting the demand from other regions remains bleak.

One of the leading manufacturers in Kerala, AVS Kottakal, highlighted the problem in obtaining sufficient supply of raw drugs such as *Saussurea lappa, Aconitum heterophyllum, Trichosalles cucumerina* and *Coscinium fenestratum*. Similarly, Bharat Ayurvedic stores noted that *Asparagus adscendes*, *Orchis latifolia*, *Anacycus pyrethrum* etc. are in short supply (Planning Commission 2000). Table 6.7 gives an estimation of the consumption of some of the threatened species. Many of these threatened species are also on the government's negative list, whose export in a crude form is restricted. The estimate is based on (a) actual consumption by selected leading manufacturers for two years; (b) extrapolation of (a) based upon sales of generic *ayurvedic* products drawn from various sources and actual concentration of herbs in generic *ayurvedic* products as per textual formulae; and (c) sales volume as available in ORG data for proprietory *ayurvedic* products and the concentration of herbs declared on labels. The estimate includes herbs being used for domestic as well as export markets.

Table 6.7: Estimation of raw material demand of threatened species

Notified species	*Annual consumption (kg.)*
Aconitum species	11,671
Acorus species	109,760
Aquilaria malaccensis	48,599
Artemisia species	795
Atropa species	1,629
Aristolochia species	6,459

Notified species	*Annual consumption (kg.)*
Colchicum luteum	1,637
Coscinium fenestratum	3,300
Costus speciosus	2,186
Commiphora wightii	68,383
Didymocarpus pedicellata	1,527
Ephedra species	84
Glorisa superba	1,414
Hyoscyamus niger	1,055
Hydnocarpus species	72,645
Orchidaceae species	1,438
Pterocarpus santalinus	15,873
Nardostachys grandiflora	14,228
Rheum emodi	235
Rauwolfia serpentina	11,083
Saussurea lappa	166,849
Strychnos potatorum	23,425
Swertia chirata	23,185
Taxus baccata	23,636

Unabated exploitation of medicinal plants, and its effect on the supply-demand cycle is becoming apparent to the industries. The Planning Commission's estimation of the potential to increase exports from Rs. 660 million in 1986–87 to Rs. 30 billion by 2005

and Rs. 100 million by 2010 should also be studied considering the sources of raw material required for this kind of growth. The export market can influence the demand for a certain species drastically. Species which are exclusively extracted for the export market are often high value-high risk items and extremely vulnerable to fluctuation. They also have very high impact on the availability of the species in the mild. There are innumerable examples of medicinal plants which have borne the brunt of export markets: *Mappia foetida* is a case in point. The wild populations of *Mappia foetida*, a tree species found in the Western Ghats, north eastern Himalayas, Myanmar and Malaysia, has seen alarming decline in the past few years in Karnataka as it is being studied for its pharmacology in India and abroad. Though not used in traditional medicine, the presence of *Campothecin*, an active principle potentially useful in curing tumours has triggered this extraction. This has led to it being assigned the status of 'vulnerable at the regional level'.

Annex 12 gives a list of the medicinal plants in short supply and their demand.

6.3 Coping with the demand supply gap

Efforts are being made by traders, industry, government as well as non-government organisations to cope with dwindling supplies and the threat of extinction. These include attempts to enhance supplies, both *in-situ* and *ex-situ*; reduce demand by using substitutes; diversify the supply base by resorting to imports; and regulate exports.

6.3.1 Using sustainable harvesting methods

Evolving sustainable harvesting methods is much easier for species whose flowers, fruits or leaves are used. However, in common practice even these species are indiscriminately harvested, mainly due

to ignorance and lack of awareness towards conservation issues. Simple measures like leaving behind one third of the roots/rhizomes collected; leaving the smaller, new bulbils while extracting rest of the plant, for regeneration (as in *Aloe vera*); collection of fruits only when ripe and not destroying the trees in the process (*Emblica officinalis*); and not removing all the flowers, could enhance sustainability considerably. There have been very few studies or research on sustainable harvesting methods. The only study in this area has been carried out in Biligiri Rangaswamy Wildlife Sanctuary in Karnataka (see Box 6.2).

Box 6.2: Sustainable harvest of medicinal plants: a case study of Biligiri Rangaswamy Temple Wildlife Sanctuary, Karnataka

The Tata Energy Research Institute undertook a study in the Biligiri Rangaswamy Temple Wildlife Sanctuary to determine what levels of major non-timber harvest of such tree species as *Emblica officinalis*, *Terminalia chebula* and *Terminalia belerica* would be sustainable.

The criteria for selecting the species for study included: (1) The species that are harvested in large quantities by pharmaceutical industries in the sanctuary or elsewhere. (2) Species that represent different parts of a plant. (3) Species that belong to different habitats. The species selected included *Emblica officinalis*, *Terminalia chebula*, *Terminalia belerica*, *Sida cordifolia*, *Sida rhombifolia var rhombifolia*, *Diascorea bulbifera*, *Asparagus racemosus*, *Cinnamomum zeylanicum*, *Decalepis hamiltonii* and *Hemidesmus indicus*. Of all these species, only three are harvested by the Soligas (the local tribe); *Decalepis hamiltonii* and *Hemidesmus indicus* for commercial market and *Dioscorea bulbifera* for subsistence.

The experiments revealed that most of the plants were affected by the harvest. However, two species, *viz. Hemidesmum indicus* and *Dioscorea bulbifera*, did not show any sign of decreasing regeneration due to the harvest. Four other species, *viz. Sida rhombifolia*, *S. cordifolia*, *Decalepis hamiltonii* and *Asparagus racemosus* showed greatly decreased regeneration in the next generation due to the harvest. *Sida rhombifolia* and *S. cordifolia* showed higher regeneration only at 25 per cent harvest, indicating their tolerance of harvest,

whereas *Asparagus* and *Decalepis* showed much lower regeneration at that harvest intensity, indicating their vulnerability to harvest.

It, therefore, became apparent that for the survival of the wild populations, either alternative species should be explored to supplement *Asparagus* and *Decalepis* or their wild population would have to be supplemented by cultivation to minimise collection from the wild. For the other species, it is essential to reduce collection intensities to ensure a sustainable supply.

Source: TERI web site: www.teriin.org.

6.3.2 Substitution of raw material

The *ayurveda* literature prescribes the use of certain alternative species as substitutes in case of non-availability of the species prescribed in the formulations. This practice of using substitutes is increasingly being followed whenever a species becomes scarce or extinct. The drug manufacturers largely depend on Bagbhatt's directions (in *Astanga Hridayam Samhita*) for determining the substitutes. For instance, the eight roots that form ingredients of the drug Astavarga are *jeevaka* (*Microstylis nucifera*), *rishbhak* (*Microstylis wallichii*), *kankoli* (*Roscorea procera*), *kshira-kankoli* (*Roscorea alpina*), *meda* (*Polygonatum verticillatum*), *riddhi* (*Hebenaria acuminata*) and *vridhi* (*Hebenaria intermedia*), which are now very rare in distribution. In the absence of adequate supply of priority species, alternate species such as *bidari-kand* (*Pueraria tuberosa*) is used at present for *jeevaka*, *asgandh* (*Withania somnifera*) for *kankoli*, *kali musli* (*Curculigo orchioides*) for *kshira-kankoli* and *taradi* (*Dioscorea bulbifera*) for *meda* and *mah-meda* roots in the Astavarga drug. Even some of these substitutes are now in short supply. The same is the case for five tree-based roots (out of ten roots) prescribed as ingredients in the manufacture of Dashmool drug; the other five belong to annual/perennial herbs and are relatively easily available (Gupta 1993).

6.3.3 Import of medicinal plants

Indian markets are heavily supplied by plants from surrounding SAARC countries, especially Nepal and Bhutan. The import of species takes place through both legal and illegal means. The trade in medicinal plants from rural areas of Gorkha district was investigated over a two-year period. The annual trade varies from 180,000 kg to 418,000 kg and consists of 36 species. Approximately 98 per cent of these products are exported to India in unprocessed form (Olesen and Hellens 1997) Many plants of Tibetan origin have entered India following ancient trade routes through the corridors of Nepal and Bhutan. Some of the significant medicinal plants imported to India are *Glycyrrhiza glabra*, *Pimpinella anisum*, *Thymus vulgaris*, *Operculina turpethum*, *Cuscuta epithymum*, *Smilax ornata*, *Smilax china* and *Lavendula stoechas*. Annex 13 gives a list of the plants imported and their quantity.

6.3.4 Industry's response to the supply crisis

The soaring export market and increased domestic demand coupled with uncertainty and scarcity of raw materials, adulterated materials obtained through traders, and government restriction on export of some species collected from the wild has encouraged some of the big *ayurvedic* manufacturers to opt for cultivation. Although the inaction of many of the pharmaceutical companies indicates their apparent lack of concern about the depleting resources, some major players have initiated steps in the desired direction (see Box 6.2).

More than 25 companies in the private sector are engaged in nursery development, generation of planting material and seeds, development of agricultural techniques for cultivation of medicinal plants and also initiating and encouraging cultivation of medicinal plants by contracting them to farmers. Annex 14 lists the organisations

(private, government and non-government) engaged in cultivation of medicinal plants, their area of operation and the activities they are undertaking to promote cultivation.

Some of the more important cultivation efforts are part of the research and development programmes developed through company foundations such as Dabur Research Foundation in Gaziabad, Zandu Foundation for Health Care in Mumbai and the Shri Dhootapapeshwar Ayurvedic Research Foundation in Bangalore and Panvel. These companies are involved in the development of methods of cultivation of medicinal plants, in direct partnership with local farmers and tribal women (Srivastava, Lambert and Vietmeyer 1996).

Box 6.2: Dabur on medicinal plants depletion

A statement made by A.C. Burman, Chairman of Dabur Nepal Private Limited in an open letter reflects the emerging understanding of the market leader in the ayurvedic industry (Dabur) of the crux of the problem.

'I am writing this letter from a remote forest in Nepal—the land set up in the lap of snow clad peaks of Himalayas. Every year, I come to these green surroundings to unwind myself. But alas! Every time I find the receding and thinning green cover. I am sure you also share my concerns. Himalayas are a rich source of medicinal plants and herbs. *Ayurveda*—the Indian science of medicine—has documented these herbs and their medicinal properties. In recent years, this rich source of herbs has been extensively used without any effort to replenish it. I found the key to this, would be to provide agricultural technology for cultivation of medicinal plants, make available saplings, provide linkages with farmers and above all financial returns to cultivators.'

An innovative project by Dabur, 'Plant for Life', which aims to develop a sustainable source of medicinal herbs also envisages collaboration with farmers. The project has set up a greenhouse at Banepa, 25 km east of Kathmandu. It consists of 1,500 sq.m of greenhouse, 1,500 sq.m of shade house for hardening and 1.5 hectares terraced area for out-planting. This facility has the capability

to produce 3–4 million saplings per annum. The greenhouse for medicinal plants in Nepal is supported by a three year technology transfer and technical collaboration agreement between Dabur Research Foundation and Dabur Nepal Private Limited. Started in December 1997, the greenhouse is fully operational and developing saplings of twenty medicinal plants, of which eight are on the list of endangered species. The 'Plant for Life' project aims to develop satellite nurseries for demonstration and distribution of the medicinal plants to farmers or other interested groups for transplantation and cultivation. The cultivated plants and/or their products may then be supplied back to Dabur Nepal or any other interested company under a buy-back guarantee programme. The project can serve as a model of collaboration between private industry, developmental agencies and farmer groups for preserving the natural resources and developing sustainable production of a wide range of medicinal plants.

The Arya Vaidya Sala (AVS) at Kottakal, a leading manufacturer of *ayurvedic* products, in addition to maintaining two large herbal gardens has also undertaken research in the propagation of nine species based on its own statistics and experiences with declining availability of plant materials. The results of this are abstracted in Table 6.8. The Arya Vaidya Sala distributed planting materials of economically viable species free of charge to the farmers, as an initial step for encouraging cultivation of medicinal plants. Field inspections and technical inputs were provided at frequent intervals. The farmers were free to sell the harvested raw material in the open market, and in case they faced difficulties in this regard, the Arya Vaidya Sala was prepared to purchase this at the market rate. The main constraints faced by the farmers in undertaking cultivation were long gestation period for some species, distress sales in the case of perishable species, and vulnerability to market fluctuations due to lack of good market information.

Table 6.8: Medicinal plants used in Arya Vaidya Sala's project

Name of the Plant	*Part used*	*Annual consumption in AVS (kg)*	*Economical viability under cultivation*	*Pure or Intercrop*
Baliospermum montanum	Roots	5,000	Viable	Pure as well as intercrop
Ceastrus fenestratum	Fruits	1,500	Not viable	–
Coscinium fenestratum	Stem and roots	10,000	Not viable	–
Crateva magna	Bark and leaves	10,000	Viable	Pure as well as intercrop
Embelia ribes	Fruit	7,500	Not viable	–
Holostemma adakodien	Roots	7,000	Viable	Pure as well as intercrop
Rubia cordifolia	Runners	9,500	Viable	Pure
Saraca indica	Flowers, bark	9,000	Not viable	–
Trichosanthes lobata	Whole plant	13,000	Viable	Pure as well as intercrop

The industry has identified various constraints regarding cultivation of medicinal plants:

- Urbanisation and reduction of fertile soil
- Land Ceiling Acts
- Lack of agrotechnology
- Inadequate support in wastelands development

- Infrastructural issues for research and development
- Economic feasibility

The efforts made by Dabur, Zandu, Indian Herbs, Arya Vaidya Sala, and other pharmacies in cultivation of medicinal plants will go a long way in strengthening the foundation of sustainable supply of raw material from known sources. Since, at present, raw material from farms directly owned or sponsored by industry has a very low ratio compared to overall industrial demand, further research and strategic interventions are required to fill this gap. However, the initiatives of a few manufacturers toward cultivation of medicinal plants cannot and should not be generalised. At best these can be described as knee jerk reactions to difficulties in availability of raw material and to a greater extent a reaction to government regulations on exports. This can be substantiated given that only a few species have been selected for cultivation while over a thousand are being used by the industry. It is also not feasible for the industry to grow the full requirement of medicinal plants on its own. Since the majority of ingredients come from the wild there must be some arrangement between the industry and forest departments to strike a sustainable balance between the usage and regeneration of medicinal plants. There has been no visible initiative either from industry or government in this direction.

