

The Medicinal Plants Sector in India

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The Medicinal Plants Sector in India: A Review

by

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Executive Summary

This report reviews the current status of the medicinal plant sector in India, which supports the primary health care needs of most of the country's population. Much of the health care sector is informal, especially since India has three major systems of traditional medicine. However, many plant products are used for tribal and folk medicinal practices which have not been properly studied. India therefore is one of the world's most medico-culturally diverse countries. Added to this scenario is the practice of Western medicine and past efforts to change indigenous medicine: in fact both have benefited from each other since indigenous systems introduced drugs to the Western pharmacopoeias while Western medicine helped upgrade a few important raw plant products to some degree of standardization.

The synergies described above led to India becoming an active participant in the global medicinal plant market. Although an insignificant supplier of finished products, India may be the world's largest supplier of raw materials. This global trade is strongly geared to the needs of importers: hence emphasis on production for the trade is often on plants introduced into India. Nonetheless, India exports significant quantities of raw materials to other Asian countries and some of these exports are associated with traditional medicine. However, India's comparative advantage in producing materials for export has not been exploited to the full at all.

With the exception of a limited number of plant species, the production base relies mainly on materials harvested from the wild. Current practices are unsustainable and many studies have emphasized rapid depletion of the natural resource base. This problem is further compounded by the inequitable nature of the harvesting and marketing of the plants, thereby perpetuating impoverishment for those charged with stewarding and gathering the resource. Evidence points to a limited number of people profiting in dramatic disproportion to their inputs.

Nonetheless, India, known to be a storehouse of biological diversity, has to focus on sustaining the resource base of medicinal plants. Efforts to relieve pressure on wild plants through cultivation have made a good start but have a long way to go. This is a complex issue by virtue of the sheer numbers of plant species and the needs for sustainable propagation, suitable agronomic practices, the selection of superior genotypes and linking production to people.

Constraints exist at all levels especially in relation to the documentation of the sector. The report discusses these in relation to the resource base; use of medicinal plants at the local level; marketing channels; exports; the domestic drug production sector and coordination efforts and information. Although the overall sector is largely informal, it works in practice. However the constraints are likely to have an increasing impact, resulting perhaps in a crisis situation.

It is not a simple matter of supplying missing documentation. There are extremely diverse stakeholders spanning the formal sectors of agriculture, forestry, health care and industry (as well as actors outside of these formal sectors). Medicinal plants fall into segments of these formal sectors and receive more or less attention depending on policy. For instance, they are one of the most valuable components of the non-timber forest products sector, being important generators of revenue.

Most of the available data regarding the formal sectors are in aggregate form and such statistics supply little information about how the market actually works; they rely solely on market price as an indicator of value. Much more attention therefore needs to be given to the socio-institutional context of the market.

On the other hand, the government has in place a wide range of organizations with initiatives aimed at strengthening various aspects of the sector and coordinating parts of it. These are supplemented by many non-governmental initiatives, several supported by outside donors. New government coordination efforts would not however be feasible at present due to the currently apparent constraints.

It is clear that a set of interventions at various levels could lead to the promotion of the sustainable and equitable development of the sector and help to avert a crisis. These could pave the way for sharply focused strategic planning for the future. The report outlines a number of these interventions.

Foreword

According to the World Health Organization, over 80 percent of the world's population relies on traditional forms of medicine, largely plant-based, to meet primary health care needs.

In India, the collection and processing of medicinal plants and plant products contributes at least 35,000,000 man days each year to the national economy, as a source of both full and part-time employment. Micro-studies suggest that a large number of those employed are women. In recognition of the significance of the sub-sector, and the fact that it is largely undocumented, the World Bank and the IDRC Medicinal Plants Network (IMPN) agreed to produce this state-of-the-art report on the medicinal plants sector in India.

The report suggests that despite a wealth of resources-biological, human and financial-being available, the lack of a coordinated approach, which considers sustainable and equitable development to be short as well as long-term goals for the sub-sector, has resulted in the simultaneous under-utilization and overexploitation of the valuable plant resources.

It is hoped that the report, will be a step towards achieving such a coordinated effort. In addition to identifying information gaps and research priorities, it outlines a set of possible interventions at various levels which could lead to the promotion of the sustainable and equitable development of the sub-sector for human and environmental benefit. These could pave the way for sharply focused strategic planning in the future.

We hope that the report will be useful to government agencies, development planners, researchers, NGOs, and donor agencies, who can work together to make the sector more sustainable and equitable.

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We would like to thank Mr. Madhusudan and Mr. Jyothi Tewari for their compilation of domestic and international trade data from the records maintained by the Government of India; as well as their colleagues, Vinod and Ramesh for synthesizing this information in a computerized, readily displayable format. Ms. Radhika Johari deserves special thanks for her editorial assistance.

We are also grateful for the cooperation and support of the recently formed Committee on Indian Systems of Medicine and Homeopathy, which has been charged with developing these sectors for the Ninth Five Year Plan by the Government of India. The invitation extended by the Committee to IMPN to collaborate in the fulfillment of this goal has facilitated our access to important information and has also enabled us to ensure that the report is relevant to current and planned national priorities and activities in India.

Thanks are also due to the participants of the South Asia Conference on Tribal and Folk Medicinal Plant Resources organized by IMPN in Tirupati, and the associated Seminar on Pharmacology and Folk Medicine, as well as the Conference on the Role of Bamboo, Rattan, and Medicinal Plants in Mountain Development, held in Pokhara, Nepal, under the auspices of IDRC/IMPN, INBAR, IPGRI and ICIMOD. Participants of both conferences contributed valuable papers providing the most up to date information in their respective areas of expertise. In addition, our subsequent consultations and discussions with many of them, helped us to identify important areas of concern for the report.

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Our interactions with all of these committed individuals throughout the study period have encouraged us in our conviction that despite the enormous amount of work that remains to be done, this report's *raison d'être*—the sustainable and equitable development of the medicinal plants sector—can indeed be achieved.

**The
Medicinal Plants
Sector in India: A Review**

Introduction

Medicinal Plants: The Global View

Human beings have been utilizing plants for basic preventive and curative health care since time immemorial. Recent estimates suggest that over 9,000 plants have known medicinal applications in various cultures and countries, and this is without having conducted comprehensive research amongst several indigenous and other communities (Farnsworth and Soejarto 1991).

Medicinal plants are used at the household level by women taking care of their families, at the village level by medicine men or tribal shamans, and by the practitioners of classical traditional systems of medicine such as Ayurveda, Chinese medicine, or the Japanese Kampo system. According to the World Health Organization, over 80% of the world's population, or 4.3 billion people, rely upon such traditional plant-based systems of medicine to provide them with primary health care (Bannerman et. al. 1983).

Allopathic medicine too owes a tremendous debt to medicinal plants: one in four prescriptions filled in a country like the United States are either a synthesized form of or derived from plant materials (Srivastava, et. al. 1995).

Even from the earliest trade data available, it is clear that the global market for medicinal plants has always been very large. According to the International Trade Centre, as far back as 1967, the total value of imports of starting materials of plant origin for the pharmaceutical and cosmetics industry was of the order of USD 52.9 million. From this amount, the total values grew to USD 71.2 million in 1971, and then showed a steady annual growth rate of approximately 5-7% through to the mid-1980s (Atisso 1983).

To give an example of the extent of trade volumes even at that time, according to one report commissioned by the World Wide Fund for Nature, the total import in 1980 of "vegetable materials used in pharmacy" by the European Economic Community was 80,738 tons (Lewington 1992). India was the largest supplier by far, with 10,055 tons of plants and 14 tons of vegetable alkaloids and their derivatives.

However, it is only during the last decade that the real significance of the medicinal plants sector has begun to be realized. Interest in natural materials by the dominant economic powers had waned from the late 1960s to the early 1980s as new possibilities in biotechnology and the synthesization of drugs beckoned. But by the mid-1980s, there was a renewed interest in natural materials and approaches to health care, coupled with a recognition that technology alone could not solve the pressing health care needs of the world's population (Tempesta and King 1994).

This new drive for natural and plant-based medicines made itself felt in the market from the mid-1980s onwards. As Table 1.1 illustrates, growth in the market in various regions is now on average 3 to 4 times the average growth rates of the national economies in the same regions. Some of these phenomenal rates, in some cases nearly 20%, imply that the market is now doubling in size every 4-5 years.

The participation of various companies in the market also attests to its new strength and importance. By 1990, some 223 major companies worldwide (of which about half were in the United States) were reportedly screening plants for new leads; the figure had been zero in 1980 (Aryal 1993).

Also in 1990, more than 2000 companies in Europe alone were marketing herbal medicinals, with 30% having a turnover in excess of \$20 million- expenditure in the United States on "unconventional, alternative, or unorthodox" therapies reached \$13.7 billion dollars during the same year (Tewari 1996). The so-called

Table 1.1 Natural Medicines Market: Regional Growth Rates 1991-98 (in %)

Region	1991-92	1993-98
EU	5	8
Rest of Europe	8	12
SE Asia	12	12
Japan	15	15
South Asia	15	15

Source: Grunwald (1994)

"nutraceuticals" sector--consisting of herbal medicines which are dubbed food or dietary supplements in order to pass FDA criteria more easily--is now estimated to be valued at USD 27 billion (Anon 1995).

The use of such alternative medicines has become increasingly popular in the developed world. For example, 1 in 3 Americans have at some time used unconventional medical therapies according to a national telephone survey published in the *New England Journal of Medicine* in 1993. In another survey conducted in 1994, it was found that 60% of doctors had at some time referred patients to practitioners of alternative medicine. In response to the overwhelming interest in alternative therapies, many of the prestigious allopathic medical institutions have also recognized their importance: an example is the National Institute of Health which created the Office of Alternative Medicine in 1991 to provide the public with information on alternative treatments and to assess those therapies which have proven successful. (Kolata 1996).

According to one account, in 1992 significant amounts of at least 74 species of medicinal plants were being commercially traded in the global market (Handa 1992). In addition to these major species, hundreds of others are bought and sold in lesser quantities across national boundaries, sometimes illegally.

A comparison of the volumes of traded materials with those of the previous decade also provides dramatic evidence of the market's growth. During the last 3 years, approximately 40,000 tons of plant drug materials (valued at DM 160 million) were imported into Germany, annually (Lange 1996), implying that one country's imports in the mid 1990s equalled half the number of plants imported by the entire continent in the mid 1980s.

Considering the Role for India

The global context briefly sketched above suggests several tremendous opportunities for India, a country unrivaled in terms of diversity of medical systems and practices, in addition to being a major storehouse of

biological diversity, with 2 of the 14 megabiodiversity areas of the world located within its borders. The global market would appear to be more receptive than ever to the mounting of a concentrated Indian effort at supplying it with medical materials and know-how. Such an effort would also appear to be increasingly remunerative for the country. India is of course already an active participant in the global medicinal plants market having been for some time the world's largest supplier of raw materials (though an insignificant supplier of finished products) (Patnaik 1994). Of the 74 species accounted for in one of the studies mentioned above, India was known to be exporting 22 and importing 8 (Handa 1992), while the German study quoted earlier, which is now underway, has found India to be Germany's largest trading partner by far (Lange 1996). Moreover, medicinal plants are one of the most important components of the non-wood forest products sector which supplies over 80% of India's net forest annual export earnings (FAO 1995, Jain 1996).

Despite these promising indications, however, it is unclear whether India is truly exploiting her comparative advantage in the medicinal plants sector and tapping the full potential of an expanding consumer base. In addition, several concerns arise in relation to the current consequences of participation in the market, with regard to the sustainability and equitability of prevailing practices in the sector.

Although only micro-studies are currently available in this regard, most of these indicate that current practices are both unsustainable, as they rapidly deplete the natural supplies of the country's plant base, and inequitable, perpetuating impoverishment for those charged with stewarding and harvesting the resource, while a few profit in dramatic disproportion to their inputs. Negative impacts on local primary health care, as plants become diverted to national and international markets, have also been cited in some cases. To add to all of these negative aspects, the market in India has been shown to be highly inefficient and imperfect.

The need of the hour, then, is to replan India's participation in the expanding global market, in light of the interests of all the stakeholders who are affected and who play a role in this sector. There is a need to collate all the available information regarding medicinal plants development in the country in order to obtain a comprehensive overview which will provide the necessary insight for coordinated and effective action. Such an overview could form the basis of a renewed development of India's medicinal plants sector, and a strategic exploitation of her comparative advantage in the global market on a sustainable and equitable basis.

Origins and Objectives of the Review

It was with the intention of providing such a comprehensive overview that the International Development Research Centre and the World Bank's Department of Agriculture and Natural Resources commissioned the authors to conduct a state-of-the-art review of the medicinal plants sector in India.

Medicinal plants, of course, do not presently constitute a sector as typically defined in international development discourse; generally they have been defined as a forestry sub-sector, or less often, as a sub-sector in health care. However, this review takes up medicinal plants as an independent sector for two reasons: 1) to emphasize that none of the various 'homes' to which medicinal plants have been assigned provide a sufficient base of expertise for their sustainable and equitable development; and 2) to provide an organizational framework for the community of researchers and stakeholders, to whom this paper will be circulated, to think through this area of common interest and move forward together.