6.3.5 Initiatives by the Forest Department and NGOs

In 1991 the Tropical Forest Research Institute at Jabalpur, Madhya Pradesh established a medicinal plant germplasm collection with 550 species of medicinal plants found in the dry deciduous forests of Satpura, Maikal, Vindhya and the Eastern Ghat mountain ranges. These regions contain a large number of medicinal plants used in *ayurveda*. The emphasis is on propagation of large-scale cultivation of species with market potential, and rehabilitation of species on the verge of extinction. The objective of the programme

was to return plants back to their original habitats for *in situ* conservation in collaboration with State Forestry Departments, as well as provide local farmers and pharmaceutical industries with high quality breeding stock.

These efforts were followed up by setting up a state level task force for the development and conservation of medicinal plants with its order No./F/3/90/10–2/94, dated 5 January 1995. This task force, operational under Madhya Pradesh State Minor Forest Produce Co-operative Federation, has started commercial cultivation of medicinal plants in 18 Forest Department nurseries with the help of village forest protection committees and primary cooperative societies. Apart from this, a four year plantation project with an annual target of 400 hectares has been started in Harda, Khargone, Bilaspur, Sagar, Kanker and Mandla districts, with the help of the Ministry of Environment and Forests.

The Forest Research Institute at Dehradun, Uttaranchal, has collected medicinal and aromatic plants of the Himalayan region and is using its nursery at Chakrata and the botanical garden at Dehradun to produce large number of plants. The rare and endangered species *Taxus baccata*, *Picrorrhiza kurroa*, *Nardoctachys grandiflora*, *Orchis latifolia*, *Crocus sativa* and *Bunium persicum* are earmarked for protection.

The Andhra Pradesh Forest Department (APFD) has taken the lead in integration of medicinal plants in the areas under Joint Forest Management (JFM) by raising some of the important species of medicinal plants like *ashwagandha*, *safed musli*, *Aloe vera* etc. in Warangal circle. The integration of JFM and medicinal plants started only in 1998, and was initiated with a view to providing quick economic returns to the VSS (Van Suraksha Samiti/Forest Protection Commitee), especially in degraded areas, where the gestation period for plantations is quite high. The research wing

of APFD has standardised the propagation techniques for about nine species. *Ashwagandha* and *Aloe vera* plantations have been raised on an experimental basis in the VSS areas. The marketing links have been made by contacting pharmaceutical companies. About 70 hectares was brought under medicinal plantation throughout the state in 1999. In the year 2000 it was intended that the programme be extended to more VSS. The Forest Department feels that this is one of the measures of bringing in sustainability in VSS and sustaining the interest of people in JFM.

SASAC (Saint Alphonsus Social and Agricultural Centre), based at Kurseong, West Bengal, collaborated with the herbal pharmaceutical company, ALTHEA, under the Italian and Indian Joint Programme in 1994, for the plantation of *Taxus baccata* in Kurseong area. The objective of the project was to enhance the forest cover with the collaboration of the local people. The West Bengal Forest Department provided SASAC with 257 hectares of reserved forest area in Kurseong for reforestation. The most noticeable part of this project is the direct involvement of farmers, Forest Department and private entrepreneurs (Mudappa and Oomen 1998).

A key organisation involved in mobilising a movement for a policy on medicinal plants conservation is the Foundation for Revitalisation of Local Health Traditions (FRLHT), with headquarters in Bangalore. FRLHT launched one of the most significant medicinal plants conservation NGO efforts in south India through a DANIDA funded pilot project, focusing on both *in situ* and *ex situ* conservation and sustainable use of the region's medicinal plants diversity.

In situ conservation was done through the establishment of a network of 30 medicinal plant conservation areas (MPCAs)—12 in Karnataka, 11 in Tamil Nadu and 7 in Kerala. The MPCAs each average 200 hectares in extent and are located within notified forest

reserves or wildlife sanctuaries, with topographical and altitudinal variations, and which harbour substantial species and genetic diversity. While the management of the MPCAs lies with the Forest Department, people's involvement in the protection of the area has also been attempted through formation of MPCA management committees and the establishment of micro-enterprises in nearby villages. The floristic studies conducted in these areas have resulted in a valuable botanical database on southern Indian medicinal plants.

The *ex situ* conservation component aims more at community involvement and is at the centre of a process of revitalisation of dying and disused local health traditions in the project states. It seeks to compliment the *in situ* efforts through a network of carefully surveyed accessions of wild germplasm, a nursery and live collection of red-listed species of southern India. The *ex situ* network of about 20 community oriented medicinal plants conservation parks (MPCPs) has been established in collaboration with NGOs and research institutions. The MPCPs also aim to promote the sustainable use of medicinal plants and document local health traditions. Another important role is to provide the local people with medicinal plants to meet primary health care needs and impart training to them.

In addition to these activities, FRLHT is engaged in medicinal plant research and development of a database. So far, three Conservation Assessment Management Plan workshops in collaboration with Zoo Outreach Organisation (ZOO), Coimbatore have been organised, in which 142 species have undergone assessment for assignment of IUCN red list categories (Ver 2.2). Other ongoing works include the correlation of classical and botanical medicinal plants; eco-distribution mapping of priority species and standardisation of seed propagation, storage and nursery techniques of selected medicinal species.

Pragya, an NGO, has been working on medicinal plants in the north western Himalayas in the Lahaul and Spiti region. It organises communities for cultivation of medicinal plants. The selection of medicinal plants for cultivation has been done keeping in view the ecological factors including restoration of endangered species as well as the requirements of local monks who practice medication. The organisation has identified 31 species for cultivation, and it is actively pursuing *ayurvedic* drug manufacturers to participate in the project by procuring medicinal plants directly from communities. It is also exploring the possibilities of on-site value addition.

6.3.6 Breaking a commandment: adulteration

In addition to these attempts to address the demand-supply crisis, there is one long-established response that represents an unofficial, illegal response by sections of the industry. The widespread occurrence of adulterants is one of the most striking aspects of the medicinal plants trade, underlining the absence of an effective mechanism of regulation, quality control or standardisation. An 'adulterant' is an entirely different species to the original prescribed, which does not necessarily possess similar properties as the original, but which is passed off as the original. For 6 out of the 12 species selected for study, one or the other form of adulteration is known to occur. The processes employed in producing adulterants are subject to much secrecy. This poses major challenges to any market-based intervention in the trade, as well as to any attempts to integrate traditional medicine into the mainstream health services.

6.4 Cultivation of medicinal plants: solution to what?

'Cultivation', here, is taken to mean the growing or raising of annual crops, generally as monoculture, in fields. Medicinal plants

'cultivation' in this sense is possible where the package of technology and agronomic practices for a species have been worked out and tested. Because trees are not 'cultivated' in this sense, they are excluded from the ambit of the term.

In the newfound enthusiasm for medicinal plants cultivation, the general perception tends to see these as short rotation, herbaceous cash crops that are more profitable than other crops. The cash crop-profit mindset presumes a high input agricultural affair involving irrigation, fertilisers, pesticides, marketing, etc. This limits the 'cultivation' of medicinal plants generally to the well-off/absentee farmer of the Green Revolution genre who can afford to take the risk in view of uncertain markets (see Box 6.3). Even so, the farmer needs incentives to move from an assured market to a risky one. According to *Down to Earth*, a number of studies have shown that the cultivation of medicinal plants can be very lucrative, but at present the cultivator has to take the risk of the whole enterprise him/herself (*Down to Earth* 2001). No systematic work has been recorded for non-industrial medicinal species or of growing these in rainfed polycultures which would be more suited for the vast majority of small farmers.

Box 6.3: Glitter of the 'Glory-lily'

The myth about benefits of cultivation of medicinal plants reaching the rural poor can be understood by taking a look at some data relating to cost-economics of *Gloriosa superba*, a popular medicinal species being cultivated in Salem/ Erode areas of Tamil Nadu. The per acre input cost includes Rs. 40,000 for planting material, Rs. 3,000 for farmyard manure or compost, Rs. 350 for fertilisers, Rs. 706 for insecticides, Rs. 4,340 for irrigation and labour charges of Rs. 2,025. The total works out to Rs. 50,421 per acre, clearly an investment out of the reach of small or marginal farmers. This kind of high input/high-risk venture falls in the domain of the big farmer with resources to enable access to all these inputs.

An analysis of the agro-technologies developed for medicinal and aromatic plants so far by institutions like Central Institute for Medicinal and Aromatic Plants (CIMAP), Indian Council for Agricultural Research (ICAR) and Regional Research laboratory (RRL), Jammu, reveal the underlying pro-industry—big farmer thinking. The question then arises: *Do we cultivate because we have failed to conserve?*

Concerns regarding *ex situ* conservation of medicinal plants (of which cultivation is one possibility) arise from a distinctly different and complicated set of reasons. Most medicinal plants extracted for trade, mainly for the *ayurvedic* and cosmetic industry, today originate from forests. An increasing number of medicinal species are threatened while the availability of still others is reportedly declining. In the face of this accelerating trend, the industries' lack of concern is alarming. For southern India alone, 94 medicinal species have been assessed as being threatened, while 42 species have been assigned threat status in the northern Himalayan states of Jammu and Kashmir and Himachal Pradesh, the only regions for which a conservation assessment was carried out. Collection rather than cultivation dominates the supply to the market.

Tribals and forest-side people have collected medicinal plants customarily for centuries; first, for their own use and later, increasingly, for commerce. Growing industrial demand and extant free riding fuel the severe ongoing over-exploitation of the resource in the wild. Several recent studies show that non-wood forest produce, of which medicinal plants form a very important component, are sometimes the only source of cash income for tribals and forest-side people. Herb collection, as this is synonymously referred to, is thus crucially linked to the livelihood of these people.

It is often erroneously believed that cultivation of medicinal species will contain or reduce this collection pressure on the wild.

6.4.1 Who benefits from cultivation?

The small and marginal farmers would be unable to benefit in view of the high inputs required to sustain productivity, just as at the beginning of the Green Revolution, and for very much the same reasons.

The tribal and forest-side people would continue to collect medicinal plants, legally or illegally, because their cash economy and several livelihood requirements are linked to this activity. Many pharmaceutical companies, especially small-scale ones, would prefer wild collected species because of their putative superiority and lower costs (no cultivation costs are involved) and smaller requirements. Thus cultivation of medicinal plants, while it may meet bulk industrial requirements and benefit large farmers (through economies of scale), it is unlikely to benefit poorer sections of rural communities and may actually further impoverish the tribal and forest-side people.

Therefore, hasty strategies to promote cultivation of medicinal plants run the risk of overlooking the undesired effects such a policy may produce. Measures of *ex situ* conservation that bypass the primary stakeholders in the NTFP economy are unlikely to conserve medicinal plants in the forests over the long term.

6.4.2 Potential target group in a medicinal plants conservation and sustainable use strategy

For the vast majority of our rural people, the conservation (availability) and sustainable use of medicinal plants is intimately linked with meeting their basic health care needs. For tribal and forest-side people the varied and widespread use of medicinal plants is blended into their folk/cultural traditions. These form the largest user group of some 8,000 species of medicinal plants found and reportedly used in the country. Historically, the use of this enor-

mous medicinal plant diversity has been needs based and was therefore largely sustainable.

It was the commercialisation of traditional medicine and the growth in exports that led to severe decline in the resource base. It is this rising industrial demand that has first depleted the forests with impunity and now would have its interests served by high resource cultivation. The argument that cultivation would lessen pressures on the wild is fallacious for many reasons.

Medicinal plants that are required in large quantities (over 10 tonnes dry) by a typical traditional pharmaceutical industry number about 70 species out of a total number of 500 odd plants used. This means that it would be uneconomic to cultivate at least 400 odd species and these would have to be got from the wild. The survival and sustainable harvest of these 400 odd species in the forests and reinforcing the stake of local communities in their conservation is crucial to the well being of the herbal pharmaceutical industry. That, in general, industry is prepared to fund neither research and development nor conservation of its very own raw material resource base, is a matter of grave concern.

6.4.3 'Growing' medicinal plants versus 'cultivation'

Instead of the term 'cultivation' (which has a connotation of single or at the most 2–3 species grown in a monocultural model with irrigation, soil working, fertilisers, pesticides, fencing, high investment, yield per acre and all the other trappings mentioned above), 'growing' medicinal plants in a polycultural model would be more sustainable and less risky. 'Growing' would, as far as possible, replicate the local, indigenous medicinal plants and other species involving not one or two big farmers but a community based organisation of the actual stakeholders like the tribals/women/herb collectors/other rural poor. In this regard the Medicinal Plants

Production Areas being promoted by the Himachal Pradesh Forest Department seem to be promising (see Box 7.1, page 85, for more details).

An experiment along these lines was made with *Aloe vera*, which was promoted as one of 10 to 15 medicinal hedge species and for growing on marginal lands by women savings and credit group members, which was then collectively marketed by READS, an NGO located in Hosur district of Tamil Nadu. It was observed that one plant of Aloe requires about one rupee worth of investment and yields about five kilograms of wet leaf, which fetches around Rs. 5 at Re.1 per kg. If one woman could purchase 100–200 plants from the nursery maintained by the NGO, and grow them for about a year, she could earn around Rs. 800–1,000 per year. The advantages of promoting such a model versus full-fledged cultivation are: it does not displace any agricultural crop; does not require high investment, thereby minimising risk; does not require protection as it is not eaten by cattle; does not require too much water, grows well in semi-arid regions; and it aims at providing supplemental incomes to the poorest women in the village thus ensuring an increased interest in growing and protecting medicinal plants. The basic requirement for such a model to work is that there has to be a prior buy-back arrangement between the NGO and an industry, and the NGO management must have organisational capabilities to run an enterprise of this nature.

7. Institutions and interventions in the medicinal plants sector

A number of international initiatives have raised awareness and interest in the use and conservation of medicinal plants (see Annex 15). Some of these international initiatives support projects concerning medicinal plants in India. Indian organisations with responsibility for the medicinal plants sector are described below.

7.1 Central government organisations dealing with medicinal plants

There are numerous central government departments and ministries with some responsibility for medicinal plants. These include the Department of Indian Systems of Medicine (which falls under the Ministry of Health), Department of Science and Technology, Department of Biotechnology (both under the Ministry of Science and Technology), Ministry of Agriculture, Ministry of Commerce and most important of all, the Ministry of Environment and Forests (MoEF) who are the official custodians of the forests of India, home to most medicinal plants. Table 7.1 summarises the responsibilities of these various ministries and departments of the Government of India. Even within the MoEF there are seven different divisions charged with some responsibility for different aspects of medicinal plants. Table 7.2 details the responsibilities of these different divisions. In addition to the central government,

Table 7.1: Summary of the responsibilities of the various ministries and departments of Government of India regarding medicinal plants

Ministry/Department	*Subject/Area of Work*
Department of Indian Systems of Medicine	Preparation of list of medicinal plants in ISM. Documentation of local health traditions and Indian system of medicine and homeopathy. Encouragement to *ex situ* cultivation. Development of agro technologies.
Department of Biotechnology	Tissue culture and preservation of medicinal plants.
Department of Science and Technology	Bio-technologies, agro-technologies, CSIR germplasm preservations, etc.
Ministry of Agriculture	*Ex situ* propagation of medicinal plants. Development of agro-technologies. Tissue culture and preservation of medicinal plants.
Ministry of Environment and Forests	Conservation of medicinal plants. Identification and notification of threatened species and advice to the Ministry of Commerce to regulate their export. Documentation of ethno-botanical use of medicinal plants. Studies on ethno-biology, survey and identification of plants including medicinal plants by Botanical Survey of India.
Ministry of Commerce	Regulation of export of medicinal plants, plant products or their derivatives as per the advice of MoEF.
State Governments	Collection of medicinal plants from the wild. *Ex situ* cultivation of priority species.

the state governments also have medicinal plants on their mandate. This is discussed in the next section.

While on the one hand the involvement of so many ministries and departments reiterates the complex nature of the resource, on the other hand it is not clear whether any of these actors take overall responsibility. Aside from a recent Planning Commission initiative (Planning Commission 2000), there appears to be little recognition of the importance and potential of medicinal plants both in commerce and in terms of the livelihoods of forest-dependent people.

Table 7.2: Summary of responsibilities handled by different wings of the Ministry of Environment and Forests regarding medicinal plants

Divisions of MoEF	*Areas of responsibility*
Conservation Strategy Division	Convention on Biological Diversity (CBD). Medicinal plant conservation and protection of traditional knowledge. Intellectual Property Rights and community benefit sharing as required under the CBD and the proposed national legislation on biological diversity. Coordinating the activities of TBGRI, FRLHT, Govind Ballabh Pant Institute of Himalayan Environment and Development and the Botanical Survey of India in the area of medicinal plants.
Forest Wing	The regulations under the Indian Forest Act 1927 and National Forest Policy 1988. ICFRE is engaged in research relating to medicinal plants.
National Afforestation and Eco Development Board (NAEB)	A scheme of NAEB on non-timber forest produce (NTFP) to promote *in situ* regeneration of forest produce, which includes conservation of medicinal plants to increase their production and replenish the stock. Local community involvement and value addition.

Divisions of MoEF	*Areas of responsibility*
Wildlife Division	CITES[18] to regulate export of trade in threatened and endangered species of plants and animals including medicinal plants. Conservation Strategy Division represented in the committee for negative list.
Research and Education Division	All India Coordinated Project on Conservation of Endangered Plant Species—Seed Biology and Tissue Culture Programme. All India Coordinated Project on Ethno-biology, etc.
International Cooperation Division	Co-ordination of Global Environment Facility and UNDP programmes. Projects on medicinal plants funded to NGOs.
Botanical Survey of India	Preparation of Red Data Book on threatened and endangered species of all Indian plants including medicinal plants.

7.2 State level organisations

The status accorded to medicinal plants in the state policies differs from one state to another. But one aspect is common; none of the states has incorporated 'medicinal plants' in a manner that reflects their enormous socio-economic-ecological significance. There is no consolidated, central level policy study available comparing the legal status of medicinal plants across the states. TRAFFIC-India is currently engaged in a study that tries to address this gap. However, states like Madhya Pradesh and Himachal Pradesh have shown some initiative in according the deserved status to medicinal plants in their policy framework. Madhya Pradesh has constituted

[18] CITES: Convention on International Trade in Endangered Species

a Biodiversity Board for conservation and sustainable use of biodiversity, which takes medicinal plants into special consideration. The Madhya Pradesh Minor Forest Produce Federation (MFPFED) is engaged in conducting studies as well as improving the benefits accruing to the collectors and forest-side people. Himachal Pradesh has also initiated concrete measures addressing the various issues relating to medicinal plants conservation and sustainable use. Medicinal Plants Production Areas in the state are promising models for replicating in other areas, addressing issues of conservation, equitable distribution of benefits as well as sustainable supplies for the consumers (see Box 7.1).

Box 7.1: Medicinal Plants Production Areas in Himachal Pradesh

Medicinal Plants Production Areas (MPPAs) seek to combine both *in situ* and *ex situ* approaches towards the production and sustainable harvest of medicinal plants grown in forest/community lands. Areas that can be effectively closed (not necessarily fenced), are suitable for indigenous medicinal species, and are located in the immediate vicinity of villages or habitations can be selected as MPPAs. These can also be areas that have already been closed under JFM/SVY (Sanjhi Van Yojna). In the latter case, a clearly identified community/ user group within the Village Forest Development Committee (VFDC) or the whole of the VFDC can be associated with each MPPA. This group will be responsible for the protection and later share the benefits that accrue from the area.

In the MPPA, to begin with, 4 to 5 high value medicinal species that are in good demand are short-listed. The ones suitable for the area and which are easily grown are then raised in nurseries and later planted out in the selected sites. In the case of existing VFDCs such sites can be already closed areas that are being managed under JFM. This will not only save money on fencing but also afford greater protection to the area and be more manageable.

It is important that when such an area is so used and the MPPA work allocated to a particular user group within the VFDC, a clear written arrangement for sharing usufructs or other monetary benefits is spelt out and understood by

all the immediate stakeholders in the endeavour. The FD and the VFDCs need to be signatories to such a written agreement.

One of the strengths of the MPPA concept over conventional JFM is that the returns through short rotation herbal species from the closed areas can be quick enough (12 to 24 months) and substantial enough (high value species) to promote and sustain public/immediate stakeholder interest in the scheme.

7.2.1 Tropical Botanical Garden and Research Institute, Kerala

Located near Thiruvananthapuram in Kerala, Tropical Botanical Garden and Research Institute (TBGRI) is a governmental research institution with the objectives of conservation of tropical plant genetic resources and development of strategies for their sustainable use; carrying out botanical, chemical and medicinal research for plant improvement and utilisation; organisation of germplasm collections of economically important plants, especially medicinal and aromatic plants; and acting as an all-India coordination centre for research projects on ethno-biology.

TBGRI maintains a national database on ethno-biology and ethno-medicine, for documentation and utilisation for scientific, developmental and industrial purposes.

Activities include *ex situ* conservation of various tropical plants, for example, the establishment of a national gene bank of medicinal and aromatic plants, with root cultures, and through micro propagation of rare and endangered medicinal plants. Various research projects on ethno-biology are undertaken. Medicinal plants are screened for the detection and isolation of active compounds. Ethno-pharmacological studies aim in particular at the detection of antibacterial and anti-fungal activities; for instance, anti-microbial and pesticidal compounds were successfully isolated from wild mushrooms. Biodiversity is evaluated through bio-prospecting.

7.3 Need for nodal agencies and a national forum

Section 6 referred to some of the organisations and industries that are involved in the field of cultivation and conservation of medicinal plants. There is a whole host of such organisations and institutions that exist but are not documented or even known to each other.[19] In addition, there are a host of organisations, both at the central and state level, that are involved in medicinal plants trade.

The operations of NGOs and communities are mostly at a micro level and it is generally difficult for them to develop working relations with industry. There is a strong need for a nodal agency which can help to develop a viable business relationship between the collectors/cultivators and manufacturers. Such a nodal agency can work as a platform for the benefit of both the collectors/cultivators and manufacturers. Three of the major concerns that such an agency would have to address relate to the provision of credit to the collectors/cultivators, arranging collective storage facilities and the quality perceptions by the industry. The traders usually provide 30–60 days credit to the collectors. The nodal agency will have to make some similar or alternate arrangements to take care of the credit needs of the people. Making provisions for storage so that the cultivators/collectors can hold on to the produce while the market price increases can substantially increase their profits.

The lack of co-ordination between various stakeholders and regulators has greatly affected the development of the medicinal plant sector in the country. Most often some activities are taken up by an agency at the local level, without considering its integration with planning at a larger scale. Even in the case of national level

[19] Currently a team of entrepreneurs of a newly formed company called the Green Infotech, New Delhi is involved in bringing out a directory containing at least 15,000 addresses of the people and institutions involved in the medicinal plants trade. This is the first systematic attempt of its kind concerning this trade.

planning there has been hardly any significant co-ordination between cultivators/collectors, industry and government agencies. The ban on export of certain plants and their formulations is a good example. The export of certain species was banned, although the number of plants in the list of banned items was subsequently reduced when the industry voiced its own concerns (see Section 6.1.2). The watered down version of the ban that now exists might not be enough of a protection against the over-exploitation of these resources. In order for effective solutions to be developed that look at the various aspects of development, usage and regulation of medicinal plants, it is strongly felt that there should be a forum at national and state level. It should act as a platform for co-ordination between various stakeholders and regulators.

In November 2000 a Medicinal Plants Board was established by the Department of Indian Systems of Medicine and Homeopathy under the Ministry of Health and Family Welfare, comprising representatives from government, trade, marketing, pharmaceutical industry and medico-ethnobotany. Cultivators, researchers, non-governmental organisations and state governments are also expected to play a crucial role in the funtioning of the Board. This Board will decide on such incentives, besides deciding on conservation and collection of raw materials, legal issues and patents (*Down to Earth* 2001). It is possible that this Board will fulfil some of the functions of the national forum described above, though it is yet early days.

8. Sustainable management and development of medicinal plants

As illustrated in earlier sections of this study, there is increasing demand for medicinal plants in both the domestic and export markets, and consequently a mushrooming of processing units, both licensed and unlicensed. The scale of consumption of raw material, particularly by unlicensed units, is very difficult to assess—as is both the quality and source of that raw material. But it is reported that some species have already become extinct through over-harvesting, and other species are endangered. Hence the need to develop and maintain a sustainable supply from known sources presents a major challenge.

Short-term solutions to supply problems appear to be limited. Cultivation is appropriate for only a limited number of species and will not, in any case, prevent collection from the wild. Collection from the wild represents an important aspect of the livelihoods of the collectors, who are typically from poor and/or tribal populations. Whilst collectors generally receive a very small proportion of the final selling price of the herbs, the local agents/traders to whom they sell the herbs frequently provide much-needed credit, in cash or in kind. Lack of organisation among collectors, and lack of information available to them, also limits short-term solutions. The potential for further organisation at the community/collector level needs to be explored, as does the possibility of ensuring better returns to primary collectors through value addition at the local level.

Apart from shortage of supply, the industry's primary concern is the quality of the raw material: this alone presents a major challenge given the prevailing extent of secrecy and adulteration of herbs. Despite the growing demand and consequent depletion of stock in the wild, efforts made by government or industry to conserve, regenerate and propagate medicinal plants are very limited compared to the scale of the problem. In fact, currently in domestic trade, it is not compulsory to show the source of origin of the plant, whether it is cultivated or collected from the wild (*Down to Earth* 2001).

Organisation and control of production may also be encouraged if consumers or retail buyers express preference for supplies that derive from socially and environmentally sustainable production. While it may be some time before the extent of such preferences encourages large-scale changes in production, this paves the way for the introduction of market based instruments as a mechanism for meeting consumer demand and ensuring sustainable production.

8.1 Towards sustainable management of medicinal plants

It is clear that in order to move towards a system of sustainable management of medicinal plants, a number of aspects need to be addressed. Some of these are summarised below.

- Better information on the current status and potential production of medicinal plants, both those that are cultivated and those that are collected from the wild, is required as a baseline from which to estimate trends in production. This is necessary before strategies for sustainable production can be developed. Current information on production potential, means for, and limits of sustainable extraction, number of units manufactur-

ing the products and their raw material requirement, use by local *vaidyas*, etc. needs to be brought together.