This review then is a mapping exercise, which tries to identify the who, what, how, where, why and when of medicinal plants development in India, in order to supply a comprehensive understanding and overall picture to researchers, NGOs, health care workers, private companies, conservation and development agencies,

policy makers and other interested stakeholders. It is intended to provide a framework and knowledge base, and an initial way forward, for those interested in seeing India exploit her comparative advantage in the global market, both sustainably and equitably.

Limits and Constraints Faced

There is no dearth of interest in medicinal plants amongst the Indian research community. As a single example, the IDRC Medicinal Plants Network, a South-Asia focused initiative operating from New Delhi, already maintains an active database of over 900 Indian researchers and development specialists working on medicinal plants projects after only one year of active compilation. When a call for proposals in the field was issued, over 250 responses were received within the subscribed period, a tremendous number considering that the grants were of the magnitude of only USD 15,000.

Unfortunately, however, this interest has not resulted in the development of a strong and high-quality knowledge base for the sector. Instead, one finds in a review such as this one several instances where information is either unobtainable or unreliable. Several factors contribute to this situation.

The most important among these is the highly secretive and complex nature of the trade in raw materials. Most experts consulted agreed that the largest part of the trade occurs in the informal sector, and is absent from official statistics and trade catalogues. As previous authors have also found (see Lewington 1993), nearly everyone involved in the medicinal plants trade is very hesitant to divulge information which is essential to a complete understanding --such as prices, supply sources, points of transformation, and transport routes. As a result, despite assiduous efforts, we still cannot claim to have a complete picture of the trade scenario, and have most likely erred in the direction of conservatively estimating the volumes of materials under trade.

Information available regarding the formal sector is also limited. Most data is available only in aggregate form, such as numbers of species being exported or overall value of the trade to India. These statistics unfortunately supply little information about how the market actually works, and may even obscure such vital information to policy makers such as seasonal fluctuations and the like. In addition, in most cases, no explanations are given for how the aggregations were calculated or verified (i.e. dry weights or fresh weights; exchange values in effect; self-reporting by companies or based on registration with governments, etc.). The lack of methodological explanation makes it virtually impossible to compare and synthesize related sets of information; or to understand why two sets of statistics, purporting to cover the same phenomena over the same time period, give differing results.

Moreover, these statistics rely exclusively on market price as an indicator of value, a narrow approach which neglects environmental, cultural, personal, and long-term methods of assigning value. The social context of the market which is extremely important in the medicinal plants sector, involving as it does, a complex market spread across time and space, is there by lost.

This constraint is related to a general lack of strategic focus in the bulk of current socio-economic research on medicinal plants in India. The largest group of scientists currently working with medicinal plants appears to be those in the natural sciences--including botanists, taxonomists, and chemists; and the applied sciences such as biotechnology and health care. In most instances where economic or social analysis has been undertaken, it has been by these same scientists, the majority of whom are untrained and unqualified to conduct such research. While laudable as an attempt to bridge the disciplinary barrier, this has unfortunately

also resulted in a generally lower quality of socio-economic analysis related to medicinal plants as against other resources, with analysis tending to oversimplify complex market and policy realities such as the frequently suggested solution: cut out the middleman. In addition, there is a regrettable absence of any 'research community' or peer group working on socio-economic and policy aspects of medicinal plants, such as that which exists with regard to agro-technology, biotechnology, and the like, which would assist in defining higher standards of quality.

Methodology

The consequences of the absence of an extensive knowledge base is that in many places there remain gaps which need to be filled; where these occur, the study takes note of them. However, these have not been so numerous as to make it impossible to give a reasonable picture of the sector. In the absence of the usual sources of information for commodity studies, this review utilizes a hybrid approach following in part the model articulated by Arnold (1994). The review attempts to understand the market by means of the 'official' sources available regarding the macro-level trade, as well as the few well-documented case studies of the micro-level situation, supplemented by interviews and discussions with experts in the field who are participants in the IDRC Medicinal Plants Network. Where common trends and tendencies appear, they are highlighted; and where gaps remain, they are acknowledged. In this way, the review serves as a stock-taking not only of the development scenario, but of the research scenario as well.

The review is structured to follow the medicinal plants from their origins in forests and on farms through to their application in formulations or as unprocessed materials. For this purpose, we have identified five major stages which medicinal plants may pass through on their way from collection to use.

Different people and plants are engaged at each stage, and the review attempts to provide information on not only on the volumes and numbers of people involved; but also to understand which ones are involved, why they are involved, how and to what extent they are involved, and when they are involved. It also tries to understand and describe how changes at different points have affected the participation of people and plants at the same or other points. Such factors are of crucial importance in considering development initiatives for the sector.

Chapter Overviews

The chapters which follow take an in-depth look at each of the stages of medicinal plant use as follows.

Chapter One focuses on the first stage of the process, that of Collection of Medicinal Plants. Here we examine the current state of the resource base; the people involved in the activity and their socio-economic and demographic make-up; the locations at which collection takes place; the methods by which collection takes place; the policies and regulations currently in force pertaining to forest use and product harvesting; and the various interventions made in the area so far, including cultivation of plants, *in-situ* and *ex-situ* conservation, and joint forest management.

Chapter Two follows the path of the plants to their use in the informal health care sector, where the vast majority are used in folk and tribal remedies. This aspect of medicinal plant use is often forgotten in analyses which concentrate on market opportunities or the "Big 3" (Ayurveda, Siddha, and Unani) systems of traditional medicine, and requires an in-depth study to understand how such market participation and promotion will affect local standards of health care, and how tribal and folk medicinal practices and plants can be strengthened and made sustaining and self-sustainable.

Chapter Three examines the marketing channels through which plants which are not used locally pass on their way from harvest to final market. It makes use of available information to characterize the different types of markets in which medicinal plants are bought and sold, and to understand who is involved in the trade. In addition, it attempts to determine the transformation points of the raw materials into products; the pricing patterns and determinants; the margins of profit accruing to different stakeholders; and the present role of the government and policy. This chapter also documents and analyzes some of the interventions of the state to date, such as the development of marketing cooperatives, as well as ongoing projects in commodity studies and market analysis.

Chapter Four describes in greater detail the International Market briefly sketched above, with particular emphasis on India's performance during the past twenty years. It provides details regarding India's exports and imports of medicinal plants and medicinal plant-derived drugs, identifying major commodities and trade partners, as well as describing the present national and international regulatory environment.

Chapter Five looks at the other major destination of plants harvested in India, that is, the country's domestic drug production sector. It considers the size and scope of both the traditional and allopathic manufacturers, their links to primary healthcare, and the current policy environment in which they operate. It also documents organizations and initiatives aimed at strengthening the capacity of these manufacturers, both national as well as international.

Chapter Six then takes stock of the current efforts at coordination and information in the sector, including networks, databases, and publications.

Finally, Chapter Seven draws conclusions from the information presented in the previous chapters, and makes recommendations for the sustainable and equitable development of the sector, articulating the potential roles that various stakeholders could play in such efforts.

Chapter 1

The Medicinal Plants Resource Base



1.1 The Cultural-Historical Context

Medicinal systems in India date back to at least 5000 BC, coinciding with the emergence of the cities of the agricultural based Indus Valley civilization around 4500 BC. This civilization was, however, superimposed upon earlier mesolithic hunter - gatherer societies centred in Mehrgarth in the plains of Kacchi, which themselves bore traces of a similar society based in the Vindhya, south of the River Ganges. While farming villages had emerged by 9000 BC in Mehrgarth, which was situated in the transitional zone between the hills of Baluchistan and the Indo-Gangetic plains, settlement became more pronounced by about 5500 BC. However, colonization of the alluvial plains only occurred after the formation of more complex societies, firstly in the Indus Basin and 2500 years later in the Ganges valley. This latter delay was due to the impenetrable nature of this area which was densely forested and therefore unsuitable for dense human populations until the advent of the iron age.

While far more is known about the food habits as opposed to the use of medicines of these early peoples, several factors influenced the development of medicinal systems over a period of time.

Firstly, ethnic changes between 2000 BC and 1500 BC, resulting from the arrival of Aryan immigrants, led to the domination of a new culture over the earlier pre-Caucasoid Dravidians settlers. These immigrants came from areas immediately north and west of the Indus valley and had links to the first city civilizations of Mesopotamia, for example, Sumer where, as in Egypt, medicinal systems were established. These influences necessarily had an impact on the development of the Vedic period with its written texts.

A second major factor involved the trade links of the Indus valley civilization overland to Gandhara and Bactria in Afghanistan, as well as by sea to Persia and the Persian Gulf. Although the Persian Empire under Darius had already incorporated the Indus valley, some 200 to 300 years earlier, paving the way for Alexander's expeditionary forces, the Mauryan dynasty had united most of the country, barring the South by 250 BC. The resulting ties between the emerging Indian civilization and other civilizations with which it came into contact, must undoubtedly have affected not just trade relations but also available knowledge regarding the use of plants for food and medicine

By the time of the post-Vedic period (after 600 BC), when medicine had been modified according to rational, scientific principles, as opposed to magical principles, the materia medica was extensive and incorporated plants from neighboring regions.

Soon afterwards, world trade, particularly with regard to spices began to intensify, both along sea routes as well as overland routes, resulting in linkages between the Near East and East and Southeast Asia. By the time of the Graeco-Roman era, pepper and ginger from India, and cassia, cinnamon and cloves from South East Asia, all of which were used for their medicinal properties, were widely known in the Mediterranean.

India obtained, by diffusion rather than by trade, some important medicinal species including *Cannabis sativa* and garlic from Central Asia; *Aloe vera*, *Cuminum cyminum*, opium poppy and *Glycyrrhiza* (liquorice) from the Mediterranean; nutmeg from Southeast Asia; *Trigonella foenum-graecum*, *Crocus sativus*, *Carum carvi* (caraway) and *Medicago sativa* (alfalfa) from Southwest Asia; *Coriandrum sativum* from the Mediterra

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nean and Southwest Asia; *Ricinus communis*, *Solanum nigrum* and tamarind from Africa; *Acorus calamus* from the Eurasian steppes; *Lepidium sativum* (cress) from Tibet; and numerous other species. Most of these were ancient introductions. A further influx took place after the Muslim conquest of India from 1221 AD onwards, placing a new emphasis on the Graeco-Arab system of Medicine (Unani) which had already incorporated elements from Egypt, Greece, Persia, India itself and China. At one point in time, approximately around 1526 AD, the Vedic and Unani systems interacted and functioned in an integrated manner as documented by Bala (1982, 1985 and 1991).

Traditional systems of medicine continued to be used in India even during the British era when western systems were promoted due to outbreaks of epidemic diseases such as cholera, smallpox and malaria. However, the adoption of public health measures was a novel concept, even in Britain, during this period, and as a result, no divergence between western and Indian medicine occurred until the ascendance of drug theory and practice in Europe towards the end of the nineteenth century.

Over time other influences from the East, particularly the Chinese/Tibetan systems of medicine affected the medicinal cultures of numerous tribal peoples of India. More importantly, oriental medicinal plants diffused into diverse regions of the Himalayas and interacted with those used in the Indian subcontinent.

Although many of the ancient as well as the more recent introductions and innovations described above, have become vital components of traditional medicine systems, India has over the millennia primarily relied on her own indigenous plant diversity in this regard. This is not surprising in light of the fact that she is one of the only countries to contain two of the globally identified areas of megabiodiversity, in addition to being a centre of origin and diversity for many crop species. The Botanical Survey of India records over 15,000 plant species occurring in the country, of which at least 7,500 have been used for medicinal purposes (Pushpangadan 1995).

Attempts to document the plant wealth of India have continued since the landmark publication by Watt (1889-96). Around 1700 species have been documented for their biological properties and drug action (FRLHT 1996) and data is available for approximately 1200 species, especially those most frequently used in traditional Indian systems of medicine, resulting in a reasonable knowledge base. However, there is still a lack of documentation relating to the properties, natural distribution, ecological tolerances and uses of a number of valuable medicinal species. Furthermore, the summaries of information which exist only provide broad as opposed to detailed information as shown in Table 1.2 and 1.3.

Table 1.2 Distribution of Medicinal Plants by Habit
(based on analysis of 1079 South Indian species)

Habit	Number	Percentage
Herbs	344	32 %
Shrubs	220	20 %
Trees	354	33 %
Climbers	127	12 %
Others	34	3 %

Source: FRLHT (1996)

Table 1.3 Distribution of Medicinal Plants by Parts Used
(based on analysis of 1079 South Indian species)

Parts	Percentage
Roots	26.6 %
Leaves	5.8 %
Flowers	5.2 %
Fruits	10.3 %
Seeds	6.6 %
Stem	5.5 %
Wood	2.8 %
Bark	13.5 %
Whole Plant	16.3 %
Rhizome	4.4 %

Source: FRLHT (1996)

Before concluding this section, two areas of concern should be noted. Firstly, it has not always been appreciated that documentation of direct relevance to medicinal use is an international task, given the interdependence of nations in relation to research or to plant exchanges-whether for medicines, food, fibre or other economic purposes. Thus, for example, listing research on active principles draws on publications from scores of countries, including India. (Asolkar, Kakkar and Chakre 1992)

A final relevant point by way of introduction concerns the importance of medicinal plants in international trade. This implies that accelerated attempts to harvest and trade materials, or to cultivate medicinal plants for profit, can well result in a focus on non-indigenous plants with consequent repercussions on the availability of the resource base to sustain national needs.