- Supply chain information is currently poor, and notoriously difficult to obtain given the non-transparent nature of the trade. Collectors are generally not aware of the market prices of plants beyond the price paid by the local agent, and have no bargaining power. In fact, it appears that at each stage of the chain, the various actors involved have little knowledge of prices paid further along the chain. Improving the information may help the collectors to get a better share of the final price of the plants, thereby increasing their stake in sustainable management.
- There is potential for organisation of collectors at the local level. Promising models for local organisation of medicinal plant collectors are already being developed and may serve to reduce the risk in business and degree of dependency upon traders to which collectors are currently vulnerable. Such organisation might also provide possibilities for mutually enforced codes of collection and for associated marketing benefits. Development of local institutions, with external facilitation and micro-credit assistance provided to primary collectors will support the development of micro-enterprises. This may enhance the bargaining power of primary collectors and shorten the supply chain—although it is likely that local agents will still have a role to play. The Small Industrial Development Bank of India (SIDBI) has several such schemes of extending micro-credit facilities for enterprise development. Small-scale value addition options, which can be carried out at primary collector's level and community level, will yield better results and ensure sustainable management and development of resources.
- The legal and administrative structure pertaining to medicinal plants can also play an important role in sustainable

management. Regulatory mechanisms that control the extent and nature of extraction can ensure that plants are sustainably harvested, while government support prices (or other incentives) can help ensure a fair share for the primary collector/ cultivator.

- Means for ensuring quality are of concern to the industry and to consumers. There is a need for some system of quality control to be developed. Apart from ensuring the quality of raw material of correct botanical specifications, it is also necessary that the ingredients listed on *ayurvedic* products be actually used in the specified proportions.
- Another quality related aspect pertains to the preservation of the harvested raw material. Many species are harvested during the monsoon period and the moisture in the atmosphere makes the harvested raw material susceptible to fungal attacks. Currently there are practically no facilities or methods available at the collector level that prevent the raw drug from getting a fungal attack. The raw material either gets thrown away or, as is often the case, infected raw material is used in the final formulation. Any research undertaken on the preservation of the raw drug will hence go a long way in quality- and waste-control.
- The increasing involvement of casual untrained labour in the collection of medicinal plants from the wild is resulting in the use of unscientific harvest practices that are damaging to the plant as well as the environment. There is a need to not only impart scientific training to harvesters but also to educate them about the short-term and long-term advantages of following harvest practices that do not damage the plants in the long run.
- Support to small and marginal farmers to undertake cultivation of low-risk medicinal plants cannot only help bring marginal

lands under cultivation but also increase production as well as improve returns to these farmers. This will, at least in some cases, reduce pressure on forest areas to meet income needs of the dependent communities.

8.2 Relevance and application of criteria and indicators

The development of criteria and indicators for the sustainable management of the forests or other landscapes in which the medicinal plants are found can help to define good practice, and can be applied to measure progress towards sustainable management. Application of criteria and indicators for sustainable management and supply of medicinal herbs to industry may help to address some of the needs identified above. But it has to be driven by voluntary approaches of collectors (generally the weakest party), by regulations (dependent on enforcement capacity) or by buyers (who will probably want proof of sustainable management through third party certification).

In addition, use of processes such as 'Conservation Assessment and Management Plan' (CAMP) would reveal the conservation status of different species.[20] This could comprise the baseline information necessary for developing an action plan for reestablishing a viable population of medicinal plants *in situ*, as well as proposing measures for *ex situ* propagation.

There are various certification systems that can be applied to different stages of the production of *ayurvedic* preparations. The World Health Organisation (WHO) has prescribed Good

[20] CAMP exercises have been designed and developed by the Conservation Breeding Specialist Group (CBSG) of the IUCN as a way of carrying out rapid 'threat status assessment' of each prioritised taxon.

Manufacturing Practices (GMP) as an indicator for certified products: GMP could be applied to the processing and production of formulations. For raw materials that are cultivated, certification of Good Agricultural Practices (GAP), also prescribed by WHO, is applicable: this means it must adhere to permissible limits of inputs like fertilisers, pesticides etc. If the raw material is collected from forests, certification of Sustainable Forest Management is appropriate. All three systems provide necessary indicators that the product is a result of sustainable practices and that it is based on accepted manufacturing norms that would also include the quality of raw material. Thus the relevance of criteria and indicators for certifying raw material and products.

The application of criteria and indicators for certification of raw material and products would primarily benefit the collector and the end-user. The market value—or more probably, market access—for certified products would be greater if the industry could get sustained supply. So, while overall volumes of plants harvested under sustainable management would likely be lower, the price and market access would be enhanced.

At present it is unlikely that certification of medicinal herbs will be feasible in India, except where collection/cultivation areas are subject to control by a recognised 'manager'.[21] If, in due course, it is applied, it may add to the cost of raw materials and may be reflected ultimately in the price of the products. However, this will ensure ecological, social and economic sustainability.

Initially, there could be scope for a voluntary code of practice,

[21] The first few cases where a private producer has sought certification were reported in 2001. Two of these pertain to bamboo plantations and the third to *Acacia nilotica* plantations. Teddy Exports, a company based in Madurai, which exports wooden products (such as body massagers) to Body Shop International Plc has sought independent Forest Stewardship Council certification from Soil Association, United Kingdom. The company's wooden products are produced using *Acacia nilotica* wood obtained from tank foreshore plantations.

complemented by education of both consumers and producers. Criteria and indicators can help to show what is good practice, and can be applied as a means of measuring progress towards that good practice. However, the current extent of the illegal trade seems to be so great that application of criteria and indicators would make little difference to the overall trade—unless it is market-driven.

8.3 Identification of draft criteria and indicators

A set of 8 criteria and 43 indicators has been developed for sustainable forest management in India, through a process known as the 'Bhopal-India Process'. The Task Force report on this subject has already been submitted to the Government of India, which has now initiated action to apply them to different forest types of India. As described above, the bulk of the supply of medicinal plants comes from forest areas and it is largely in the forest areas that the plants are threatened due to unsustainable extraction and use practices. Thus the concern of sustainable management of medicinal plants can broadly be addressed by using criteria and indicators approach for ensuring sustained supply of forest goods and services.

From the set of 8 criteria and 43 related indicators of the Bhopal-India Process all the 8 criteria and 32 indicators can be applied exclusively to the sustainable management, development and use of medicinal plant resources. These are given in Table 8.1.

With the help of criteria and indicators, the status of medicinal plants in relation to their contribution to the well-being of humans and ecosystems can be measured in sample areas, trial sites or—best of all—forests subject to certification, where their status can be correlated with production figures. With baseline data, subsequent measurements will indicate the direction of change leading to well being (or not) of humans and ecosystems.

Table 8.1: Draft criteria and indicators for sustainable management and supply of medicinal plants

Criteria	*Indicators*
1. Increase in the extent of forest and tree cover	1.1 Area of dense and open forest 1.2 Area under JFM
2. Maintenance, conservation and enhancement of biodiversity	2.1 Area of protected ecosystems 2.2 Area of fragmented ecosystems 2.3 Number of rare, endangered, threatened and endemic species 2.4 Level of species richness and diversity in selected areas 2.5 Availability of medicinal and aromatic plants in various forest types 2.6 Status of non-destructive harvest 2.7 Number of keystone and flagship species in various forest types
3. Maintenance and enhancement of ecosystem function and vitality	3.1 Status of natural regeneration 3.2 Extent of secondary forests with medicinal plants 3.3 Incidence of pests and diseases, weed infestation, grazing and fire
4. Conservation and maintenance of soil and water resources	4.1 Extent of ground cover 4.2 Area under watershed treatment 4.3 Soil erosion status
5. Maintenance and enhancement of forest resource productivity	5.1 Growing stock of keystone and flagship species 5.2 Volume of production of identified/ important medicinal plants
6. Optimisation of forest resources utilisation	6.1 Aggregate and per capita consumption of medicinal plants 6.2 Import and export 6.3 Recorded removals

Criteria	*Indicators*
	6.4 Direct employment in conservation, development and extraction 6.5 Direct employment in *ayurvedic* industries 6.6 Level of processing and value addition
7. Maintenance and enhancement of social, cultural and spiritual benefits	7.1 Degree of people's participation: number of committees and area protected by them 7.2 Use of indigenous knowledge 7.3 Human development index 7.4 Extent of cultural/sacred protected landscapes: forests, trees, ponds, streams, etc.
8. Adequacy of policy, legal and institutional framework	8.1 Existing policy and legal framework for conservation, extraction and utilisation of medicinal plants 8.2 Enabling conditions like JFM resolution, transit rules etc., for participation of communities, NGOs, civil societies 8.3 Level of investment and priority for research and development of medicinal plants 8.4 Human resource capacity building 8.5 Status of information dissemination and utilisation

8.4 Potential and constraints regarding applicability of criteria and indicators

Application of the set of criteria and indicators appears to be a potentially reliable means of measuring the success of conservation and development measures, as it can simultaneously assess social, economic and ecological factors concerning medicinal plants. With the use of tools like criteria and indicators on specific cases, the value of medicinal plants in all three dimensions would be

highlighted. This would also enable an assessment of their social and economic contribution to local livelihoods and economies. Despite its rich cultural and biological diversity, indigenous knowledge and practices, India's contribution to the global herbal medicine market (as compared to China, for example) is very low. Measurements using criteria and indicators will provide a mechanism for introspection to boost sustainable availability and export of medicinal plants.

Measurement of all indicators may have some limitations, as all of them cannot be measured in one go. According to their measurability, they can be grouped into three categories (i) those which can be measured from the existing secondary sources of information, (ii) those for which information can be gathered from the field with little effort, and (iii) those which may require long-term research. In the early stages the indicators of the first group and some of second group can be measured. As resources develop and the potential of medicinal plants grows, the third category of indicators can also be measured through investment in research and development.

However, application of criteria and indicators and the potential development of a system of certification would not be welcomed by some of the actors in the medicinal plants trade. An unorganised market definitely makes better business sense to the traders and agents. There are no bills involved, no policies, forest officials are easy to please and local communities have no option but to further their business interests. Traders and agents literally control the market prices (*Down to Earth* 2001). Hence there is little incentive to support efforts to streamline market transactions. The identification and organisation of buyers who demand certified products offers the most likely means of encouraging a more sustainable system.

8.5 Potential agencies to monitor indicators and certify the system as sustainable

Third party certification is essential for market reward. For example, institutions like the Indian Institute of Forest Management, Bhopal, can act as an impartial agency for such work—and further training in certification issues is being imparted under the WWF/World Bank Alliance initiative. A number of NGOs and other autonomous institutions in different parts of the country can be identified to undertake certification. The development of group certification schemes will help to lower the cost of certification.

9. Recommendations

This section presents some recommendations relating to the sustainability of forests and other landscapes from which medicinal herbs are extracted, the livelihoods of those involved in collection and cultivation, and to the sustainability of the *ayurvedic* industry itself. As illustrated elsewhere in this report, the production and processing of *ayurvedic* plants is highly complex and there are many aspects where improvements might be made. The recommendations that follow constitute some initial thoughts as a result of this study; further research is clearly necessary in a number of areas.

Assessment of the resource and current level of utilisation

- While an inventory for timber and fuel production is carried out at frequent intervals, there is no such inventory for medicinal plants. In view of the growing economic, social and ecological importance of medicinal plants, it is essential that inventory methods be evolved through research and development. Commercially important medicinal plant resources should be inventoried to get the picture of production potential, their conservation status, use practices, etc.
- There is currently no mechanism to accurately estimate the quantum of medicinal plants used by the *ayurvedic* industry. A comprehensive survey of the quantum of medicinal plants used, along with the sources of supply, should be carried out. A ready reference guide for correlating trade names of medicinal plants

to their botanical names should be prepared to help in estimating the volume of trade of different species.

Measures to control unsustainable harvests and improve production

- Unsustainable and destructive extraction has been widely reported. In the absence of full knowledge of sustainable harvesting regimes for different products, at least 50 per cent of the fruits, roots, leaves, flowers and other materials collected should be left on the plant for future regeneration.
- There is a need to control premature harvesting of products such as fruits of *Emblica officinalis*. An initiative in this direction in Madhya Pradesh has shown positive results.
- Value addition and processing at the collector level should be encouraged so that the collectors can earn the same amount of income from much less quantity.
- Direct link between the processing industry and primary collector/cultivator should be encouraged.
- Forest areas from where medicinal plants are extracted should be brought under sustainable forest management practices. Application of criteria and indicators, developed under the Bhopal-India Process, will help to track progress towards sustainable forest management. In particular, the proposed 8 criteria and related 32 indicators of relevance to medicinal plants may be applied with suitable local modifications.
- Application of criteria and indicators is most likely to be effective if it is market-driven. It may be more realistic to start with a voluntary code of practice for the production of *ayurvedic* medicines, complemented by education of both consumers and producers. However, it depends upon industry and/or consumer organisations to initiate this. The identification and organisation of buyers who demand certified products would ultimately bring greater market access and higher prices for industry, and

assured quality for consumers. The current thrust of the Planning Commission on increasing the exports of the *ayurvedic* formulations should be used as opportunity for exploring niche markets for certified *ayurvedic* products.

- Given that the collection and trade of medicinal plants are highly unorganised at the local levels, it is recommended that local level institutions such as FPCs need to be strengthened, so that the cultivation and conservation of medicinal plants may be integrated into the JFM arrangements. With proper micro-credit facilities and training, micro-enterprises can be developed by these FPCs. A few initiatives in this regard have already been started in some states.
- At present, export of prohibited plants (29 species including 18 mentioned in Appendix I and II of CITES) is possible if these are present in some formulation (as against raw form) or if the label of the formulation does not mention the name of the species. This policy should be urgently reviewed.