1.2 The Resource Base

Medicinal plant species are increasingly under threat. At present, it is feared that 15-20 percent of the total vascular flora of India (over 3,000 species) may fall under one of the IUCN categories of threatened, rare, or endangered. While a comprehensive analysis of the status of medicinal plant species has never been carried out, it is estimated that approximately one third of the plant species listed in the Red Data Book of India, may have medicinal properties (Bisen et al. 1996).

The piecemeal efforts which have been undertaken to assess the threat to medicinal plants bear out the assumption that the number threatened is high. At least 120 medicinal species have been officially classified as endangered (Jain 1987) and a threat assessment exercise recently carried out by an NGO in South India (FRLHT 1996) showed that of 78 plants occurring in the three states of Kerala, Karnataka, and Tamil Nadu only 21 were at low risk (Appendix 1).

However, what is required is specific data, for example on whether a species under threat in one region of the country is at low risk elsewhere, or whether estimated threats are for species which are old introductions from other countries (See Appendix 2) from where new germplasm could be obtained.

The largest gap in knowledge relates to paucity of information on patterns of genetic diversity as well as which segments of the species' genepool/distribution need attention for conservation and for further development through domestication and cultivation. It is well known that certain sources of a particular species may be more efficacious for medicinal use than other sources. This is an area requiring strategic attention.

The pressures exerted on the resource base are to a large degree caused by overexploitation (over-collecting) as well as in many cases by poor collecting techniques. It is often easier to uproot the entire plant rather than to selectively gather the specific parts required, especially where commercial profits are available for the collectors.

As result of the above factors, together with increasing populations, increased demands for crude drugs and lack of a comprehensive knowledge base, the continued availability of plant material from the wild cannot be scientifically or practically assured.

Nor has the resource base been replaced to any significant extent by cultivation. Nearly all experts consulted in the field agreed that the vast majority of plants continue to be harvested from the wild, with estimates of up to 100 per cent for wild-harvesting in some of the predominately rural and tribal regions (Vedavathy, pers. comm., 1996; Nambiar, pers. comm., 1996), though usually in the order of 95 percent (FRLHT data for Karnataka, Kerala and Tamil Nadu).

Even in cases where official organizations have set up cultivation of certain species to supply external markets it is still inadequate. An ongoing study of the imported pharmaceutical plant materials of India's largest trading partner, Germany, suggests that 70-90 percent of the species acquired by the country are primarily wild-harvested (Lange 1996), a practice now commonly known as 'mopping.'

The forests of India, covering 19.4 percent of the country's total geographical area, or 328 million hectares of land, form the major ecosystems for the provision of medicinal plants. Of this area, the largest proportions are covered by tropical wet, tropical moist deciduous, and tropical dry deciduous types. However, it should be noted that medicinal species are unevenly obtained not only from the different forest types but also the different regions of India.

The forests of Himachal Pradesh, said to have been the birthplace of Ayurveda, are known to supply a very large proportion of the medicinal plant requirements of India, with one estimate quoting figures as high as 80 percent of all Ayurvedic drugs, 46 percent of all Unani drugs, and 33 percent of all allopathic drugs developed in India (Aryal 1993). The Western Ghats, one of the hotspot areas of mega-biodiversity, form a second major supply source, While the Himalayas represent a third heterogeneous source. Unfortunately, however, information regarding major supply zones is often protectively guarded as a result of increasing scarcity of supply, and is far from being well documented.

Additionally, not all the plant sources are Indian. It is important to note that Indian markets are heavily supplied by plants from surrounding SAARC countries, especially Nepal and Bhutan. These countries, whose processing sectors are miniscule in comparison to those of India, have supplied medicinal plants both legally and illegally to India for centuries. Many plants of Tibetan origin have entered India following ancient trade routes through the corridors of Nepal and Bhutan (Edwards 1993).

Table 1.4 Forest Types in India and Their Distribution

Forest types	Area/million hectare	% of total area under forest
Tropical wet	5.13	8.0
Tropical evergreen	2.64	4.1
Tropical moist deciduous	23.68	37.0
Littoral and swamp	0.40	0.6
Tropical dry deciduous	18.36	28.6
Tropical thorn	1.65	2.6
Tropical dry evergreen	0.14	0.2
Sub-tropical broad leaved hill	0.28	0.4
Sub-tropical pine	4.24	6.4
Sub-tropical dry evergreen	1.25	2.0
Montane wet temperate	2.34	3.6
Himalayan moist temperate	2.20	3.4
Himalayan dry temperate	0.03	-
Sub-alpine and alpine	1.86	2.9

Source: Bajaj (1990)

The importance of these two countries in supplying medicinal plants also draws attention to the significance of mountain ecosystems in providing medicinal plants in India. A conference, organized in May 1996 in Pokhara, Nepal, by IDRC, the International Centre for Integrated Mountain Development (ICIMOD), and the International Plant Genetic Resources Institute (IPGRI), on the role of Bamboo Rattan and Medicinal Plants in Mountain Development documented the great importance of medicinal plant collection in mountain environments. Researchers at the Workshop estimated that over 120 million people in the Himalayan region rely primarily on plant products, mostly extracted from the wild, among which medicinal plants were one of the major groups (Karki, Rao, Rao & Williams 1997).

Much more needs to be done to understand the economic pressures sustaining the trade of medicinal plants across borders. However, it is interesting to note that species of high altitude origin are generally of high value while those originating at lower altitudes are of lower value as the following two examples illustrate:

Swertia chirayita (chirayata) is one of the low-value, low-altitude plants. It is collected for a bitter principle active against fever and digestive disorders, with long established use in Ayurvedic medicine. It is a herb found at mid-altitudes (1200-3000 m) on open ground and recent slash-and-burn forest. Most chirayata in Indian commerce is collected from East Nepal. India also exports the extract chiretta containing the glycoside chiratin to Europe and Asia (Edwards 1993).

Nardostachys jatamansi (jatamansi) is a high-altitude, high-value plant. It is a perennial herb from the alpine Himalayas (5000 m) and occurs in Nepal, Bhutan, Kashmir, Sikkim and Madhya Pradesh. The rhizomes are collected. Although non-processed exports are officially banned from Nepal, a major illegal trade continues to India for extraction of a pale yellow volatile oil of high value as a drug for numerous ailments, and an ingredient in perfumes. Interestingly this plant was listed in the pharmacopoeia of Hippocrates, a Greek who lived during 460-357 BC.

1.3 The Collectors and their Background

The secrecy of the medicinal plants trade, as well as seasonal variations, make it difficult to determine the precise number of people involved in collecting medicinal plants from the wild. However, some data exists regarding collection of non-timber forest products (NTFPs) as a whole, which can provide a broad brush attempt to estimate those collecting medicinal plants.

According to a study carried out in 1987 by the National Centre for Human Settlements and the Environment in New Delhi, over 50 million people were living in and around forests in India and relying upon NTFPs for subsistence and cash income (NCHSE 1987). To take a single regional example, an intensive study in Tamil Nadu revealed that on average, more than 100,000 persons enter the forests of the state each day to collect forest products, including medicinal plants (Appasamy 1993).

All available evidence suggests that it is the poorest of the poor who rely on the harvesting of NTFPs, such as medicinal plants, for their earnings (Godoy and Bawa 1993; Appasamy 1993). This is particularly the case where people have had relatively unrestricted access to forests as common property resources: the plants are easily accessible, and the markets do not demand a high level of processing or related skills (Edwards 1993). Table 1.5 illustrates divergences between high and low income groups in terms of dependence on NTFPs. Common property resources are a vital component of income for the poor, which, if diminished, would exert a major impact on their ability to meet their most basic survival needs.

The role of women has also begun to receive a significant amount of attention from those involved with medicinal plants as well as with alternative approaches to forest development. It is widely held among the papers and case studies obtained during this study that women play a major role in collecting, and in some cases marketing medicinal plants, especially since these activities coincide with their basic responsibilities of providing health care to children and families (Nambiar, pers. comm. 1996; Vedavathy, pers. comm. 1996; Arnold 1994; Pokhara Declaration). While men living in and near forests tend to be involved with the higher income-generating timber trade, anecdotal evidence suggests that women have been a major force in the collection and utilization of products such as medicinal plants. However, research findings which thoroughly consider the extent and nature of women's participation are not yet available.

Table 1.5 Degree of Dependence by Rich and Poor on Common Property Resources

State	Common Property Resource Contribution		
	Household Category	Income (%)	Days of employment per household
Andhra Pradesh	Poor	17	139
	Wealthy	1	35
Gujarat	Poor	18	196
	Wealthy	1	80
Karnataka	Poor	20	185
	Wealthy	3	34
Madhya Pradesh	Poor	22	183
	Wealthy	2	52
Maharashtra	Poor	14	128
	Wealthy	1	43
Rajasthan	Poor	23	165
	Wealthy	2	61
Tamil Nadu	Poor	22	137
	Wealthy	2	31

Source: Jodha (1990)

There is a close relationship between medicinal plants and other NTFPs in the lives of those who collect them. Case studies have revealed that, collection of medicinal plants has typically comprised one component of a number of livelihood strategies pursued by forest and fringe dwelling communities. Activities which usually accompany collection of the plants include collection of other NTFPs such as resins, gums, bamboo and cane, honey, and the like (Godoy and Bawa 1993). In addition to these extractive activities, many case studies have indicated that the families involved are also active in the agricultural sector.

Table 1.6 depicts the contribution of various rural activities to the livelihood security of a small tropical Sri Lankan village studied in 1992 (Gunatilake et al. 1993). Medicinal plants contributed approximately 24 per cent of the total family income; while livestock contributed 35 percent; cardamom collection 33 percent, and a range of other activities made up the remaining income. Significantly, these figures are averages, and both incomes and labor inputs from different activities would vary from season to season. It is likely that a similar situation would be found in India.

In addition to recognizing that medicinal plants usually comprise only one of a number of income-generating activities of the collectors, it is also important to note that research outside the South Asia region suggests that extraction of medicinal plants and other non-timber forest products is a job of necessity rather than of choice, and that it may be only a stand-by until more profitable means of making a living, are available, particularly through livestock and agriculture activities (Browder 1992). As noted in a survey of NTFP case studies conducted in 1993, the richer households and villages become, the less time they tend to spend collecting medicinal plants and other NTFPs; instead, they turn to more attractive non-forest based occupations such as agriculture and business enterprises (Godoy and Bawa 1993).

Table 1.6 Contribution to the Total Income By Each Activity of the Farming and Forest Collection System

Activity	Participating households		% contribution to income	Average contribution to income (\$/family/year)
	#	% total		
Rice Cultivation	56	93	11.5	195.50
Other Annual Crops	35	58	4.5	117.10
Perennial Crops	17	28	1.7	91.80
Kitchen Gardens	59	98	3.9	63.60
Livestock	33	55	0.3	24.40
NTFP	60	100	16.2	253.10
Shifting Cultivation	52	86	20.3	365.60
Cardamom	41	68	26.0	607.90
Other Income	49	81	15.5	294.10

Source: Gunatilake et. al., (1993)

In fact, according to the same survey, richer households and villages tend to: a) extract fewer plants and animals; b) spend less time foraging and more time in non-forestry occupations; c) consume fewer wild plants and game; and d) use more domesticated animals and industrial substitutes (Godoy and Bawa 1993).

This has very important implications for development projects which seek to capture greater benefits locally from medicinal plants, suggesting that livelihood choices are very susceptible to change, and that participation will depend upon trade-offs, given the informal and opportunistic nature of the market.

An additional consideration is the possibility that as these products become more valuable, especially medicinal plants, their access will tend to be monopolized by the richer segments of society. Access to markets, political authority, and the like, can enable the rich to divert the flow of medicinal plants so that they are better served and provided for by these, while the poor forest-dwellers lose access to the resources as they become more valuable (Dove 1994). Medicinal plant collecting, in other words, could go the way of timber in moving from a poor man's source of income to that of a rich man; and even, from a poor man's source of medicine to that of a rich man.

There are virtually no known comprehensive studies regarding the methods by which medicinal plants are harvested from the wild. However, conventional wisdom holds that the collecting methods are unscientific and unsustainable, with estimates as high as 70 percent of the plants being destructively harvested (Godoy and Bawa 1993, FRLHT 1996).

Methods of collection also vary in relation to who is collecting the plants and for what use. Godoy and Bawa (1993) have suggested that plants destined for local use by the collector or his immediate society tend to be harvested more sustainably than those destined for commercial markets. Tribal groups and those with close connections to the forest and land are also reported to use very sustainable methods of extracting medicinal plants for use in their own formulations, in some cases including elaborate rituals which are designed specifically to promote the health and future yields of the plants. (Vihari 1996; Vedavathy 1996).

In addition, it has been found that poor villages tend to extract low volumes of a number of forest products of low value; whereas richer villages remove greater volumes of fewer goods of higher value. This intensification or specialization by the wealthier groups is due to fact that richer groups tend to be less reliant on forests for subsistence needs, and can therefore focus on high-value, low-volume products such as medicinal plants, which provide the highest remunerative gains (Godoy and Bawa 1993).

1.4 The Policy Environment

Common Property and Forest Access Laws

Although in numerous parts of India, forests have in effect been managed as common property resources since time immemorial, this has not officially, been the case since 1878, when the colonial government legislated the Forest Act, dividing forests into three categories which even now continue to be used: reserved forests, protected forests, and village forests. Reserved forests and protected forests were under the jurisdiction of the Forest Department, and constituted by far the largest portion of forest lands in the country. The difference between reserved and protected forests lay in the use of resources, which in reserved forests was tightly restricted, whereas in protected forests, Forest Department officials were allowed to make use of the resources for purposes which were seen to benefit the colonial economy.

The concept of village forests entailed that communities dwelling in or near forest areas should have the right to make use of them. The village forests were thus under the control of the village Panchayat, a semi-democratically comprised council which still prevails in Indian villages. However, though officially under local control, in practice the state could still override the decisions of the village. This situation continued even after independence, and in fact, the National Forest Policy Resolution of 1952 specifically stated that the claims of communities in and around the forests could not override 'national interests.'

Jodha (1990) has shown that from 1952 to 1982, common property resources declined dramatically, even as population pressure increased. As Table 1.7 shows, in all of the seven States studied, there has been a dramatic increase in persons per hectare of common property resources; in several states, this number has increased nearly threefold during the survey period .

As it became apparent that local needs frequently could not be met without some degree of control being exerted over the local resource, a movement began to ensure that forest policies were more in line with peoples' actual needs. In 1982, a Report of the Committee on Forests and Tribals stated that three areas must be addressed by forest policy: ecological security; products used for food, fodder, fibre, timber, and other domestic needs of the rural and tribal populations; and materials used by cottage, small, medium, and large industries (Appasamy 1993). This was an attempt to shift the focus of forest policy away from the 'sustained yield' concept which mainly benefitted large-scale industry, and to emphasize forests as a means of meeting the needs of a variety of stakeholders, including forest-dwellers and future generations.

Table 1.7 Decline in area of common property resources (CPR) and increase in population pressure on them

State	Average area of CPRs per village (ha)	Decline since 1950-52 (%)	Persons per ha of CPR	
			1951	1981
Andhra Pradesh	827	42	4.8	13.4
Gujarat	589	44	8.2	23.8
Karnataka	1165	40	4.6	11.7
Madhya Pradesh	1435	41	1.4	4.7
Maharashtra	918	31	4.0	8.8
Rajasthan	1849	55	1.3	5.0
Tamil Nadu	412	50	10.1	28.6

Source: Jodha (1990)

The 1982 report described above was actually incorporated to some extent at the policy-making level while the 1988 National Forest Policy specifically addressed many of the issues concerned. One section of the policy read, "the life of the tribals and the other poor living within and near forests revolves around forests. The rights and concessions enjoyed by them should be fully protected, their domestic requirements of fuelwood, fodder, minor forest produce and construction timber should be the first charge on the forest produce." Unfortunately, however, the Forest Policy is not a legal enactment, serving rather as a set of guidelines for interpreting the laws. This leaves the rights of forest-dwelling communities to some degree of control and access to forest produce legally unprotected in most cases and vulnerable to strong-arm tactics used by state and local forest departments, as well as by industry.

At the same time, policy makers at the state government level have in many cases attempted to ensure access to the forests by tribal and other poor communities. In Kerala, for example, under the Monopoly Procurement and Marketing Policy Act of 1978, permission was given to tribal and tribal societies to collect 120 items from the forests, of which 73 were known to be medicinal plants. Unfortunately the collection monopoly in this case was of questionable benefit since only 15-25 items were actually collected due to the fact that the prices obtained for the remaining items were not remunerative (Santhosh 1996).

Similar policies are known to have been enacted in other states, frequently linked to government-operated marketing cooperatives. Unfortunately, these legally monopolistic (only tribals sell) and monopsonistic (only cooperatives buy) markets have tended to fail and have rarely allowed the poor communities they intended to serve to actually benefit from their harvesting from the forest, as further discussed in Chapter 3.

Forest Products Regulations

In terms of policy, medicinal plants have generally been lumped into the broad category of Minor Forest Produce (MFP). Even the relatively progressive 1988 Forest Policy Resolution continues to use this terminology. However, as the markets and sizes of the user communities suggest, a more accurate designation for these products would be Non Timber Forest Products (NTFPs), which has recently gained widespread recognition around the world.

Nonetheless, NTFPs, including medicinal plants, have rarely been considered as warranting the enormous amount of consideration and research given to timber policies. However, some provision for regulation was made as early as 1927 under the Indian Forest Act. This Act defined two types of forest produce, for which permits, registration, and licensing were required when collected and traded:

Section 2 (4) (a) regulated selected forest products, regardless of their origin in forests or elsewhere; for the most part it identified tree species used for timber;

Section 2 (4) (b) regulated all non-tree plants, all parts or produce of such plants, including leaves, flowers, and fruits and all parts or produce of trees not specified in the first category, but only when originating in a forest.

Most medicinal plants are covered under sub-section (b), and are not subject to regulations unless extracted from the forests. However, some items such as bark and wood-oil from certain trees were covered under sub-section (a); and subsequent state amendments to the Act have added several medicinal species to this sub-section, as shown in Table 1.8, subjecting to significant regulation regardless of origin.

Additionally, in some cases complications associated with management of the different types of forests described earlier can become burdensome and overwhelming to the collectors of the plants. One such case from the Central Himalayan forests was documented in 1993. The government had recently come under sharp criticism by the Forest Panchayat of the village Khaljhuni, regarding the commercial exploitation of MFP. The detailed and laborious procedure of gaining government permits was found to comprise 13 percent of the total costs faced by the villagers in extracting MFP. This situation encouraged illegal extraction, in addition to increasing opportunities for (greed) and corruption on the part of bureaucrats, at the villagers' expense (Rao and Saxena 1996).

Table 1.8 Medicinal Species Included by State Amendments in Section 2 (4) (a) of 1927 Indian Forestry Act

State	Species
Gujarat	<i>Rauwolfia serpentina</i> , Kodaya gum
Maharashtra	Rosha grass including oil, <i>Rauwolfia serpentina</i>
Karnataka	Sandalwood oil, rosha grass and oil, <i>Phyllanthus emblica</i> , <i>Terminalia chebula</i> , <i>Terminalia bellerica</i> , <i>Capparis mooni</i>
Tamil Nadu	Sandalwood
Kerala	Gum, fibres and roots of sandalwood and rosewood
Orissa	Gums, roots of Patafgaruda, sandalwood, tamarind
Uttar Pradesh	Gum, Chiraunji

Source: Jha (1990)

1.5 Interventions to Date on the Resource Base

More than any other aspect of the medicinal plants sector, the maintenance of the resource base itself has received the most attention with regard to both governmental and non-governmental initiatives. A relatively large group of interested but generally uncoordinated natural scientists, and a smaller group of policy makers and social scientists, have variously been involved in such initiatives, whether incidentally as a part of forestry or agricultural research, or specifically with medicinal plants as the focus. Efforts have been concentrated primarily on cultivation and conservation. In addition, the movement for Joint Forest Management in India has likewise been relevant regarding access to land and use of NTFPs such as medicinal plants.

Cultivation

Given the demands of the market for a continuous and uniform supply of raw materials, and the increasing depletion of the forest resource base, expanding the number of medicinal plants in cultivation appears to be an important strategy for research and development. However, according to one estimate, of more than 400 plant species used for production of medicines by Indian Industry, less than 20 are currently under cultivation in the country (FRLHT 1996).

The potential returns to the farmer from cultivation of medicinal plants is reported to be quite high. A 1995 study suggested that the cultivation of certain high altitude Himalayan herbs could yield products priced anywhere between Rs. 7,150 to 55,000 per hectare although it is not clear at which point in the marketing chain these prices are paid (Nautiyal 1995). What is clear however is that although estimates of returns vary widely, medicinal plants can be valuable crops. Rao and Saxena (1994) reported average annual (per hectare) incomes of Rs. 120,000 through mixed cropping of high altitude medicinal herbs. High altitude medicinals tend to command higher prices but those of lower altitudes are still significant. Data for some low-altitude crops from the Amarkantak region of Madhya Pradesh (Table 1.9), show economic returns for four profitable species. Cultivation is clearly a sustainable alternative to collection of medicinal plants from the wild.

Table 1.9 Economic Returns of Cultivated Species in Amarkantak Region, Madhya Pradesh

Species	Yield (kg/ha)	Market Rate (Rs/kg)	Market Value (Rs)	Total Expenses (Rs)	Net Return (Rs)
<i>Curcuma angustifolia</i>	9800	6.00	58,800	10,760	48,040
<i>Rauwolfia serpentina serpentina</i>	850	75.00	63,750	9,480	54,270
<i>Acorus calamus</i>	3500	10.00	35,000	7,950	27,040
<i>Chlorophytum tuberosum</i>	150	150.00	25,500	9,480	13,020

Source: Goswami and Bhatnagar (1991)

Most of the produce of cultivated medicinal and aromatic plants is exported as crude drugs e.g. *Psyllium*, senna leaves, opium poppy and Asgand. Unfortunately, however, due to emphasis being placed on important cash crops, as well as the fact that the majority of the cultivated species are not indigenous to India, most cultivation efforts are not alleviating the pressure being exerted on the natural resource base.

Nevertheless, a number of techniques have been developed to increase the quality and yield of many of the cultivated species. It is estimated that Indian public sector research institutions have developed standardized practices for the propagation and agronomy of a total of about 40 species (Chadha and Gupta 1995; (FRLHT 1996).

Public Sector Research Efforts

Much of the research progress to date has resulted from the decision of the Indian Council for Agricultural Research (ICAR) to establish an All-India Coordinated Research Project on Medicinal and Aromatic Plants (AICRPMAP), in 1972, under the auspices of the National Bureau of Plant Genetic Resources (NBPGR). Efforts have mainly focused on the development of agro-technology techniques, including propagation methods for medicinal and aromatic plants. Aromatic plants have however tended to receive more attention, perhaps because their market values are in general more widely known.

ICAR works through a network of research stations, including the National Research Centre for Medicinal and Aromatic Plants located in Anand, Gujarat, which specializes in domestication, and has created structural links between the NBPGR and its Plant Breeding Division in order to develop improved varieties of some of the medicinal plant species used in allopathic preparations.

Another major national public research organization, the Council for Scientific and Industrial Research (CSIR), has also played a significant role with regard to cultivation of medicinal plants, through its creation of CIMAP, the Central Institute of Medicinal and Aromatic Plants, in Lucknow. CIMAP is now a preeminent institution in India focusing on agro-technology as well as basic studies; improvement and enhancement of the resource base, and chemistry and related research regarding product development from plants. Priority species are also frequently aromatic plants. To illustrate the current research focus those species accorded priority for rapid clonal propagation and genetic manipulation are listed in Appendix 4.

In connection with the two major research efforts described above, the Central Government initiated a five year program (1992-1997) implemented by the Ministry of Agriculture to accelerate research and development of medicinal plants. With the support of 16 state agricultural universities, state horticulture and agriculture departments, regional research laboratories and the International Crop Research Institute for the Semi-Arid Tropics (ICRISAT), the GOI is establishing herbal gardens, nursery centres and demonstration seed production centres nation-wide.

Private Sector Research Efforts

Private companies have also begun to invest in the cultivation of medicinal plants, since they face difficulties with regard to increasing supply gaps as well as in some cases adulterated materials from the wild. One such company, the Arya Vaidya Sala, in Kottakal, Kerala, in addition to maintaining two large herbal gardens, has also undertaken research on the propagation of 10 species, the demand for which currently outstrips supply, or may soon do so.

Table 1.10 Species Under Agro-technical Research by the Arya Vaidya Sala, 1995

Species	Number of formulations in which species is utilized by AVS	Quantity demanded annually by AVS (kg)
<i>Baliospermum montanum</i>	27	1000
<i>Celastrus paniculatus</i>	15	540
<i>Cosciniium fenestratum</i>	70	3300
<i>Crateva nurvala</i>	13	1840
<i>Embllica ribes</i>	75	3030
<i>Hemidesmus indicus</i>	30	19000
<i>Holostemma ada-kodien</i>	40	3860
<i>Rubia cordifolia</i>	40	4200
<i>Saraca asoca</i>	3	5310
<i>Trichosanthes lobata</i>	32	5800

Source: Bajaj and Williams (1995)

A comparison of the species depicted in Table 1.10 with those shown in Appendices 2 and 3 reveals that there is no overlap in research efforts and that the AVS venture is complementary to that of the government. Further, the AVS venture which has been undertaken with funding by IDRC is encouraging the participation of farmers, who are now enthusiastic about cultivating medicinal crops, and is investigating the potential of intercropping the selected medicinal species with other economically viable species to create an added incentive for farmers.

Other traditional drug manufacturers in India have also begun to invest in cultivation experiments and developments. Some of the companies are undertaking R&D programs through the creation of company foundations, such as the Zandu Foundation for Health Care in Mumbai and the Shree Dhootapapeshwar Ayurvedic Research Foundation in Bangalore and Panvel. These companies are actively involved in the development of cultivation methods of medicinal plants of importance to them, with the direct participation and partnership of local farmers and tribal women. (Lambert 1996). All such efforts will result in an increase in the number of medicinal plant species cultivated, particularly indigenous Indian species.

Ex-Situ Conservation

Establishing collections of medicinal plant germplasm is another means of helping to maintain the resource base. At present such collections include those designated as genebanks as well as herbal gardens. Many of these are scientific reference collections of species, as are specimens of medicinal plants grown in botanical gardens. For the collection of living plants to constitute a major conservation field genebank, a wide range of intraspecific diversity is needed, well documented in relation to its origins and uses. However, there is no comprehensive documentation available on existing collections to ascertain to what extent they act as *ex situ* collections or as sources of planting materials. Nonetheless, the list of major collections described below (and in Appendix 5) highlights the interest and activities being devoted to this area.