Cultivation

- A comprehensive review regarding the current status of cultivation of medicinal plants in the country should be carried out. Existing bottlenecks being faced by farmers as well as companies should be identified and removed.
- Large-scale cultivation of important medicinal plants has been tried in different regions of the country. These practices have often used very heavy doses of inputs such as chemical fertilisers, pesticides, etc. There is little information on the likely impact of these inputs on the medicinal properties of the plants. Until the results of further research on such impacts become available, large-scale cultivation should be taken up with caution. It is recommended that the certification criteria of WHO (GAP: Good Agricultural Practices) be applied for the products from *ex situ* sources.

Institutional responsibility for medicinal plants

- There is a plethora of organisations dealing with various aspects of medicinal plants. There is a need for a nodal organisation at national level to bring together various stakeholders and to deal with the entire range of issues pertaining to medicinal plants. It is hoped that the recently constituted Medicinal Plants Board would fulfil this role.
- In the absence of specific legal and policy provisions pertaining to conservation, development and utilisation, much unsustainable harvesting and other malpractices (adulteration, premature harvesting, use of substandard raw material, lack of scientific validation-certification etc.) are going on. The Medicinal Plants Board should frame appropriate legal and policy frameworks to address these problems. The Medicinal Plants Board will have to work closely with the proposed National Biodiversity Authority and the State Biodiversity Boards in this regard. The emphasis should be on facilitating sustainable harvests and management methods instead of merely regulating production and supply.
- It is generally felt that, despite the impacts of the supply crisis, industries are not showing adequate concern towards conservation and sustainable supply of raw material and the well-being of collectors. It is recommended that the proposed nodal agency should bring together all interested parties i.e. the government agencies (Forest and Agriculture departments), industries, collectors/growers, NGOs etc. The nodal agency should ensure flow of information and develop participatory approaches for future development. It must be realised that it is in the interest of all stakeholders and the country that the science of *ayurveda* flourishes and its returns are shared by humanity at large, nationally and internationally.

Annex 1: Study terms of reference

The broad objective of the study is to determine what market-based instruments might enable the *ayurvedic* industry to contribute to the sustainable management of medicinal plants. The study should specifically assess the potential and applicability of market-based instruments for (i) ensuring a sustainable supply of high quality medicinal plants of known origin to the *ayurvedic* industry; and (ii) ensuring economic benefits for cultivators/primary collectors.

Phase I: an overview of the *ayurvedic* industry in India, especially in relation to its raw material (i.e. medicinal plants) consumption.

- Estimation of the number of units of *ayurvedic* industries and their financial turnover (small/medium/large; organised/unorganised sector). Overview of the structure of the industry.
- Estimation of volume of raw material (medicinal plants) involved.
- Sources of raw material (forest/cultivation/import).
- Trends observed in the consumption of raw material (quantity and quality) by the *ayurvedic* industry and projection for future.
- Estimation of volume and nature of export of medicinal plants and processed medicinal products over the years and likely future trend. Where are the main export markets?
- Perception of the *ayurvedic* industry of fast-depleting plant resources and the thinking about future raw material supplies. Is there concern within the industry for future availability of raw material resources?
- Efforts made by the *ayurvedic* industry (especially major companies) to take up cultivation/plantation of medicinal plants. Efforts at collaboration with cultivators/collectors. What has been the experience?

- Efforts made by the Forest Department and NGOs for the cultivation and propagation of medicinal plants, especially by involving the tribal and other rural communities. What has been the experience?
- Identification of selected medicinal plants/raw materials to be studied in detail along the supply chain on the basis of criteria such as scarcity/ abundance, seasonality, perishability etc.

Phase II: a study of pricing, value addition and information flow mechanisms at different points in the supply chain ranging from the primary collector/ cultivator to the processing industry.

- Pricing at different points in supply chain from the primary collectors/ cultivators to the processing industry for identified raw materials. Share of players at different points in the supply chain out of the price paid by the processing industry.
- Value addition at different points in the supply chain (also investigate the nature of value addition e.g. does it need substantial capital investment or technical expertise?).
- Relationship and information flow between different players in the supply chain, specifically looking into collectors/cultivators and industry's access to each other. How this proximity or absence of it is influencing the present supply chain. What is the role of middlemen and contractors?
- Potential and constraints of primary collectors/cultivators coming together in the form of cooperative, Forest Protection Committee etc. so as to enhance the scale of operation and bargaining power. Previous experience (if any) available from the sites.
- Viability of value addition at local level. Previous experience (if any) available from the sites.
- Possibilities for shortening of supply chain.
- Possible interventions at the level of communication channels to enhance information flow among collectors/cultivators and also between collectors/cultivators and the *ayurvedic* industry.

Phase III: an investigation into the possibility of application of market-based instruments to ensure supply of sustainably managed medicinal plants to the *ayurvedic* industry and better returns for primary collectors and/or cultivators.

- Relevance of developing criteria and indicators and certification for medicinal plants. Who will it benefit?

- Identification of draft criteria and indicators for sutainable supply of medicinal plants to the *ayurvedic* industry.
- Potential and constraints regarding the applicability of identified criteria and indicators for certification of sustainably managed medicinal plants.
- Possibilities for simplifying supply chain including possibilities for partnerships between industry and collectors.
- Potential impact of certification on the domestic as well as overseas market-views of industry as well as consumers. Is there a demand for certification in the export market?
- Potential agency to monitor these indicators and certify the system as sustainable.

Annex 2: Questionnaire sent to industry

Name of the company

Annual turnover 1999–2000

No. of medicines being manufactured

What are the sources of medicinal plants?
Please tick

Traders

Collectors

Government Depot/Agencies

Contract Cultivation

Own Cultivation

Grade the convenience of availability of Medicinal Plants.

Please tick the appropriate box

Very difficult	Difficult	Normal	Convenient	Very convenient

If it is difficult to get raw material, please grade the enormity of problem areas between 1–5, where 1 is minimum

Problem Area	Grade of Enormity
Availability	
Quality	
Price	
Adulteration	
Any Other	

Did industry ever feel that it is not able to procure certain species?

Which species and when?

What reasons, does the industry feel, have been responsible for non-availability or scarcity of certain species?

How has industry coped with this scarcity (various mechanisms adopted by industry for different species from time to time)?

Has there been abnormal escalation of prices for certain species at certain period or over the years? If yes, for which species and what can be the possible reasons for this.

Can there be any problems in sustained supply of raw material? If yes, what can be the problems in sustained supply of raw material to the industry.

What steps the company has taken to deal with the problem of raw material (medicinal plants)?

1

2

3

Is cultivation one of the options the company has selected to deal with the problem of medicinal plants?
Yes /No

If cultivation is one of the options, has it been already started?
Yes /No

If the company has selected cultivation, is it/will it be

Own cultivation

Contract cultivation

Both the above

If the company has already started cultivation

When was cultivation started?

Location of cultivation area

Total area under cultivation

Area reduced or increased under cultivation and why?

No. of species grown and area under each species.

Quantities of different species produced at present.

Are the species under cultivation being also procured from outside?

If yes,

Why not all the quantity being purchased from outside? Or vice versa. What are the constraints in cultivating the required quantity of a particular species?

Also compare in following format

Name of species	Quantity from cultivation	Quantity purchased

Is there any plan for enhancement or downscaling for direct cultivation by the company and why?

What are the strengths of self-cultivation perceived by the industry?

What are the constraints felt by the industry in cultivation?

What has been the experience of cultivation *vis-à-vis* raw material supply?

What are the factors that influence the choice of species for cultivation?

Any cost analysis or any other kind of study being taken by industry itself or through some one else on cultivation aspect.

Is any of cultivated species banned by the government for collection from forest areas?

Is industry also cultivating with research institutions for technical knowhow? If yes, with which institutions?

Any other govt.(Forest Department), non govt. or private enterprise involved in cultivation of medicinal plants known to company.

Does cultivation ensure supply of raw material?

Annex 3: Background to the *unani* and *siddha* system of medicine

Unani system

The *unani* system of medicine was introduced in India by Arabs and Persians from Greece where it originated between 460 BC–377 BC. According to Hippocrates, disease is a normal process and its symptoms the reaction of the body to the disease. The body has four humours namely Blood (*Dam*), Phlegm (*Balgam*), Yellow bile (*Safra*) and Black bile that keep the equilibrium. The humours have specific temperament and the temperament of a person is expressed as being sanguine, phlegmatic, choleric and melancholic according to their level in the body. The system believes in the presence of some self-preservation mechanism in human body. The diagnosis and treatment are based on the concept of temperament and changes in temperament are related to changes in the balance of humours. Drugs are made of herbal, animal and mineral origin. The drugs stimulate and strengthen the defence mechanism and normalise the imbalance.

Siddha system

Siddha means achievement or perfection. *Siddhas*, saintly figures who achieve excellence through the practice of *yoga*, promoted the system in Tamil Nadu. The manuscripts are in Tamil. It is believed that eighteen *Siddhas* contributed towards the development of *siddha* medicine. It is largely therapeutic in nature.

The principles and doctrine of this system are similar to that of *ayurveda*. The difference is basically linguistic. According to this system, the human body is the replica of the universe, as are the food and drugs, irrespective of their origin. This system also accepts the five-element theory and the *tridosha* theory as in *ayurveda*. The diagnosis involves identifying causes by examining pulse, urine, eyes, voice, body colour, tongue and the state of the digestive system (ITCOT 1999).

Annex 4: Important medicinal plants used in *ayurveda*

Plant	*Sanskrit name*	*Main indications/effect*
Acorus calamus	Vacha	Nervine, antispasmodic, sedative, stomachic, expectorant, laxative, diuretic
Artemisia absinthium	Indhana	Anthelmintic
Artemisia vulgaris	Nagadamni	Anthelmintic, expectorant
Asperagus racemosus	Shatavari	Antispasmodic, antidiarrhetic, demulcent
Azadirachta indica	Neem	Skin disease, antibacterial
Bacopa monnieri	Brahmi	Nervine tonic, diuretic, sedative
Boerhavia diffusa	Punarnava	Diuretic, expectorant, laxative
Boswellia serrata	Shallaki	Antiarthritic, analgesic, anti-inflammatory
Buchanania lazan	Piyala	Skin disease, laxative
Butea monosperma	Palasa	Diarrhea, flatulence, anthelmintic
Callicarpa macrophylla	Pringu	Joint pain, skin disease, blood disease
Calotropis gigantea	Alarka	Bronchitis, diarrhea, cancer

Plant	*Sanskrit name*	*Main indications/effect*
Cannabis indica	Bhang	Insomnia, dysmenorrhea
Capsicum annum	Katuvira	Rubefacient, stimulant
Carum carvi	Krishnajira	Flatulence, stomachic
Carum copticum	Ajwayan	Spastic bowel, flatulence, dyspepsia
Cassia angustifolia	Markandika	Constipation, liver disease, joint pain
Cassia fistula	Argbhada	Ringworm, constipation, fever, antibacterial
Cedrus deodara	Devdaru	Fever, diarrhea, urinary disease
Centella asiatica	Mandukparni	Sedative, alterative, anxiolytic
Cichorium intybus	Kasni	Emmenogogue, digestive
Cinnamomum camphora	Karpoor	Diarrhea, nervousness, muscular pain, fever
Crocus sativus	Kumkuma	Nervine sedative, emmenogogue, aphrodisiac
Cinnamomum zeylanicum	Twak	Dyspepsia, flatulence, diarrhea, menorrhagia
Cissampelos pareira	Laghu Patha	Spastic bowel, uterine prolapse, alterative
Clitoria ternatea	Aparajita	Constipation, edema, anthelmintic, demulcent
Cocos nucifera	Narikela	Fever, pharyngitis, skin disorder, alterative
Coleus aromaticus	Pashanbheda	Kidney stones, conjunctivitis, spastic colon

Plant	*Sanskrit name*	*Main indications/effect*
Cordia obliqua	Shleshmantaka	Expectorant, colic, dyspepsia, ulcers, cough
Coriandrum sativum	Dhanyaka	Flatulence, colic, joint pain, antiseptic
Crinum deflexum	Sudershan	Emetic, inflammatory condtions
Cuminum cyminum	Jeeraka	Diarrhea, dyspepsia, antiseptic, hookworm
Curculigo orchiodes	Talamulika	Hemmorroids, asthma, kidney stones, skin
Curcuma longa	Haridra	Arthritic pain, anti-inflammatory, skin disease
Curcuma zedoaria	Shati	Cough, asthma, leukorrhea, tonnesillitis
Cynodon dactylon	Doorwa	Diuretic, styptic, hematuria, hemmorrhoids
Cyperus rotundus	Mustaka	Anti-inflammatory, flatuence, fever, estrogenic
Datura metal	Dattura	Anti-spasmodic, joint pain, asthma, dysmenorrhea
Daucus carota	Garijara	Blood purifier, nervine tonic, jaundice
Dolichos biflorus	Kulitha	Edama, kidney stone, asthma, dysmenorrhea, tumours
Eclipta Alba	Bhringaraj	Hepatic, deobstruent and tonic, alliterative, emetic, purgative, antiseptic, antiviral