Herbal Gardens

India has joined the G-15 Gene Banks for Medicinal and Aromatic Plants (GEBMAP) initiative, and currently acts as the coordinator for the Asian countries in the network. Three gene banks have been established in the country; one through the Central Institute for Medicinal and Aromatic Plants in Lucknow; one managed by the National Bureau of Plant Genetic Resources in New Delhi; and one coordinated by the Tropical Botanical Garden and Research Institute, Trivandrum. The Department of Biotechnology is the nodal agency to which this work has been assigned.

The Tropical Forest Research Institute (TFRI), Jabalpur, has established a herbal garden with a collection of 461 species, including rare and endangered species (see Appendix 6). Emphasis is on propagation for large-scale cultivation of species with market potential, and rehabilitation of species on the verge of extinction.

The Forest Research Institute at Dehra Dun has collected significant medicinal and aromatic plants of the Himalayan region and is using the NWFP nursery at Chakrata and the botanical garden at Dehradun to produce large numbers of plants. Cultivation and harvesting techniques have been standardized for a number of these plants. The following rare and endangered species were earmarked for protection in the garden: *Taxus baccata*, *Picrorhiza kurreea*, *Nardostachys jatamansii*, *Orchis latifolia*, *Crocus sativa*, *Bunium persicum*.

The Department of Indian Systems of Medicine and Health, Ministry of Health and Family Welfare, has promoted the establishment of small herbal gardens in educational institutions as a means of furthering traditional medicine systems.

The Central Council of Research in Ayurveda and Siddha situated in Pune maintains a Medicinal Plant Garden, which houses 320 species of medicinal and aromatic plants, including a number of endangered species.

It is not clear to what extent the collections overlap, and how far they address the conservation needs of the country. Almost certainly, an assessment is needed and the strategy being pursued requires definition. The responsible organizations include several GOI departments, as well as international agencies with an interest in this field such as G-15; IUCN; WWF; Botanic Gardens Conservation International, IDRC, Canada, and some the UN Agencies.

In-Situ Conservation

Several institutions, including ICFRE, TFRI, the Forest Survey of India, the Botanical Survey of India, and CIMAP, have conducted vegetation surveys revealing continuing losses of the medicinal plants resource base (Tewari 1996). Additionally, several meetings of experts organized in the region have called for a judicious mix and balance of *ex-situ* and *in-situ* approaches to conservation: IDRC, for instance has in the past 3 to 4 years repeatedly stressed this need (Bajaj and Williams 1995; Tirupati Declaration 1996; Karki, Rao, Rao & Williams 1997).

Government Initiatives

In-situ conservation of biodiversity has for some time been given priority by the GOI although it is still too early to assess the success of its initiatives in protecting biodiversity and their consequences for local means of income generation and land access.

The government created forest preservation plots in 1905 and since then has established them throughout the diverse forest ecosystems of India. These include 65 national parks, 426 sanctuaries, 13 biosphere reserves, 316 preservation plots and more than 7200 sacred/religious groves. This network covers more than 5 percent of the nation's geographical area, and is coordinated/monitored by the Ministry of Environment and Forests (Bhatnagar and Bisen 1996). It has been strengthened on numerous occasions, most notably through the Forest (Conservation) Act of 1980 and the Conservation of Forests and Natural Ecosystems Act of 1995. The extent to which the network protects India's medicinal plant biodiversity is however not well understood due to the need for inventory and documentation.

The Wildlife (Protection) Act of 1972 refers mostly to the protection of species within the protected areas network, with only a small number of plant species being covered regardless of location. The only medicinal species among these is kuth, which is also a restricted species identified by the Convention on International Trade in Endangered Species (CITES), covered in more detail in Chapter 4.

However, a policy dialogue has been initiated regarding medicinal plants conservation, and statements of support for such a policy are forthcoming from many of the stakeholders in the sector, including the private companies which depend upon a continuous source of raw materials supply (Lambert 1996). More recently a meeting of governmental, non-governmental, and private sector representatives was held at the M. S. Swaminathan Research Foundation in Chennai in 1996, in order to begin the long process of developing and enacting national policy.

Non-Government Initiatives

A key organization involved in mobilizing a movement for medicinal plants conservation policy is the recently-formed Foundation for Revitalization of Local Health Traditions (FRLHT), with headquarters in Bangalore and funded by DANIDA. FRLHT established a coordinated network of 30 *in-situ* research areas in the states of Tamil Nadu, Karnataka and Kerala between 1993 and 1997. These medicinal plant conservation areas, (MPCAs) average 200 hectares in size, and are located within notified forest reserves or wildlife sanctuaries (FRLHT 1995). They are listed in Appendix 7.

Many of the MPCAs have contiguous forest communities whose cooperation and involvement benefit these *in-situ* conservation sites. With their assistance, unwanted animal grazing and accidental fires which may damage the flora of these reserves can be prevented. To ensure that the MPCAs continue to exist in the long-term, FRLHT has obtained commitments from the State Forest Departments involved to maintain them beyond the duration of the project.

Joint Forest Management

Achieving the empowerment and involvement of people is also the primary thrust of a growing movement in India known as Joint Forest Management (JFM). JFM refers to cooperative agreements made between village communities and the local forest departments to protect a particular area of state-owned forest land and then share the final harvest (Sundar 1996). As such, it offers an approach which allows communities to have a greater degree of control and access to state-owned lands, and enables them to benefit more than from predominant tenure and forest property policies.

Started in the Arabari Hills of West Bengal by A. K. Banerjee in the 1970s, JFM has proved to be a novel and workable concept in achieving the combined objectives of development and conservation. In 1990, the Ministry of Environment and Forests wrote to the Forest Secretaries of all States and Union Territories, requesting them to actively encourage participation of communities in rehabilitation of degraded forest areas,

and to attempt to replicate successes. Although many areas have been slow to adopt JFM (Guha 1994), it is estimated that 10,000 to 15,000 village forest protection and management groups are currently protecting over 1.5 million hectares of state forest lands (Sundar 1996).

Although not extensively documented, medicinal plants and other NTFPs have a potentially important role to play in JFM schemes.

CHAPTER 2
Chapter 2
TRADITIONAL KNOWLEDGE

Traditional Knowledge and Indigenous Uses



Chapter 2

Traditional Knowledge and Indigenous Uses.

In order to understand the extent to which medicinal plants are used at the local community level, a useful distinction can be employed related to the type of medical practice:

Allopathic, generally understood as 'modern' medicine, and based predominantly on the principles of Western Post-Enlightenment Science which has dominated the last three centuries.

Classical Traditional, referring to the documented and standardized "Great Tradition" systems of medicine, including (in India) Ayurveda, Siddha, Unani, Amchi, and Homeopathy, with different epistemological bases to that of Western Science.

Folk Traditional, referring to those medical practices which are usually transmitted orally from generation to generation and whose use is generally confined to a particular geographical region or group of people such as a tribe or caste community.

Most studies and common wisdom in India suggest that few people adhere solely to any one of these types of medicine, more often shifting from one to the other, based on a combination of factors including preference, faith, availability, and cost. A recent study by the Ministry of Health and Family Welfare, concluded that less than 30 percent of India's population is adequately served by modern medicine and the primary health care centres which were meant to reach the most remote areas. The organized Indian systems of medicine (ISM) are said to have similar levels of penetration. Hence it has been asserted by some that up to 500 million people continue to take recourse to some form of traditional folk medicine, including local innovations on classical systems (FRLHT 1995).

Although this assertion cannot be conclusively proven, there is information to suggest that it may be correct. According to the Anthropological Survey of India, there are over 4,635 tribes spread throughout the country, most of whom live near forests and depend upon their resources to fulfil basic needs. In addition, the majority of India's population of nearly 1 billion continues to be rural and village-dwelling, frequently isolated from the usual means of medical knowledge transmission. Taking these factors into account, an estimate of 500 million does not seem exaggerated.

While microstudies conducted in South Asia reveal the existence of a large number of practitioners, displaying various levels of specialization, as shown in Table 2.1, millions of households still practise self medication using locally available remedies based on medicinal plants.

A large number of species, many of which are indigenous to the South Asian region are used in these preparations, which are themselves unique to India in many cases. The GOI has in recent years been active in placing medicinal plants within the broader context of ethnobotany through an All-India Coordinated Research Project on Ethnobotany under the Ministry of Environment and Forests. The resulting findings are also of interest to private companies, mostly foreign-based, which are seeking to develop new drugs.

Table 2.1 Some Practitioners of Folk Traditional Medicines in South India *

Traditional Carrier	Subjects	Number
Housewives and Mothers	Home remedies; food and nutrition	Millions
Traditional Birth Attendants	Normal deliveries	700,000
Herbal Healers	Common ailments	300,000
Bone Setters	Orthopaedics	60,000
Visha Vaidhyas	Natural Poisons	60,000
Other Specialists	Skin; respiratory; mental illnesses; arthritis; dental; wounds; liver; fistula; piles	About 1 per 300 Herbal Healers

*Based on extrapolations from micro-studies. Source: Sankar (1994)

Information about tribal and folk practices assists these companies in identifying prospective plants for future drug manufacture. In recent times, such 'bioprospecting' companies have attracted a great deal of attention, both positive and negative, at international fora, especially at the UN Conference on Environment and Development in 1992 and at subsequent discussions. What is clear is that the pharmaceutical industry whether international or national will continue to benefit from traditional knowledge, since many pharmaceutical products have been derived from plants-some 75 percent of these were discovered by examining the use of these plants in traditional medicine (Tempesta and King 1994). Indeed, it has been shown that through consultations with indigenous peoples, the success rates from bio-prospecting can be increased from approximately 1 in 10,000 to even 1 in 2 (Anon 1995).

Such considerations of benefit to pharmaceutical industries should not however cloud the major research objectives stated by WHO: since the therapeutic practices based almost entirely on the use of traditional herbal remedies are prescribed by traditional medical practitioners, who are respected members of the community, the government has responsibilities to formulate national policies that encourage the national use of herbal medicines and to promote their safety and quality (WHO 1991, 1993). A WHO/IUCN/WWF International Consultation on Conservation of Medicinal Plants noted that the loss of indigenous cultures has direct consequences on the identification of new medicinal species to benefit the wider community (Akerlele *et al.* 1991).

Growing urbanization and changing cultural preferences, the overexploitation of the plant resource base upon which traditional medicine depends, and the lack of organized support and activity with regard to folk and tribal medicine, have led most experts working in this field to conclude that these traditions are slowly dying out (Bajaj and Williams 1995; Vedavathy, pers. comm. 1996).

Traditional uses of medicinal plants may also decline due to increasing commercialization of the medicinal plant sector, and diversion of raw materials for sale in markets. One study conducted in Arunachal Pradesh examined the use of Mishmi tita (*Coptis teeta*), a bitter root that is found at altitudes of between 2000 meters and 3000 meters in the districts of Dibang and Lohit. Over the last decade, local people have been selling the species for a very remunerative price of Rs. 1000 per kilogram locally, after which it is exported via Calcutta to Japan and Switzerland. Though this plant was traditionally used by tribals for the treatment of fever, backache and dysentery, it is now being substituted by opium for local use due to the fact that all available supplies are for export, (Aryal 1993). The fact that other locally available species such as kutaya (*Hollarrhena antidysenterica*) and *Berberis* are not being substituted is an indication of the locally specific nature of traditional knowledge.

What is surprising, however is that most studies relating to folk and tribal medicine have concentrated more on the practices themselves, in isolation from the social and economic context in which they occur. Manuals and publications of ethnobotanical studies tend to be primarily lists of plants with brief descriptions of their methods of use. In most cases, little information is included regarding the number of people knowledgeable about the practices, or the demographic make-up of both the practitioners and the users of the medicines. The logic of the practice as understood by the practitioners themselves, as well as important associated rituals apart from drug administration, for example methods of collecting and processing, are also rarely reported.

2.1 The Policy Environment

Policy implications relating to the traditional knowledge base of indigenous peoples on medicinal plants and health care are complex due to the fact that they are coloured by debates on biodiversity conservation imperatives, knowledge systems for drug discovery, intellectual property rights/patents and equitable sharing of benefits derived from indigenous knowledge. Although India is committed to the Convention on Biological Diversity, questions of equity are yet to be fully addressed. The proposed UN Declaration on the Rights of Indigenous Peoples, as well as the activities of the International Labor Organization and the General Agreement on Trade and Tariffs (GATT) all impinge on national policy development in this area. It will therefore be some time before policy is formulated and practical applications developed. The latter are likely to devote attention to encouraging collaboration between all concerned parties in order to foster respect for the contribution of indigenous knowledge, as well as to ensuring that regulations take local laws and customs into account in the utilization of biodiversity.

It is also imperative that GOI policies regarding the use of medicinal plants in health care are comprehensive period in their coverage in order to encompass all of the different types of medicine-allopathic, classical traditional and folk traditional.

Although they may constitute the largest part of health care provision among India's population, especially among the poor, tribal and folk practices are still not recognized by GOI policies dealing with health care or medicinal plants. However, these policies do recognize the value of the classical traditional systems. Furthermore, tribal practices have begun to assume greater importance in recent years due to the current debate on intellectual property rights and the potential implications of bioprospecting.

There is however a danger, as articulated by several NGOs, most notably the Third World Network led by the Indian scientist Vandana Shiva, that new possibilities for the exploitation of the poor, will be created by the Trade Related Intellectual Property (TRIPS) stipulations attached to GATT. India is a signatory to GATT and has agreed to comply with the stipulations in principle, although a good deal of internal debate continues with regard to who should obtain universally valid patents as well as the benefits which should accrue to the communities providing the input knowledge.

2.2 Interventions to Date

Government resources tend to have been unevenly allocated to those sectors of health care which utilize medicinal plants. Thus, the classical systems of Ayurveda, Siddha and Unani have received considerable attention, as has allopathic medicine. Furthermore, issues relating to the domestic and international marketing aspects of medicinal plants, as well as the need for wider ethnobotanical documentation are also being addressed.

Nonetheless, the All-India Coordinated Research Project on Ethnobotany which works to identify and document plants used by various ethnic groups has shown that a great deal needs to be done before the relevant pharmacopoeia is developed and is accorded the same priority as those developed for other systems. It is worth noting that over 65 percent of tribal areas have been surveyed, and a database of the plants used in tribal medicine is being developed (see Appendix 8).

Recognizing the constraints related to tribal medicine, the IDRC Medicinal Plants Network (IMPN) sponsored a South Asia Regional Conference on Tribal and Folk Plant-Based Medicines, in September 1996, which was attended by experts on tribal and indigenous culture and medicine, economic botany, ethnobotany, forest and agricultural resource management, pharmacology, public health, and socio-economic development, from India and some of the surrounding SAARC countries. The stated aim of the conference was to formulate an action plan for the development of sustainable and self-sustaining tribal and folk medicinal systems, and to this end participants drafted and endorsed a "Tirupati Declaration" which outlines clear and concrete steps for achieving this goal (see Appendix 9). Some of the areas which require policy development are raising the status of tribal and folk medicine as an effective health care resource; sustainable management of the resource base; equitable sharing of benefits and increased livelihood security for the poor.

Chapter 3

**The Marketing Channels:
From Harvest
to Market**

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The Marketing Channels: From Harvest to Market

While Chapters 1 and 2 of this report provided background information on the medicinal plants resource base and its uses, the following chapter focuses on the commercial aspects of medicinal plants entering the market. Although the dearth of high quality research poses constraints on the extent to which overall conclusions can be drawn, it is still possible to provide an outline of the main actors involved; their transactions; points of transformation of the raw materials; prices, and profit margins accrued in the trade, on the basis of available data.

3.1 The Main Actors in the Trade

Available case studies and published analyses (including Majumdar 1991; Dobriyal, et al. 1995; Olsen-Smith 1996; Arnold 1994; Chandan, pers. comm. 1996; Edwards 1993; Lokamanyan; Bajaj and Williams 1995 and Aryal 1993) suggest that there are five categories of actors involved in the marketing channels for medicinal plants, from their movement from the forest or farm, to their final export or consumption as drugs or herbal preparations. These actors include:

- Collectors
- Petty Traders
- Private Agents
- Wholesale Dealers and
- Final Consumers.

With the exception of the collectors, who have been mentioned in Chapter 1, there is very little information available by which to characterize the market actors. It appears from relevant studies conducted on this subject that men are the primary participants in the market beyond the collection stage, with no mention being made of women's roles as agents, contractors, or wholesale dealers. Furthermore, important socio-economic data relating to the social and economic backgrounds of traders, agents and dealers, including questions of whether or not they belong to the same families or castes, or are regionally affiliated, is not generally available.

In addition, little is known of the role played by the medicinal plants trade in the overall livelihoods of those involved—from the private agents through to the final consumers. It is unclear from published information whether traders tend to specialize in medicinal plants, or whether, like the majority of the collectors, they are involved with additional commodities or primarily work in altogether different occupations. This information—which would reveal the extent of each of the actor's stakes in the market—is extremely important in order to understand and assess their relative contributions and needs in medicinal plants development.

Finally, since the numbers of people involved under each of the categories described above are difficult to estimate, the degree of concentration of the market at various stages of the process cannot be discerned.

3.2 The Chain of Transactions

A major reason for the information gaps described above is the highly secretive nature of the medicinal plants trade. Although it is difficult to procure reliable information regarding the people, plants, and paths involved in the marketing channels, it is nevertheless possible from the information available, to discern a general--though not universal--path of transactions followed by medicinal plants.

Before discussing the various stages of the marketing process, it is important to note, that many, and perhaps most, medicinal plants will not follow this exact path. In some cases, there may be multiple sales from one market(*mandi*)-based private agent to another, or else the products may be directly supplied by the market/agent to the final consumers. In addition, trade activities may move in and out of both the formal sector, as well as the legal boundaries at various points of the chain of transactions.

What frequently sets the chain of transactions in motion are advance orders placed by wholesale dealers in the large urban markets to private agents, usually based in comparatively smaller markets which may be situated at considerable distances from the wholesaler's location. These private agents then employ petty traders who visit the local markets.

Except where associated with agricultural products or other forest goods, local markets are rarely round-the-clock establishments. Rather, they may be weekly or otherwise regularly-timed *haats*, usually held at the village or multiple-village level. Petty traders visit these markets and buy directly from the collectors/farmers or their representatives. The purchase of medicinal plants is generally based on fresh weights, although some traders prefer to use dry weights.

The petty traders then forward these items to the district level markets, or *mandis*, for sale to private agents, known as *arhatiyas*. These agents are versatile and well organized: they are conversant with rates in *mandies* throughout the state, as well as with the prevailing rates in the larger markets.

Final transactions generally take place in very large markets located in the urban centres. Currently the major known markets for medicinal plants are found in Amritsar, Calcutta, Chennai (Madras), Cochin, Delhi, Kanpur, Mumbai (Bombay), and Tuticorn (Bhatnagar and Bisen 1996; Chandan, pers. comm. 1996; Olsen-Smith 1996). High-volume buyers purchase the products from wholesalers to supply Indian production industries, or the international market.

Given that most of the trade occurs in the informal unorganized sector, and that whatever little occur in the formal sector suffers from a great deal of false reporting and poor record-keeping, it is virtually impossible to assess the current volumes of trade in the domestic marketing channels. However, expansion of the volume of trade seems indisputable.

In addition, there is little data available on the social and institutional context of the market transactions, making it difficult to speculate on the decision-making patterns of the different actors involved. The role of social relationships of obligation, caste, familial ties, and other connections therefore needs to be considered, as do decisions regarding personal health care and local uses of plants which also affect decision-making patterns.

Given that the private agents sometimes enter into advance contracts with the wholesalers, there is a distinct possibility that these agents may provide credit to petty traders, who in turn provide it to the villages or collectors: although this is a known practice in some cases, the overall extent to which it is done is not clear. In addition, little is known about the trading scenario of non-cash economies which still exist in large parts of India, especially in the Northeast Region.

The dearth of market information available to collectors and others located at a distance from the major urban markets also affects decision-making, while the lack of storage technologies and facilities is another major factor, which probably accelerates sales of plants even when prices may not be as competitive.

3.3 Transformation Points of the Raw Materials

Most significantly, all the case studies indicate that virtually no processing or value addition occurs in the marketing channels prior to purchase by the wholesale dealers. The few exceptions to this involve only the most basic processing of the products (Edwards 1993; Chandan, pers. comm., 1996).

The following descriptions of the processing methods involved for three spices-tikhur (*Curcuma angustifolia*), baibirang (*Embelia tsjeriam*), and safed musli (*Chlorophytum tuberosum*), collected from the forests of Madhya Pradesh, provide examples of cases where minor transformation of the raw materials is necessary. After collection, *baibirang* is sun-dried; *safed musli* is washed to remove the outer cover; and tikhur is grated/cut into small pieces and then rubbed by hand and left to soak overnight in water. In the morning, after the *tikhur* has been thoroughly soaked, the starch that has settled in the buckets of water is removed and formed into cakes. With the exception of tikhur, these plants require very little additional labor to prepare them for the market.

In general, there appear to be few if any processing or quality requirements in the major Indian markets; wholesale agents buy maximum quantities of all specimens, and pay according to weight, regardless of quality. Even basic grading and cleaning operations tend to be centralized in major Indian cities (Edwards 1993).

3.4 Marketing Margins

It is a commonly held view among those associated with the medicinal plants sector that the marketing of medicinal plants--like other NTFPs and many agricultural products in developing countries--is generally biased in favor of the so-called 'middleman,' resulting in low returns to the stewards and collectors of the resource. In many cases, prices paid by wholesalers are of a higher magnitude than the selling prices for collectors, even though no value addition to the plants occurs during the stages falling between the collector and the wholesaler.

Table 3.1, reveals the prices of some important medicinal plants collected in Madhya Pradesh. Of particular significance is the remarkable disparity in the prices within the state and in Delhi, which in addition to Kanpur, Lucknow and Mumbai, is one of the major trading centres to which the medicinal plants of Madhya Pradesh are transported.

Studies which document these price differences, usually posit the view that the middleman exploits the lack of market information to obtain a cheap price. Certainly this is at least partly true: the market is imperfect in terms of price-setting because of the restricted flow of information. However, the question of who benefits from this situation is more difficult to answer, requiring careful study of each transaction. In addition, such studies must also do away with the hypothesis of the 'middleman,' and instead recognize that there are several middlemen, including petty traders, contractors, and wholesale buyers, each of whom operates according to the different levels of information available to him.

Table 3.1 Prices of Important Medicinal Plants in Madhya Pradesh and Delhi Markets (All figures in Rs/kg)

Species	Local Name	Katni Price	Jabalpur Price	Delhi Price
<i>Emblica officinalis</i>	Aonia	800	140	600
<i>Terminalia bellerica</i>	Bahera	90	200	250
<i>Chlorophytum tuberosum</i>	Safed musli, Kulai	14,000	25,000	20,000
<i>Curcuma angustifolia</i>	Tikhur	2,000	-	--
<i>Embelia tsjeriam</i>	Baybirang	800	-	1,800
<i>Acorus calamus</i>	Bach	1,200	900	--
<i>Dioscorea daemona</i>	Baichandi	1,100	-	--
<i>Semecarpus anacardium</i>	Bhilwa	100	100	500
<i>Cyperus rotundus</i>	Nagamotha, Mutha	200	900	-
<i>Swertia chirayita</i>	Chirayata	400	500	--
<i>Woodfordia floribunda</i>	Dhawi phool, Dhua	200	-	700
<i>Aegle marmelos</i>	Bel guda	225	-	500
<i>Rauwolfia serpentina</i>	Sarpgandha	-	2500	6000

Source: Prasad and Bhatnagar (1991)

While research on this question is lacking in India, it has been carried out in Nepal, which effectively serves as an Indian supply zone for medicinal plants, and helps to give some indication of the marketing channels leading to Indian markets.

Table 3.2 Average Marketing Margins for main MAP species from Gorkha District, Central Nepal*

Species	Collectors		Road Head Traders		Terai Wholesalers
	Net Margin	Gross Margin	Net Margin	Gross Margin	Net Margin
Jatamansi	50.02	9.04	-8.72	40.94	25.55
Kutki	37.99	6.45	0.19	55.56	48.67
Chiyata	52.21	16.45	2.17	31.34	12.57

* All figures represent percentages of Delhi wholesale prices during the main trading season (October 94-March 95)

Source: Olsen Smith (1996)

Table 3.2 shows the marketing margins for *jatamansi*, *kutki*, and *chiyata* harvested from the Gorkha district of West Nepal. In this situation, margins of the final Delhi prices obtained by two categories of middlemen - the roadhead trader, who is responsible for transporting the plants from the collector to the roadhead market; and the border town-based (Terai) wholesalers, who moved the plants from the roadhead to the Delhi market - were analyzed.

As shown in the table, collector prices for the plants were relatively high, and accounted for 40 to 50 percent of the prices paid by wholesalers in Delhi. At first glance, the gross margins (ranging from 6.45 percent to 16.45 percent) accruing to the road-head traders also appear to be relatively fair, given that these traders do not add any value to the raw materials. However, when considered against the costs borne by the roadhead traders--including storage, transport, royalties, and rent-seeking by local officials, their margins of the Delhi prices are extremely low. Net margins range from a high of 2.17 percent down to even negative losses.

By contrast, the gross and net margins of the Terai wholesalers, who alone are in contact with the Delhi-based traders, are exceedingly high, with net margins of up to 48.47 percent.

This study highlights two major points. Firstly, it is evident that not all middlemen are equal, in terms of knowledge of the market, and secondly, traders in closest proximity to the collectors make the least profit, a conclusion also borne out by an ongoing study being conducted in Himachal Pradesh (Chandan, pers. comm. 1996). This may be as important trend which needs to be given recognition.

3.5 Overall Trends in Pricing

Given the imperfections and complexities of the market as described above, price behavior is difficult to assess. Prices tend to be volatile and in some cases may follow 6 to 9 year cycles based on fluctuations between scarcity and over-supply, as well as seasonal variations. In addition, as noted above, prices also vary enormously in different places, a phenomenon which though still not fully understood, seems to be primarily a result of the general lack of information dissemination and overall awareness of different buyers and sellers at different points in the chain.

Despite the variations in time and space, and the lack of extensive information, there is a reasonable body of evidence available from micro-studies to suggest that medicinal plant prices are showing an overall, rise at a relatively fast rate. In some cases, this has been linked directly with the growing scarcity in supply of several commercially valuable species. Some examples of these trends are given below.