Plant	*Sanskrit name*	*Main indications/effect*
Elettaria cardamomum	Elaichi Chhoti	Bronchitis, flatulence, dyspepsia, hemorrhoids
Emblica officinalis	Amalaki	Fruit: cooling, laxative, stomachic, tonic, diuretic
Evovulus alsinoides	Shankhapushpi	Anxiety, diarrhea, bronchitis, memory loss, fever
Ferula Foetida	Hingu	Flatulence, cough, constipation, palpitation, aphrodisiac
Ficus religiosa	Aswatha	Ulcers, skin disease, diabetes, constipation
Ficus racemosa	Udambara	Diarrhea, hemorrhoids, bleeding, disproders, antiseptic
Foeniculum vulgare	Satupuspa	Cough, flatulence, dysmenorrhea, hookworm, edema
Grewia hirsuta	Nagbala	Diarrhea, wounds, heart disease, fever
Gmelina arborea	Gambhari	General tonic, to increase strength, antiviral, indigestion
Gymnema sylvestre	Meshastringa	Diuretic, astringent, hypoglycemic, refrigerant, stomachic
Hemidesmus indicus	Sariva	Excellent alternative, to increase appetite, cough, skin
Holarrhena antidysenterica	Kutaja	Diarrhea, dysentery, amebiasis, anthelminthic
Hyoscyamus niger	Yavani	Chronic dementia, hysteria, palpitations, asthma, sedative

Plant	*Sanskrit name*	*Main indications/effect*
Hyssopus officinalis	Zupha	Cough, asthma, bronchitis, amenorrhea
Ipomoea digitata	Vidari	Cough, hoarseness, respiratory stimulant, tonic
Justicia adhatoda	Vasaka	Bronchitis, asthma, jaundice, antispasmodic
Linum usitatissimum	Uma	Cystitis, bronchitis, boils, expectorant, demulcent
Luffa acutangula	Koshataki	Splenomegaly, emetic, skin disease, expectorant
Madhuca longifolia	Madhuca	Tonnesillitis, cough, rheumatic joints, diabetes, appetiser
Michelia champaca	Champaka	Gastritis, chronic arthritis, emmenagogue, diuretic, colic
Mimosa pudica	Lajjalu	Menorheagia, hemorrhoids, skin wounds, diarrhea
Mimusops elengi	Bakula	Tonic, cardiotonic, urogenital disease, snakebite, skin sores
Morinda citrofolia	Ach	Acne, eczema, hyperlipidemia, bronchitis, diarrhea
Moringa oleifera	Sigru	Source of Vitamin C, colds, boils, fever, joint pain, gout
Mucuna pruriens	Kapikachchha	Nervine tonic, aphrodisiac, Parkinsonism, hypercholesterolemia
Narostachys jatamansi	Jatamansi	Nervousness, anxiety, dysmenorrhea, insomnia, hair tonic

Plant	*Sanskrit name*	*Main indications/effect*
Nelumbo nucifera	Parijata	Refrigerant, sedative, demulcent
Nyctanthes arbortristis	Parijata	Liver diseases, constipation anthelminthic, antihistaminic
Ocimum sanctum	Tualsi	Demulcent, expectorant, anticatarrhal antispasmodic, anthelminthic
Paederia foetida	Prasarni	Rheumatic joint pain, edema, bladder stones, inflammation
Papaver somiferum	Ahiphenam	Anxiety, diarrhea, aphrodisiac, sedative
Peucedanum graveolens	Satapushpi	Flatulence, colic, abscesses, digestive
Phyllanthus fraternus	Bhumiamalaki	Jaundice, liver disease, fever, genitourinary disease, edema
Picrorrhiza kurroa	Katuki	Hepatitis, asthma, anorexia
Piper nigrum	Maricha	Dyspepsia, cough, pharyngitis, headache, diarrhea
Plantago ovata	Isaphgol	Constipation, colitis, irritable bowel, cystitis
Plumbago zeylanica	Chitraka	Abortifacient, warts, rheumatic joint pain
Premna integrifolia	Agnimantha	Flatulence, fever, arthritis, liver deobstruent
Prunus amygdalus	Badama	Mental energy, general tonic esp. nerve and kidney, semen
Pterocarpus santalinus	Rakta Chandana	Skin tonic, liver disorders, fever

Plant	*Sanskrit name*	*Main indications/effect*
Punica granatum	Dadima	Anthelminthic (esp. tapeworm), diarrhea, dyspepsia
Randia ducmentorium	Madana	Fruit and rind are emetic, diaphoretic, and antispasodic, bark is sedative and nervine calmative
Rauwolfia serpentina	Sarpagandha	Hypertension, anxiety, insomnia, colic

Annex 5: Major plants required by Indian pharmaceutical industries

Ingredient	*Source of supply (August 1999)*			*Consumption (tonnes)*
	Cultivation	*Wild*	*Imported*	
Ajwain (*Carum copticum*)	100%			200
Akkalkadha (*Anacycus pyrethrum*)			100%	50
Cardamomum green (*Elettaria cardamomum*)	66%		33%	60
Cardamomum big (*Amomum subulatum*)		Assam		NA
Aloes (*Aloe vera*)		Maharashtra, Tamil Nadu		200
Amala green (*Emblica officinalis*)	50% South	50% MP/UP Maharashtra		10,000
Anantmool (*Hemidesmus indicus*)		TN, AP		200
Baheda (*Terminalia belerica*)		Maharashtra, MP		500
Bhringraj (*Eclipta alba*)		MP, UP, TN, Maharashtra, W Bengal		500

Ingredient	*Source of supply (August 1999)*			*Consumption (tonnes)*
	Cultivation	*Wild*	*Imported*	
Brahmi (*Bacopa monnieri*)		Tamil Nadu, West Bengal		700
Kankol (*Piper cubeba*)			150 tonnes	NA
Chitrak (*Plumbago zeylanica*)		Maharashtra, TN		500
Dalchini (*Cinnamomum zeylanicum*)			100%	250
Daruhaldi (*Berberis aristata*)		Nainital, Kulu		500
Deodar (*Cedrus deodara*)		Nainital, Kulu		200
Gajpippali (*Scindapsus officiale*)			100%	400
Guggul (*Commiphora wightii*)		10% Gujarat, Rajasthan	90%	500
Harda (*Terminalia chebula*)		Maharashtra, MP		500
Nutmen/mace (*Myristica fragrans*)		20% Kerala	80%	500
Jambhul beej (*Eugenia jambolana*)		Maharashtra, Gujarat, UP, MP, TN		300
Jatamansi (*Nardostachys grandiflora*)		Nepal, Assam, Kulu		200
Jeshthimadh (*Glycyrrhiza glabra*)			100%	5000

Ingredient	*Source of supply (August 1999)*			*Consumption (tonnes)*
	Cultivation	*Wild*	*Imported*	
Kadu kutuki (*Picrorrhiza kurroa*)		Kulu (HP), Nepal, Assam		200
Kesar (*Crocus sativa*)		Jammu and Kashmir		5
Clove (*Syzygium aromaticum*)	13% Kerala		87%	150
Black pepper (*Piper nigrum*)	Kerala			150
Ginger (*Zingiber officinale*)	50% Assam, Kerala		50%	500
Ashwagandha (*Withania somnifera*)	50% MP	50% MP		500
Nagkesar (*Mesua ferrea*)				200
Pipramool (*Piper longum*)	AP, Maha-rashtra			200
Safed musli (*Chlorophytum arundinaceum*)	40% MP, Maharashtra	40% MP, Maharashtra	20%	25
Shatavari (*Asparagus racemosus*)	50% MP, UP	50%, MP, UP		500
Vayvidang (*Embelia ribes*)		Maharashtra, MP		200
Kuchla (*Strychnos Nux vomica*)		Assam, AP, Bihar		1000

Ingredient	*Source of supply (August 1999)*			*Consumption (tonnes)*
	Cultivation	*Wild*	*Imported*	
Kalmegh (*Andrographis paniculata*)		MP, UP, Bihar		250
Senna	60% TN 20% Gujarat			1000

Source: Mr. Anand Puranik, Chemexcil, Mumbai, personal communication

Notes: AP: Andhra Pradesh. MP: Madhya Pradesh. UP: Uttar Pradesh. TN: Tamil Nadu. Nainital District is in Uttaranchal state (formerly part of UP); Kulu is in Himachal Pradesh; Kutch is in Gujarat.

Annex 6: Number of licensed pharmacies in Indian System of Medicine

State/Union Territory	*Number of licensed pharmacies (April 1999)*				*Number of licensed pharmacies holding loan licences**			
	Ayurveda	*Unani*	*Siddha*	*Total*	*Ayurveda*	*Unani*	*Siddha*	*Total*
Andhra Pradesh	556	222	–	778	4	–	–	4
Assam	39	–	–	39	–	–	–	–
Bihar	228	21	–	249				
Delhi	78	24	–	102	1	–	–	1
Goa	5	–	–	5	1	–	–	1
Gujarat	892	–	–	892	125	–	–	125
Haryana	210	3	–	213	–	–	–	–
Himachal Pradesh	54	–	–	54	–	–	–	–
Jammu and Kashmir	10	–	–	10	–	–	–	–

* When the licence to manufacture is held by one party but the premises used for manufacture of the product belong to another party, the arrangement is referred to as a loan licence.

State/Union Territory	*Number of licensed pharmacies (April 1999)*				*Number of licensed pharmacies holding loan licences*			
	Ayurveda	*Unani*	*Siddha*	*Total*	*Ayurveda*	*Unani*	*Siddha*	*Total*
Karnataka	241	–	–	241	20	–	–	20
Kerala	962	–	–	962	9	–	–	9
Madhya Pradesh	225	12	–	237	11	–	–	11
Maharashtra	757	–	–	757	243	–	–	243
Orissa	160	–	–	160	–	–	–	–
Punjab	149	–	–	149	2	–	–	2
Rajasthan	388	4	–	392	–	–	–	–
Tamilnadu	218	8	323	549	17	3	6	26
Tripura	1	–	–	1	–	–	–	–
Uttar Pradesh	2,575	217	–	2,792	2	–	–	2
West Bengal	620	22	–	642	21	–	–	21
Chandigarh	2	–	–	2	–	–	–	–
Dadra and Nagar Haveli	10	–	–	10	–	–	–	–
Daman and Diu	1	–	–	1	1	–	–	1
Pondicherry	24	–	94	118	1	–	–	1
TOTAL	8,405	533	417	9,355	458	3	6	467

Source: Website of Department of Indian Systems of Medicine and Homeopathy: www.indianmedicine.nic.in

Annex 7: Top 20 medicinal plants traded in India in value terms

	Trade name	*Botanical name*
1	Atis	*Aconitum heterophyllum*
2	Meetha telia/Bachnag	*Aconitum violaceam*
3	Safed musli*	*Chlorophytum borivillianum*
4	Guggul*	*Commiphora wightii*
5	Mamira/Mishmi-bitter	*Coptis teeta*
6	SalamPanja/Salep	*Dactylorhiza hatagirea*
7	Vidanga/Baibiranga*	*Embelia ribes*
8	Nagkesar	*Mesua nagassarium*
9	Rampatri/Bombay Mace	*Myristica malabarica*
10	Jatamansi*	*Nardostachys grandiflora*
11	Gaozaban	*Onosma bracteatum*
12	Kutki*	*Picrorrhiza kurroa*
13	Kakra-singi	*Pistacia integrimma*
14	Sarpa gandha*	*Rauwolfia serpentina Benth*

*Species selected for detailed market study

	Trade name	*Botanical name*
15	Manjishta	*Rubia cordifolia*
16	Chandana/Sandalwood	*Santalum album*
17	Chobchini gulabi	*Smilax glabra*
18	Chiraiyta*	*Swertia chirata*
19	Taggar/Mushkabala	*Valeriana hardwikii*
20	Banafsha	*Viola pilosa*

*Species selected for detailed market study

(Source: *Amruth*, December 1999)

Annex 8: Top 17 medicinal plants consumed by Baidyanath, Jhansi

	Trade name	*Botanical name*
1	Amla*	*Emblica officinalis*
2	Ashok*	*Saraca indica*
3	Babul	*Acacia arabica*
4	Ghee kunwar*	*Aloe vera*
5	Urad	*Phaseolus mungo*
6	Harra* (Large and Small)	*Terminalia chebula*
7	Munakka	
8	Arjun	*Terminalia arjuna*
9	Adusa	*Adathoda vasica*
10	Baheda	*Terminalia belerica*
11	Guduchi	*Tinospora cordifolia*
12	Kateri (Large and Small)	*Solanum surattense*
13	Rasna	*Pluchea lanceolata/Polygonum spp./ Dendrophthe facultata*
14	Shankhpushpi	*Convolvulus pluricaulis*

*Species selected for detailed market study

	Trade name	*Botanical name*
15	Jawasa	*Alhaqi maurorum/pseudalhaqi*
16	Ashwagandha*	*Withania Somnifera*
17	Safed musli*	*Chlorophytum borivillianum*

*Species selected for detailed market study

Annex 9: Plants considered in market study by TRAFFIC (India)

	Trade name	*Botanical name*
1	Atis	*Aconitum heterophyllum*
2	Agar	*Aconitum melasensis*
3	Daruhaldi	*Berberis spp*
4	Safed musli*	*Chlorophytum borivillianum*
5	Guggul*	*Commiphora wightii*
6	Mameera	*Coptis teeta*
7	Salabmisri	*Orchis latifolia*
8	Kutki*	*Gentiana kurroa*
9	Kalihari	*Gloriosa superba*
10	Kapoorkachri	*H.spicatum*
11	Pushkarmool	*Inula racemosa*
12	Jatamansi*	*Nardostachys grandiflora*
13	Kutki*	*Picrorrhiza kurroa*
14	Vankakadi	*Picrorhiza hexandrum*

* Species selected for detailed market study

	Trade name	*Botanical name*
15	Lal chandan	*Pterocarpus santalinus*
16	Sarpgandha	*Rauwolfia serpentina*
17	Kuth	*Sassurea lappa*
18	Chirayata	*Swertia chirata*
19	Talispatra	*Taxus wallichiana*

(Source: Mr Manoj Mishra, TRAFFIC-India: personal communication)

Annex 10: Major medicinal plant species exported from India

Plant name	*Plant part exported*
Plantago ovata	Seed and husk
Cassia angustifolia	Leaf and pod
Rheum australe	Rhizome
Inula racemosa	Rhizome
Rauwolfia serpentina	Roots
Hedychium spictatum	Rhizome
Zingiber officinale	Rhizome
Colchicum luteum	Rhizome and seed
Acorus calamus	Rhizome
Adhatoda vasica	Whole plant
Juglans regia	Bark
Punica granatum	Flower, root, bark
Barbris aristata	Root
Juniperus communis	Fruit

Plant name	*Plant part exported*
J.macropoda	Fruit
Heracleum candicans	Rhizome
Picrorrhiza kurroa	Root
Aconitum species	Root
Saussurea lappa	Rhizome
Swertia chirata	Whole plant
Podophyllum emodi	Rhizome
Valerina wallichi	Rhizome

Source: Handa 1992.

Annex 11: Notification prohibiting the export of medicinal plants

Ministry of Commerce, Government of India

Notification No. 24 (RE-98)/1997–2002

New Delhi, dated 14 October 1998

S.O. (E) Attention is invited to para 4 of Notification no. 2(RE098)/1997–2002 dated the 13th April, 1998 relating to export of plants, plant portion and their derivatives and extracts obtained from the wild.

In exercise of the powers conferred under Section 5 of the Foreign Trade Development and Regulation Act, 1992 (No. 22 of 1992) read with paragraph 4.1 of the Export and Import Policy 1997–2002, the Central Government hereby makes the following amendment in the Schedule 2 Appendix 2 of the book titled 'ITO (HS) classification of Export and Import items 1997–2002' relating to export of plants, plant portions and their derivatives and extracts obtained from the wild.

The export of under-mentioned 29 plants, plant portions and their derivatives and extracts as such obtained from the wild except the formulations* made therefrom, is prohibited.

Cycas beddomei (Beddomes cycad)

Vanda coerulea (Blue Vanda)

Saussurea costus

Paphiopedilium species (Ladies slipper orchids)

Nepenthes khasiana (Pitcher plant)

Renathera imschootiana (Red Vanda)

Rauwolfia serpentina (Sarpagandha)

Ceropegia species

Frerea indica (Shindal Mankundi)

Podophyllum hexandrum (emodi) (Indian Podophyllum)

Cyatheacease species (Tree Ferns)

Cycadaceae species

Dioscorea deltoidea (Elephant's foot)

Euphorbia species (Euphorbias)

Orchidaceae species (Orchids)

Pterocarpus santalinus (Red Sanders)

Taxus wallichiana (Common Yew or Birmi leaves)

Aquilaria malaccensis (Agarwood)

Acibitum species

Coptis teeta

Coscinium Fenestratum (Calumba wood)

Dactylorhiza hatagirea

Gentiana kurroo (Kuru, Kutki)

Gnetum species

Kamphergia galenga

Nardostachys grandiflora

Panax pseudoginseng

Picrorrhiza kurroa

Swertia chirata (Charayatah)

*The term 'formulation' used here shall include products, which may contain portions/extracts of plants on the prohibited list but only in unrecongnisable and physically inseparable form.

Plants and plant portions, derivatives and extracts of the cultivated varieties on the above plant species (excluding Sl. No. 16) will be allowed for export subject to production of Certificate of Cultivation from the Regional Deputy Director (Wildlife), or Chief Conservator of Forests or Divisional Forest Officers of the State concerned from where these plants and plant portions have been procured. However, in respect of the cultivated varieties of the species as covered by Appendix 1 (Sl.No.1 of 6 of Paragraph 2 (1) above and Appendix

2 (Sl. No. 7 to 18 and Sl. No. 26 and 28) of Para 2 (1) above, CITES permit for export will also be required.

The value added formulations, as defined under sub-para (1) of paragraph 2 above, made out of imported species of plants and plant portions as specified in Sub-para (1) Paragraph 2 will now be allowed to be exported freely without any restriction subject to furnishing of an affidavit to the Customs authorities at the time of export that only the imported plant species as above have been used for the manufacture of value added formulations being exported. In the event of affidavit proving to be false, on the basis of random sample tests, actions would be initiated against the firm under the Foreign Trade (Development and Regulation) Act, 1992.

All formulations—herbal/*ayurvedic* medicines, where the label does not mention any ingredients extracted from these prohibited plants shall be freely exportable without the requirement of any certification from any authorities whatsoever.

Export allowed only through the ports of Mumbai, Calcutta, Cochin, Delhi, Chennai, Tuticorin and Amritsar.

This is issued in public interest.

Sd/-
(N.L. Lakhanpal)
Director General of Foreign Trade

Annex 12: Medicinal plants in short supply

Botanical Name	*Common name*	*Quantity required (Tonnes/ annum)*	*Period of shortage of supply (years)*
–	Ashtvarga	0.095	23
Acacia catechu	Khair chhal	2.40	5
Aconitum heterophyllum	Ativisha	0.55	15
Alpinia galanga	Kosthakulinjan	0.22	4
Aquilaria agallocha	Krishnageru	0.17	12
Artemisia maritima	Kirmani ova	0.33	5
Artocarpus heterophyllus	Phanas ambe	0.055	5
Baliospermum montanum	Dantimool	0.32	3
Berberis aristata	Daruhaldi	2.70	6
Cedrus deodara	Devdar	2.20	10
Commiphora wightii	Guggul	2.30	5
Convolvulus arvensis	Harenvel	0.156	6
Curculigo orchioides	Kalimusli	2.25	4

Botanical Name	*Common name*	*Quantity required (Tonnes/ annum)*	*Period of shortage of supply (years)*
Curcuma zedoaria	Kapurkachri	0.225	5
Dioscorea bulbifera	Dukkarkand	0.175	7
Embelia ribes	Vaividang	3.40	3
Gentiana Kurroo	Triman	0.22	4
Hemidesmus indicus	Chavak	1.20	3
Inula racemosa	Pokharmool	0.65	6
Mallotus philippiensis	Kapila	0.155	12
Mesua ferrea	Nagkesar kala	0.65	6
Myrica esculenta	Kaiphal	0.225	5
Myristica fragrans	Jaiphal	0.33	3
Nardostachys grandiflora	Jatamansi	0.66	5
Nelumbo nucifera	Kamalphool	0.31	8
Picrorrhiza kurroa	Kutaki	1.55	5
Piper cubeba	Kankol	0.335	5
Piper longum	Pippali	1.25	5
Piper longum	Pippalmool	0.85	5
Piper nigrum	Shvet miri	0.09	13
Pistacia chinesis	Kakdashingi	0.45	10
Plumbago zeylanica	Chitrak lal	3.50	5

Botanical Name	*Common name*	*Quantity required (Tonnes/ annum)*	*Period of shortage of supply (years)*
Pterocarpus santalinum	Raktchandan	1.025	18
Rubia cordifolia	Manjishtha	1.15	4
Saraca indica	Ashok chhal	6.80	4
Saussurea lappa	Koshtha	0.43	5
Smilax china	Chopchini	0.55	5
Solanum indicum	Motiringani	1.15	5
Swertia chirata	Kirata	2.50	7
Tecoma undulata	Raktroda	0.30	6
Valeriana wallichii	Tagar	0.275	5
Vetiveria zinzanioides	Vala	1.15	4
Wagatia spicata	Vakeri bhate	0.12	4
Wrighatia tinctoria	Andrajava	0.418	5

The data refers to Sandu Brothers, Mumbai, who are manufacturers.

Source: Planning Commission 2000

Annex 13: Raw drug material imported to India

Botanical name	*Trade name*	*Quantity (in Tonnes)*	*Value (in Rs.)*	*Country*
Anacycus pyrethrum	Akkalkadha	200	–	–
Asperagus adscendens	Musli white	5	–	Pakistan
Atropa belladona	Belladona	–	230,235	Germany
Cinnamomum zeylanica	Dalchini	200–300	–	China
Commiphora wightii	Guggul	450	–	Pakistan
Curcuma zedoaria	Kapurkachri	200	–	China
Elettaria cardamomum	Cardamomum green	20	–	Guatemala
Garcinia indica	Kokum	192	12,625,666	Sri Lanka
Glycyrrhiza glabra	Jeshthimadhu	5000	–	Pakistan, Iran, Afghanistan
Hemidesmus indicus	Sariva	7	146,591	Myanmar
			27,054	Mexico
			6,942	Morocco
Myristica fragrans	Nutmeg/mace	400	–	Indonesia, Sri Lanka
Piper cubeba	Kankol	184	5,504,054	Indonesia
		35	1,054,406	Singapore

Botanical name	*Trade name*	*Quantity (in Tonnes)*	*Value (in Rs.)*	*Country*
Psyllium husk	Isabgol	–	572,351	Indonesia
Rauwolfia serpentina	Sarpgandha	28	514,139	Myanmar
Saussurea lappa	Kusth	40	163,527	Bhutan
		65	910,236	Myanmar
		89	1,586,499	Nepal
Swertia chirata	Chirata	272	2,282,212	Nepal
–	*Ayurvedic* and *Unani* herbs	–	3,452	Afghanistan
		–	199,816	China
		21	265,156	Indonesia
		121	946,283	Iran
		714	17,303,260	Nepal
		543	6,704,313	Pakistan
		–	748,756	Poland
		16	513,101	Saudi Arabia
		23	149,085	Singapore
		8	3,731	Somalia
		13	66,650	Sri Lanka
		20	98,622	UAE
		–	1,563,741	USA
–	Saps and extracts of Opium	1	533,123 2,532,474	France USA
Azadiracta indica extracts	Extracts of Neem	–	16,988	France

Source: Planning Commission 2000

Annex 14: Organisations engaged in cultivation of medicinal plants

Organisation	*Region of activity*	*Area (Acres)*	*ND/FC/EC*	*Medicinal plant(s)*
Agrotech Limited	Haridwar (Uttaranchal)	Spread over 6 villages	ND/FC	Papaya
Alembic	Gujarat, West Bengal	2,000	ND/EC	Vasaka
Annapurna Biotech Limited	Andhra Pradesh	250	ND/FC	Aswagandha, *Hyoscyamus*, Black Musli, Sarpagandha
Arya Vaidya Sala, Kottakal	Cauvery Basin		EC/FC	Senna, Vakuchi, Shatawari, *Coscinium*
Baidyanath Ayurved Bhawan	Shivpuri, Lalitpur, Hajipur (Madhya Pradesh and Uttar Pradesh)	100	ND/FC	Aswagandha, White Musli, Sarpagandha, Chandan, Aspara-agus, Priyangu
Basils Agro Farms Limited	Solan (Himachal Pradesh), Nurpur (Punjab)	50	ND/FC	Asparagus, Basils, Thyme, Parsley, Celery
Burroughs Wellcome	Jammu and Kashmir	2,500 (Spread over)	FC/EC	*Pruraria tuberosa*, *Digitalis*

Key: ND—Nursery Development; FC—Field Cultivation; EC—Encourages Cultivation (including contract cultivation).

Organisation	*Region of activity*	*Area (Acres)*	*ND/FC/EC*	*Medicinal plant(s)*
Chemiloids	Aswaraopet (Khammam, Andhra Pradesh)	700	FC	*Strychnos*, Sadabahar, *Tylophora asthamatica*
Cipla Limited	Karnataka and Coimbatore (Tamil Nadu)	2,000	FC/EC	Senna, Sadabahar
	Mangliwas (Rajasthan)	3,000 (Spread over)	ND/FC/EC	Guggulu
Crystal Biotech Limited	Haryana, Uttar Pradesh	400	ND/FC	Lemon, Amla, Papaya
Dabur India Limited	Uttaranchal	74	ND/FC	*Taxus*, Long pepper, *Saussurea*, *Digitalis*, Acorus, Mentha, Lavender, Salvia, Aswagandha, Basils
	Birganj, Lamjung, Melumchi, Kathmandu, Dolkha, Viratnagar, Hiley (All in Nepal)	1,000	ND/FC	*Saussurea*, Mints, Lavender, *Salvia*, *Taxus*, *Zanthoxylum*, Aswagandha, Basils, Saffron, Long pepper, *Swertia chiraita*
	Sandila (Lucknow)	200	FC (currently wasteland being reclaimed)	Amla, Mentha, Acorus, Basils, Chamomile, *Tylophora*, Lemon grass, *Euphorbia*, Mehandi

Key: ND—Nursery Development; FC—Field Cultivation; EC—Encourages Cultivation (including contract cultivation).