In Madhya Pradesh, a study of the price behavior for twenty medicinal plant species revealed that the rates of most species had shown a considerable increase in the last decade. The sharpest increase in price was reported for *Baibirang* due to a scarce supply of the plant and a high demand for it.

In Karnataka, a study conducted to observe the trend in rural prices demonstrated an increase in price for the majority of the 30 selected medicinal plants (Chandrakanth and Lokamanya 1994). In fact, 75 percent of the medicinal plants showed a positive rate of increase, ranging from 0.18 percent for the bark of *Ailanthus excelsa* to about 30 percent for the roots of *Stereospermum suaveolens*. Prices varied according to the end use of the marketed plant part: the gum from roots of trees were more highly priced than the bark.

In Kerala, prices were monitored at raw drug shops/stands in Thiruvananthapuram district over the period 1990-1995. In these 5 years, almost all of the 155 plants recorded, demonstrated a very significant increase in price; in several cases, as shown in Table 3.3, the 1995 prices of these plants were in excess of 200% of the 1990 price, and the prices of some had even quadrupled (Santhosh 1996).

Table 3.3 Variation of Prices of Medicinal Plants in Raw Drug Shops, Trivandrum District, 1990-1995 (All prices in Rs/kg)

Botanical Name	1990 Price	1995 Price	Percentage Variation
<i>Adhatoda vasica</i> (<i>A. zeylanica</i>)	2.67	13.75	415%
<i>Cynodon dactylon</i>	1.83	6.50	255%
<i>Terminalia chebula</i>	3.17	15.71	396%
<i>Gmelina arborea</i>	2.86	13.14	359%
<i>Tragia involucrata</i>	6.00	29.88	398%
<i>Cyperus rotundus</i>	3.17	12.75	302%
<i>Alpinia calcarata</i>	6.33	34.17	440%
<i>Sida cordifolia</i>	3.83	12.25	220%
<i>Piper cubeba</i>	26.25	356.25	1257%
<i>Piper longum</i>	32.50	156.88	383%

Source: Santhosh (1996)

3.6 The Policy Environment

Since almost all trade occurs in the informal sector, there is little relevant policy which affects the marketing channels described here. The regulations on licensing and registration for certain products appear to be easily bypassed and are generally not unenforced. Beyond these policies, little has been done to address the domestic market. The focus of most regulatory and related policy has been on exports and is dealt with in Chapter 4.

3.7 Interventions to Date

By far, the most common form of intervention in the marketing channels for medicinal plants has been the establishment of cooperatives. Cooperatives are alliances of producers of similar resources, who wish to secure fair and equitable prices for their commodities, generally funded by the government. Cooperatives attempt to fill the information gap often experienced by isolated collectors and producers, and help to build strong, equitable links to the market for the plant material. India has a strong tradition of cooperative institutions, ranging from poor farmers to forest-dwelling tribes, and for products ranging from food crops and vegetables to milk products (Tewari, pers. comm. 1996).

Cooperatives for minor forest products have been established in several states of India, generally working with tribals, who in many instances have been granted monopoly rights on the collecting of minor forest produce, of which medicinal plants are a significant part. Some of the most noteworthy cooperative organizations currently dealing with medicinal plants are: the Girijan Service Cooperative society (GSCS); the Tribal Development Cooperative Corporation, and at the state level, Forest Development Corporations, and Minor Forest Produce Divisions. In addition, there are several other state-level federations or cooperatives.

The national government also created TRIFED, the Tribal Federation, through the Multi-State Cooperative Act, 1984, which attempts to link these cooperatives for the benefit of the tribes involved in collection of MFP. In addition to facilitating communication and cooperation between the cooperatives, TRIFED is also developing a Marketing Information System.

Case Studies

In Kerala, the Girijan Service Cooperative Society (GSCS) is responsible for managing over 120 NTFPs which include medicinal herbs, spices, oils, seeds, dyes and edible products collected from the forest hills of Kerala. In fact nearly 61% of all NTFPs collected in the state were by GSCS cooperatives, of which there are 33 in total. However, assessments by the GSCS suggest that nearly 70% of these cooperatives currently marketing NTFPs are functioning poorly if at all (Thomas and Meerabai 1993).

A comparison of the prices of NTFPs marketed through private traders and the Scheduled Caste/Scheduled Tribe (SC/ST) Federation showed that private traders invariably offered higher prices than the SC/ST Federation. In addition, private traders were willing to purchase several items not purchased by GSCS, which confined its purchases to a small group of the well-known commercially valuable species. Also, the SC/ST Federation's poor record of timely payment to GSCS prevented them from collecting NTFPs on schedule, creating ample opportunities for private traders without similar monetary constraints.

Due to the failure of the GSCS to provide competitive prices, tribals in Kerala are now said to sell their materials to middlemen, and at times directly to raw drug shops or herbal drug production units/agents. One study conducted in the Thiruvananthapuram district of Kerala in 1995 found significant differences between the buying prices of government-supported cooperatives and private raw drug shops. The researchers involved cite one case of the plant *Adhatoda vasica*, a relatively rare plant used in ayurvedic formulations, which was priced at Rs. 1.4/kg by the tribal co-operative society; and Rs. 13.7/kg by the raw drug shop, a difference of nearly 900% (Santhosh 1996). Table 3.4 shows a number of other plants which are also subject to significant price variation.

Table 3.4 Variation of Prices in Medicinal Plants in Trivandrum District
Between Raw Drug Shops and Tribal Cooperative Society (1995)
(All prices in Rs/kg)

Botanical Name	Co-Op. Price	Raw Drug Shop Price	Percentage Variation
<i>Adathoda vasica</i>	1.40	13.75	882%
<i>Eclipta alba</i>	1.00	8.67	767%
<i>Terminalia chebula</i>	3.80	15.71	313%
<i>Syzygium cumini</i>	1.40	16.67	1091%
<i>Tragia involucrata</i>	4.75	29.88	529%
<i>Cyperus rotundus</i>	1.90	12.75	571%
<i>Clerodendrum serratum</i>	1.90	28.00	1374%
<i>Helicteres isora</i>	1.15	10.50	813%
<i>Momordica dioica</i>	3.3	37.67	1042%
<i>Phyllanthus amarus</i>	1	18.57	1757%

Source: Santhosh (1996)

Given this situation, it is not surprising that in general where cooperatives exist, about 27 to 33 percent of the total produce is still marketed through private channels (Bhatnagar and Bisen 1996).

A case study in the Central Himalayas also illustrates some of the difficulties faced by cooperatives. A marketing federation was established for the Khaljhuni medicinal plant collectors to protect their economic interests. This government cooperative aimed to help prevent exploitation in distant markets, and, on behalf of the government, to ensure that taxes were collected from the commercial sale of the medicinal plant products.

As in Kerala, the cooperatives were limited in the range of products they could purchase, constraining the villagers' potential trade. In addition, cooperatives would only purchase the product at the motorable road head, incurring nearly twice the transportation cost of pick-up from the village. The maintenance costs of the cooperative were also quite high and this prevented them from pricing products as competitively as private traders, e.g., cooperatives would purchase *Picrorrhiza kurrooa* at Rs. 22.25/kg and lichens at Rs. 10.55/kg (1993), while traders would offer Rs 56/kg and Rs 26/kg, respectively, for the same products. The cooperatives were also devoid of village representation which prevented any strong affiliations from developing (Rao and Saxena 1996).

Chapter 4

**The International
Market**

Chapter 4

The International Market

While all the studies regarding the international market consulted for this report (Handa 1992; Patnaik 1994; Shiva 1994; Raju 1995; APEDA 1996; Bisen 1996; CHEMEXCIL 1996; Lambert 1996; Tewari 1996) share certain limitations, the range of available information provides a sense of the scope and size of the export market. The available studies agree on two basic facts: firstly, that India figures prominently at the global level; and secondly, that in terms of both volumes and prices, it is showing accelerating annual rates of export growth.

One summary of the medicinal plant export market suggests that exports from India have been steadily growing at the rate of 26 percent since 1991-92, with total exports rising to Rs. 1.65 billion, or approximately US\$ 47 million in 1994-95 (Raju 1995). However, these figures would appear to be an underestimate if compared with information provided by the Centre for Minor Forest Products (COMFORPTS), Dehra Dun as shown below.

Table 4.1 Medicinal Plants Export Values from 1960-61 to 1990-91
all figures in Rs. million

	Period			
	1960-61	1970-71	1980-81	1990-91
Value	9.90	84.60	674.20	7675.0

Source: Shiva (1994)

According to COMFORPTS, medicinal plant exports reached a value of over US\$ 260 million by 1990-91.

4.1 Detailed Studies Concerning the Export of Medicinal Plants

Less comprehensive studies focusing on a particular aspect of this sector, or on particular plants, suggest that the total official market for exports lies somewhere in between the two estimates presented above. One such study has been conducted by CHEMEXCIL, the Basic Chemicals, Pharmaceuticals, and Cosmetics Export Council, a GOI-constituted group comprised of trade, government, and industry representatives (Lambert et al. 1996).

As indicated in Table 4.2, according to CHEMEXCIL, exports of crude drugs and essential oils from India from the companies under study constituted a market of nearly half a billion dollars in the past decade. In

1994-95 alone, exports of crude drugs exceeded US\$ 53 million, representing an 18 percent growth rate over the previous year, and almost a trebling of the market size as compared to 1984-85.

Table 4.2 Export of Crude Drugs and Essential Oils from India Between 1985-1995
(All figures in US\$ '000)

Year	Crude Drugs	Essential Oils	Total Revenue
1985-86	19,272	4,553	23,825
1986-87	16,848	6,889	23,737
1987-88	22,489	4,638	27,127
1988-89	17,805	4,974	22,779
1989-90	25,504	8,600	34,104
1990-91	36,802	5,821	42,623
1991-92	41,345	15,592	56,937
1992-93	48,417	15,267	63,684
1993-94	45,355	19,504	64,859
1994-95	53,219	13,250	66,459

Source: CHEMEXCIL, cited in Lambert (1996)

However, as recognized by the organization itself, CHEMEXCIL's membership represents a relatively small segment of the industry-mainly the larger companies. The estimate of US\$ 53 million neither takes into account the role of small enterprises, nor that of the informal/illegal market, thus reinforcing the generally held conviction among experts interviewed that the total official market is significantly larger than indicated in many of the available statistics.

Keeping track of exports of medicinal and aromatic plants is officially the responsibility of the Agricultural and Processed Food Products Export Development Authority (APEDA). APEDA uses the Indian Trade Classification Code based on the harmonized system (ITC-HS), which is in conformity with the two most widely followed global classification systems, the Brussels Tariff Nomenclature and the Standard International Trade Classification (SITC) of the United Nations (Patnaik 1994). The Directorate General of Commercial Intelligence and Statistics (DGCIS) in Calcutta publishes a volume containing the official trade statistics of all 11,000 commodities categorized under this system.

Medicinal plants fall under the designation code 12.11, which is defined as "Plants and parts of plants (including seeds and fruits), of a kind used primarily in perfumery, in pharmacy, or for insecticidal, fungicidal, or similar purposes, fresh or dried, whether or not cut, crushed, or powdered."

The 36 groups of medicinal plants falling within this category are not defined by species per se. Instead, they are defined as groups such as 'ginseng roots,' or by local and trade names such as *Chiraita*. It should also be noted that these groups do not account for all the plants, which are known to circulate in the international market. Nevertheless, this information which is regularly published every fiscal year, provides strong indications of some of the major contours of the market.

The ten most-exported items in terms both of weight and dollar value are listed in Table 4.3, along with their export values over the period studied.

Table 4.3 Reported Sale Values of the Top Ten Medicinal Plant Exports, 1990-94
(All figures in Rs. Millions)

Plant Group	1990	1991	1992	1993	1994
Agarweed	6.2	7.4	4.31	1.68	1.83
Psyllium Husk	581.0	620.0	—	692.0	1,060.0
Psyllium Seed	56.9	65.2	56.7	62.9	77.1
Sandalwood Chips/Dust	310.0	247.0	183.0	156.0	92.4
Senna Leaves and Pods	37.3	112.0	122.0	82.0	85.1
Tukmaria	2.96	—	2.47	2.22	18.9
Ayurvedic/ Unani Herbs	35.2	56.2	99.4	85.3	99.8
Other Roots*	75.3	58.7	83.8	77.5	13.2
Other Herbs*	45.8	103.0	145.0	102.0	75.4

* Includes all roots apart from those of liquorice, belladonna, cubebs, galaragal, ipecac, serpentina, zedovary, and kuth.

Source: APEDA (1995)

While several of the products described above have annual markets worth a sum in the region of USD 1 million, a product of particular interest is Isabgol (Psyllium husks), which in 1994 brought in sales of over one billion Rupees, or approximately USD 30 million. Another important aspect of these statistics concerns the significant variations which occur from one year to the next in terms of volumes of trade. Although it is impossible to ascertain the reasons for such fluctuations from the data presented above, nevertheless, their scale and frequency suggest that the market for medicinal plants is still very much at the embryonic stage.

Some of the importing countries are very constant in their demands for plant materials and by far, the most frequent destinations for exports of medicinal plants are the USA, Japan and Germany, followed by other European countries and the Middle East. India's top ten medicinal plant trading partners are listed in Table 4.4.