Organisation	*Region of activity*	*Area (Acres)*	*ND/FC/EC*	*Medicinal plant(s)*
EID Parry's	Karnatka, Tamil Nadu	1,200	FC/EC	Neem
Enbee Plantations Limited	Budhni, Sehore, Hosur, Bhopal, Ichawar (Madhya Pradesh) Tirunelvelli (Tamil Nadu) Satara (Maharastra)	9,766	ND/FC	White Musli, Sarpgandha, Aswagandha, Acorus, Isabgol, Musk Dan, Shatawari, *Bixa*, Sadabahar, Basils, Ginger, Garlic, Jaiphal
German Remedies Limited	Barabanki, Lucknow, Bareilly	4,000	EC/FC	Chamomile
Glaxo India Limited	Karnataka and Andhra Pradesh border; Jodhpur, Pali (Rajasthan)		EC	Senna
Himalayan Drug Company	North India, Karnataka, Tamil Nadu	60,000	FC/EC	*Aloe vera*, *Rauwolfia serpentina*, Aswagandha Brahmi,Senna, *Saussurea lappa*
Hoechst India	Eastern Uttar Pradesh		FC/EC	*Coleus forskohlii*
Indian Herbs	Saharanpur, Rampur	ND-100 FC-2000	ND/EC/FE	Acorus, Punarnava, Kalmegh
Indian Herbs with Horticulture Department	Bangalore	200 (On govt. waste land)	FC/EC	Kalmegh, Basils
Jain Irrigation	Jalgaun (Maharastra)	1,000	FC/EC	Papaya

Key: ND—Nursery Development; FC—Field Cultivation; EC—Encourages Cultivation (including contract cultivation).

Organisation	*Region of activity*	*Area (Acres)*	*ND/FC/EC*	*Medicinal plant(s)*
JVS Agrobase Limited	Kerala	24	ND/FC	Mints, Mushrooms, Black pepper, Ginger
Lahul Potato Society	Lahul and Spiti, Kulu (Himachal Pradesh)	1,000	EC	*Saussurea lappa*
Lucky Laboratories Limited	Bulandshar (Uttar Pradesh)	50 (1,000 Area likely to be acquired)	ND/FC	Amla, Ashok, Ashwagandha, *Hyoscyamus*
Lupin Laboratories Limited	Rishikesh (Uttaranchal)	50	ND/FC	Aswagandha, Isabgol, White Musli
Mr. Girish Sharma (NGO)	Ajmer (Rajasthan)	25	EC	*Aloe vera*
Narayandas Prajapati (NGO)	Jodhpur (Rajasthan)	400	FC/EC	Aswagandha, *Aloe*, Acorus, Guggulu, Senna
Naturoworth Medico Plants	Uttar Pradesh, Madhya Pradesh	1,500	ND/FC	Aswagandha, *Ocimum*, Mentha, Acorus, White Musk, Brahmi, Giloe, *Curcuma*, Ginger
Peru Tech Limited	Maharashtra	2,000	ND/FC	Papaya, Garlic, Ginger
Pepsi Co.	Punjab/Himachal Praesh	5,000	ND/FC	Garlic, Ginger, Turmeric
Proctor and Gamble	All over India	100,000	EC	Mints

Key: ND—Nursery Development; FC—Field Cultivation; EC—Encourages Cultivation (including contract cultivation).

Organisation	*Region of activity*	*Area (Acres)*	*ND/FC/EC*	*Medicinal plant(s)*
Save Earth Plantations	Bihar, Haryana	Spread over several villages	ND/FC/EC	Jawa, Lemon, Mints, Aswagandha, Brahmi, Papaya, Pachouli, Acorus
Southern Herbs	Kolar (Karnataka)	Spread over many villages	EC	Sadabahar

Key: ND—Nursery Development; FC—Field Cultivation; EC—Encourages Cultivation (including contract cultivation).

Annex 15: International initiatives in the medicinal plants sector

In 1978 the World Health Organisation (WHO) and the United Nations Childrens Fund (UNICEF) came out with the Alma Ata Declaration setting the goal of providing 'Health for all by the year 2000'. In support of that goal, WHO, UNICEF and the world community endorsed traditional medicines programmes worldwide and underscored the important role of traditional medical systems in providing primary health care to 80 per cent of the world's population. In 1987, the 40th World Health Assembly adopted a resolution reaffirming the Alma Ata Declaration.

These were the measures that triggered off a worldwide interest in bio-cultural aspects of medicinal plants and helped focus on their current state. Recognising that the vast majority of the world's population depends on traditional medicine for their primary health care, it was realised that there was an urgent need to ensure: a) availability of safe and effective herbal medicines of good quality for those who need them, and b) continuous supply of medicinal plants.

While scientists in universities and research institutes focused their attention on screening medicinal plants for biologically active compounds and evaluating herbal remedies, little attention was paid to the actual conservation of medicinal plant diversity itself. This resulted in serious loss of biodiversity, genetic erosion, extinction of several useful medicinal plant species threatening the continuous and regular availability of herbal medicines, thus jeopardising the health care needs of more than four billion people, who depend on these plant based traditional systems of medicine.

In response to this crisis, a large number of inter-governmental and international agencies set in motion a series of initiatives to promote conservation and sustainable utilisation of biodiversity. Some of the initiatives which had a bearing on the state of affairs concerning medicinal plants, are mentioned below:

The Chiang Mai Declaration: 'Saving Lives by Saving Plants', 1988

A major international consultation on Conservation of Medicinal Plants organised jointly by the WHO, the International Union for the Conservation of Nature (IUCN) and the World Wildlife Fund (WWF) met in Chiang Mai, Thailand in March 1988.

The consultation issued the Chiang Mai Declaration, 'Saving Lives by Sharing Plants', stating that the participants recognise medicinal plants as being essential for primary health care, both in self-medication and in national health services. The declaration sought to draw the attention of the United Nations, its agencies and member states, other international agencies and their members and non-governmental organisations to:

- the vital importance of medicinal plants in health care;
- the increasing and unacceptable loss of these medicinal plants due to habitat destruction and unsustainable harvesting practices;
- the fact that plant resources in one country are often of critical importance to other countries;
- the significant economic value of the medicinal plants used today and the great potential of the plant kingdom to provide new drugs;
- the continuing disruption and loss of indigenous cultures, which often hold the key to finding new medicinal plants that may benefit the global community;
- the urgent need for international cooperation and coordination to establish programmes for conservation of medicinal plants to ensure that adequate quantities are available for future generations.

The Chiang Mai Declaration heralded the beginning of the era of worldwide interest and concern for medicinal plants.

Legal actions

Two internationally binding agreements are relevant to the protection of medicinal plants: the Convention on Biological Diversity and the Convention on International Trade in Endangered Species of Wild Fauna and Flora.

Convention on International Trade in Endangered Species

The principal tool for monitoring or restricting international trade of species threatened by over-exploitation is the Convention on International Trade in Endangered Species (CITES), which came into force in 1975. Over 130 signatory

nations, including India, agreed on an international treaty establishing a permit system to regulate trade in endangered species and in species at serious risk. Member countries are required to establish or designate scientific authorities to conduct non-detrimental studies for listed species, and management authorities to issue permits and certificates. Appendix I to the Convention covers species threatened with extinction, under which trade in these species of wild origin is prohibited. However, for research or other purposes, certain provisions are made. The only Indian medicinal plant to make it to this list is a Western Himalayan species: *Sassurea costus (=Sassurea lappa)*.

Appendix II includes species which are perceived to be threatened with extinction unless their trade is regulated. The wild collected material of species mentioned here can be traded (internationally) under an export permit issued by the competent authority. The Indian medicinal species which are included here are *Aquilarea malaccensis, Dioscorea deltoidea, Nardostachys grandiflora, Picrorrhiza kurroa, Popophyllum hexandrum, Pterocarpus santalinus, Rauwolfia serpentina* and *Taxus wallichiana*.

The Convention on Biological Diversity 1992

The need to find solutions to the threats to biological diversity in the context of problems of habitat loss and over-exploitation; the complex social and economic development problems such as poverty, inequitable distributions of land, wealth and other benefits and illiteracy, which influence the ability of traditional societies to use medicinal plants and other biological resources, led to the drafting of the UN Convention on Biological Diversity (CBD) and Intellectual Property Rights signed by over 150 countries in Rio de Janeiro during the First Earth Summit in 1992. This Convention reflects a fundamental change in how the international scientific community perceives the environment and issues in human ecology. This international agreement entered into force in 1993.

The CBD is the first international legal instrument to address biological diversity conservation and the sustainable use of its components comprehensively. Unfortunately, individual countries, including India, are still left with the task of developing viable policies that effectively promote bio-prospecting and sustainable development while protecting the rights and the cultures of local communities.

The Biodiversity Convention focuses on the sustainable use of the elements of biodiversity and the establishing of economic incentives to conserve nature.

For medicinal plants this means giving preference to a compatible level of collecting wild plants, rather than cropping them on a large scale. If medicinal plants are only cultivated as field crops, there is no economic incentive to retain their natural habitat.

The Convention therefore opposes the opinion widely held by traditional ecologists that rare medicinal plants should be cultivated, so that collecting wild populations will cease. Whether to promote wild collection or cultivated production has to be weighed up in each case. In the case of Jatamansi (*Nardostachys grandiflora*) root native to Nepali highlands, for example, cultivation seems to be a suitable strategy in conservation. A frequently used ingredient in *ayurvedic* medicine, large quantities of this root is exported to India. As it became impossible to meet the demand by collecting wild growing plants, it seemed justified to cultivate the crop in order to fulfil the extra demand and yet retain the species—and this approach is showing success.

World Bank Group Support

The world's premier lending agency has recognised not only the socio-cultural, but also the economic dimensions of medicinal plants. This is reflected by its recent policies incorporating medicinal plants component into its lending programmes and drafting of future strategies in this sector. The Bank's new lending instruments—learning and innovation loans and adaptable programme loans—are especially suited to the efforts aimed at combining multiple objectives of conservation, community participation, livelihood issues and economics. They allow for project design flexibility to incorporate lessons learned, encourage institutional reforms, and, where appropriate, foster pilot exercises to test new approaches. The following are especially suited:

The Global Environment Facility (GEF) provides grant and concessional funds to developing countries and those with economies in transition for projects and activities that address four aspects of the global environment: biological diversity, climate change, international waters, and the ozone layer. Activities related to land degradation, primarily those addressing deforestation and desertification as they relate to the focal areas, are also eligible for funding. Along with the United Nations Development Programme and the United Nations Environment Programme, the World Bank is an implementing agency for the GEF.

The Global Overlays Programme was launched in 1995 and adds a global dimension to the traditional work that the Bank undertakes collaboratively

with its client countries. The programme is designed to help countries adjust their policies to integrate global externalities into their national economic planning.

Some of the World Bank assisted initiatives, which attempt to address issues related to sustainability of medicinal plants in the Indian sub-continent are:

The Kerala Forestry Project: The International Development Association (IDA), the World Bank's concessionary lending arm, is assisting medicinal plants conservation as a key objective of biodiversity conservation component in several forestry projects in India. The Kerala Forestry Project comprises a pilot programme that involves tribal and other forest-dependent communities in the inventory, conservation, and sustainable development of medicinal plants. It is to be implemented initially in five villages that are economically highly dependent on medicinal plants. The Kerala Forest Department and the Tropical Botanical Garden and Research Institute (TBGRI) have formed a partnership to design and implement the programme. While relatively modest, this programme seeks to enhance sustainable management of the medicinal plant resources of Kerala in a way that will enable local communities to reap the economic benefits of these resources without depleting the forests and endangered plant species.

The India Capacity Building for Food and Drugs Quality Control Project: In addition to supporting initiatives to conserve medicinal plants and ensure their sustainable use, the Bank also advocates complementary actions to increase the capacities of its client countries to safeguard the quality of drugs, including plant-based remedies. India is currently preparing a project for possible IDA financing with a broad array of activities to improve the safety of conventional drugs and traditional remedies and prevent food adulteration. This project is expected to include a comprehensive survey of medicinal plants in the north-western state of Himachal Pradesh and establish a centre for quality control and improvement of herbal drugs. In addition, the project will upgrade pharmaceutical standards and quality control in India by improving federal laboratories that test medicinal plants and set standards for remedies used in traditional medical systems. This project should boost consumer protection through higher quality standards for both traditional remedies and modern drugs.

TRAFFIC

TRAFFIC is a joint programme of the World Wide Fund for Nature (WWF) and the World Conservation Union (IUCN), whose objectives are to monitor

the wildlife trade in order to ensure that it is at sustainable levels and in accordance with domestic and international laws and agreements.

The trade in wild plants (and animals) for medicinal purposes is a priority area of work for TRAFFIC. TRAFFIC Europe (Germany) is preparing a study of the international trade of medicinal plants of Indian origin, while TRAFFIC India is engaged in establishing working relationships with key stakeholders in the medicinal plants sector such as collectors, traditional practitioners, conservationists, NGOs, industry and government personnel and toward collecting information required for ensuring sustainable management of medicinal plants in trade. (See Annex 9 for the list of medicinal species being studied in detail by TRAFFIC-India) (Mulliken n.d.).

Medicinal Plants Specialist Group of the IUCN

The Species Survival Commission (SSC) is one of the largest and most active of IUCN's six volunteer commissions. The SSC network encompasses 7,000 volunteer member scientists, field researchers, government officials and conservation leaders from 169 countries.

Commission members provide leadership for conservation efforts for specific animal and plant groups, and contribute technical and scientific counsel to biodiversity conservation projects throughout the world. The SSC works primarily through its 110 Specialist Groups. The Medicinal Plant Specialist Group (MPSG) was established in 1994 and currently comprises approximately 50 members.

The activities of MPSG include the identification of priority taxa and regions for conservation, and the promotion of the rational and sustainable utilisation of medicinal plants. The newsletter 'Medicinal Plant Conservation' is published once or twice a year, and a Bibliography on Medicinal Plants Conservation has been compiled.

In 1996, a 'Directory for Medicinal Plants Conservation' prepared by M. Kasparek, G. Gröger and U. Schippmann, was published and a 'Medicinal Plant Significant Trade Study' was launched in 1996 together with the Federal Agency for Nature Conservation and the TRAFFIC Network in order to review the status of those medicinal plants which are in international trade and are protected under the CITES.

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