Trade with bordering South Asian countries is also high, and is in fact probably much higher than believed since the informal sector dominates a large part of the trade with countries such as Nepal and Bangladesh (Edwards 1993).

In addition to being a seller in the international market for medicinal plants, India is also buyer, especially from its neighbors, though often on an illegal informal basis as mentioned earlier. APEDA statistics for the period 1990-95 reveal that the major countries reporting sales to India are Pakistan, Nepal, and Singapore, and that the greatest volumes of imports are for liquorice roots, poppy, and Ayurvedic/Unani herbs.

Table 4.4 Top Ten Export Destinations for Indian Medicinal Plants, 1990-94
(All figures in Rs millions)

Country	1990	1991	1992	1993	1994
Bangladesh	11.7	15.5	21.0	8.72	2.07
China/ Taiwan	69.4	131	9.66	105	54.5
France	50.9	53.5	58.7	55.6	55.5
Germany	90.7	124	127	88.7	130
Italy	16.0	16.4	29.8	22.2	32.6
Japan	48.4	49.3	36.8	36.9	30.0
Pakistan	36.3	28.9	45.9	51.6	31.9
Saudi Arabia	18.2	34.0	330	150	11.4
U A E	15.1	22.1	17.9	14.8	22.7
U K	73.7	54.9	87.6	80.9	97.0
U S A	49.7	548	683	600	653

Source: APEDA (1995)

4.2 The Policy Environment

The Customs Act of 1986, now in force through the Export/Import Policy (or EXIM policy) of 1992-97, is the primary regulatory policy relating to export of medicinal plants. The EXIM policy restricts the export of three major plant groups:

Species listed in the Appendices of CITES, the Convention on International Trade in Endangered Species, to which India is a signatory;

Wild orchids; and

45 additional items of plants, plant portions, and their derivatives indicated in Public Notice No. 47 dated March 30, 1994.

Medicinal plants have only recently begun to figure prominently in the Convention on International Trade in Endangered Species, or CITES and this is largely because of strong interest expressed by India in November 1994 (Schippman 1996). India proposed 13 medicinal plant species for inclusion in the CITES Appendices, of which 3 were accepted. Currently, the total number of species regulated by the Convention is 9, as listed below. This number is however still considered to be very small compared to the number of plants for which regulation through the Convention would be appropriate. Nevertheless, it represents a significant increase given the fact that only one medicinal species, *Saussurea lappa*, was originally covered by the Convention.

Table 4.5 Medicinal Plants Regulated by CITES Convention

Species Name	Common Name
<i>Aquilaria malaccensis</i> *	Agar Tree
<i>Dioscorea deltoidea</i>	Psingli mingli
<i>Panax quinquefolia</i>	American Ginseng
<i>Podophyllum hexandrum</i>	Papra / Vakasa
<i>Prunus africana</i>	Bankakji
<i>Pterocarpus santalinus</i> *	Kino / Raktachandan
<i>Rauwolfia serpentina</i>	Sarpgandha / Serpentwood
<i>Saussurea lappa</i>	Kut, Pachaka
<i>Taxus wallichiana</i> *	Yew

* Proposed by India in the CITES November 1994 meeting.

Source: Schipmann 1996

Confusion regarding the export status of pharmaceutical products composed of *Saussurea* and *Aloe* in April 1994, was clarified by CITES provisions, since according to Resolution Conf. 5.9, not only living plants, but also cosmetics and other pharmaceuticals prepared from living plants are regulated (Nambiar, pers. comm., 1996). This means that these products, as well as the plants themselves, would require export permits from their countries of origin before they could be traded in the international market.

There is, however, some concern among the international scientific community, that the actual implementation of CITES regulations and the requirement of export permits from the countries of origin is not being fulfilled with regard to medicinal plants (Schipman 1996). The primary reason for this relates to the lack of well-educated customs officials at the points of export. Identification manuals have still not been prepared for the medicinal species listed in CITES, with the result that customs officials cannot distinguish between various plants, especially as medicinals are generally designated by their trade names (rather than botanical names) by the time they reach the international markets, and are traded as parts, rather than whole plants. The forest department staff issuing transit or export permits are largely untrained in the identification of species in such forms and the preparation of identification manuals is generally held to be the responsibility of the country which proposes a species for inclusion. India has yet to produce these manuals.

In response to these concerns, the German Ministry of Environment is funding a study which will determine trade volumes of the plants; identify which parts and derivatives are the major trade commodities (and therefore require comprehensive standards for identification); review problems of implementation; and make recommendations for improved implementation in the future (Schipman 1996).

Since the issue of a Notice restricting the export of an additional 45 plant species, many of which are medicinal plants as well as species covered under CITES, it has become a government requirement to obtain a Certificate of Cultivation issued by a Regional Deputy Director (Wildlife), Chief Conservator of Forests or Divisional Forest Officers of the state from which the plants were procured, in order to export them. This notice further restricts exports to just six major ports: Mumbai, Calcutta, Cochin, Delhi, Chennai, and Tuticorn.

An additional export regulation of particular interest on the Indian medicinal plants front concerns the total ban--imposed in 1969--on the export of the roots of *Rauwolfia serpentina*, locally known as sarpagandha (Lambert 1996). This species, known for its reserpine content, was banned in order to help develop a local extraction industry in India. Although reserpine can now be synthesized, the process remains expensive and extraction is still not an economically viable activity. This action, taken nearly three decades ago, and still in force, has not yet been implemented with respect to any other medicinal plant species in the country. Further, there is no available information regarding development of the extraction industry, and the effectiveness of the policy.

Chapter 5

**Domestic
Drug Production**

Domestic Drug Production

Medicinal plants are the raw materials for indigenous drug manufacturers within India. These manufacturers can be divided into two types of enterprises: those which produce drugs used in the so-called Indian Systems of Medicine and Homeopathy (ISM); and those which produce allopathic drugs.

5.1 The Indian Systems of Medicine and Homeopathy (ISM)

Unlike the folk and tribal systems of traditional medicine outlined in Chapter 2, the traditional systems of Ayurveda, Siddha, and Unani are well-documented, highly formalized systems, which have evolved over centuries. Ayurveda developed with the Aryan invasion (see Chapter 1). The origins of the Siddha system, whose practice is mostly confined to the south of India, particularly the state of Tamil Nadu, are however more contested. While some hold that the system is a variation of Ayurveda, others argue that it has pre-Aryan, Dravidian roots. The Unani system, as mentioned in Chapter 1, was a later introduction and continues to be widely practiced especially in North India and among the country's Muslim community. Homeopathic medicine is also often attached to the other three systems in describing India's medical diversity, and the policy and planning measures adopted by the government, officially recognize all four forms of medicine for the purposes of national health services. Although not a traditional system, homeopathy like these other systems differs in its theoretical orientation from allopathy, and is highly reliant on medicinal plants and nature-based cures. In addition to these four systems, Yoga, Naturopathy, and Amchi (Tibetan) medicine are also practiced in India, although the available databases and degrees of recognition accorded to these systems appear to be low at present.

ISM in India command the same degree of scope, organization, and reach that is commonly associated with Western allopathic medicine in other countries. It has been estimated that there are approximately 460,000 practitioners of the traditional systems, of whom about 271,000 are registered under the state boards, and about 145,000 practitioners of homeopathy (see Table 5.1).

There are also over 100 undergraduate teaching institutions specializing in traditional systems of medicine and awarding degrees in Ayurveda, Siddha, and Unani, as well as over 20 postgraduate departments awarding degrees and doctorates. Of the registered practitioners estimated by the study mentioned above, 117,774 Ayurveda; 10,268 Unani; and 1,559 Siddha were institutionally qualified (Bajaj and Williams 1995).

Finally, traditional medicine hospitals account for 1,690 of the total number of hospitals in India, and there are at least 13,770 dispensaries of traditional (mostly plant-based) medicines (Bajaj pers. comm. 1996).

Table 5.1 Numbers of Practitioners of Indian Systems of Medicine

System of Medicine	# Practitioners	# Practitioners Institutionally Qualified
Ayurveda (Registered)	223,000	117,774
Siddha (Registered)	18,128	10,268
Unani (Registered)	30,456	1,559
Unregistered*	189,416	-----
Total	460,000	30,456

* Estimate.

Source: Bajaj and Williams (1995)

Size of the Industry

According to the Office of the Drug Controller General of India, there were 7843 licensed pharmacies manufacturing drugs used in the ISM, and 857 licensed pharmacies manufacturing homeopathic medicines in 1991. The largest numbers of these pharmacies are located in the states of Uttar Pradesh, Kerala, Maharashtra, and Gujarat, while the lowest (and sometimes nil) numbers occur in the states of the Northeast region of the country.

In addition to approximately 8000 of these licensed pharmacies, it is also well known that a number of other small-scale processing enterprises are unlicensed and operate in the informal sector (Ahmed 1993). Unfortunately, data regarding the participation of both the licensed and unlicensed firms in the medicinal plants raw materials trade, and the extent of their demands for raw materials, are not readily available. Further, the structural breakdown of the licensed pharmacies in terms of large and small companies is unknown, making it difficult to assess the level of concentration in the market. Similarly, the size of the market for processed drugs, both domestic and international, is unknown, and though private research is known to have been conducted by many of the larger companies (Madhusudan pers. comm., 1996), in the face of these information gaps, which require extensive primary research, only a few case studies and examples can help to provide an indication of the current character of the industry.

Some of the most interesting statistics have been provided by the Arya Vaidya Sala, Kerala, which manufactures traditional ayurvedic drugs for domestic use as well as for limited export. The Sala has provided detailed information with regard to plants used, people employed, and values of processed products (Table 5.2).

The relatively large numbers of people, plants, and products involved suggest that the domestic industry's consumption of medicinal plants must indeed dwarf that of the formal exports market, especially as the Arya Vaidya Sala is only one of 8,000 manufacturers involved in the sector and represents neither the largest nor smallest among these.

Growth has also occurred in this sector with one of the largest ayurvedic companies, Dabur India Ltd reporting annual growth rates of 25 percent in their sales since 1990, and a doubling of their turnover every three years. (Aryal 1993).

Table 5.2 Resource Use Patterns, Income, and Employment Generation Reported by Arya Vaidya Sala, Kottakal, Kerala

Plants "imported from northern states"	
Number	550
Amount	500 tons (dry weight)
Roots/rhizomes	25%
Origin	Calcutta, Orissa, Assam, Maharashtra, Delhi, Madhya Pradesh, Punjab, and Kashmir
Market Value	ca. Rs 5.2 crore (US\$ 1.6 million)
Collecting/Transport Cost	2-3%
Plants cultivated in Kerala	
Number	150
Amount	400 tons
Roots/Rhizomes	40%
Market Value	ca. Rs 4 crore (US\$ 1.35 million)
Number of People Employed	1600
Income Generated	Rs 6 crore
Medicinal Plant Processing in Kerala	
Number of People Employed	540
Sales Values	ca. Rs 8 crore (US\$ 2.65 million)
Annual Storage	540 tons
Estimated Loss in Storage	0.25 tons

Finally, estimates made by traders in Guwahati suggest that the annual turnover of the pharmaceutical concerns in Assam, where only 18 licensed companies are known to be in operation, could be "anything between Rs. 350 to 450 crores," requiring supplies of more than 700 metric tons of high-value medicinal plants in the region every year (Subhani 1994).

Although no large-scale studies have been conducted, some data has been collected at the micro-level which bears this out. To take one example, a recent study of ayurvedic products in both the organized and unorganized marketing channels from 1987-1990 revealed an increase in trade of nearly 30 percent (Nambiar pers. comm., 1996).

Links to Primary Health Care

Through the Five-Year Plans of the government, some attempts have been made to develop ISM as a main component of Primary Health Care (PHC). In addition, the 1982 Health Policy served to integrate the practitioners of traditional medical systems into the nation's health care system. Thus, for example, primary health care centers and dispensaries are now permitted in most states to have a traditional practitioner in addition to the two required allopathic physicians (Bannerman 1982).

5.2 The Allopathic Industry

Although less involved generally in the utilization of medicinal plants, the allopathic pharmaceutical industry in India also needs to be understood in order to provide a comprehensive picture of the current scenario, as well as insights for developing more effective options when dealing with the traditional drugs industry.

According to the Drug Controller of India, the allopathic industry has seen significant growth in the past few decades, thanks largely to a supportive politico-economic context. Industrial policies have in general favored indigenous growth while import policies restricting the import of drugs which are indigenously produced, along with customs tariff barriers, have served to protect local industry from international competition in the domestic market (Gupta 1995).

Nevertheless, the role of India's allopathic industries is mostly confined to the production of bulk drugs for mass consumption. The domestic companies cannot compete internationally, as they are constrained by outdated technologies, a limited production capacity, and high raw material/solvent costs. This last constraint is especially noteworthy as the prices of commonly used chemicals are 3 to 6 times higher than their international counterparts (Gupta 1995).

The export of a few of the bulk drugs produced in India is mainly possible because the companies involved import the materials they need duty free, and because the countries buying these products do not produce them locally as a result of the safety hazards and/or environmental degradation associated with their production.

5.3 The Policy Environment

Although affected by a large number of policies at the government level, the two most critical policy domains for indigenous industry are those regarding intellectual property rights, and standards and quality controls.

Intellectual Property Rights

As mentioned in Chapter 2, India has recently accepted Trade Regulated Intellectual Property (TRIPS) as a part of the General Agreement on Trade and Tariffs (GATT). This agreement may have a significant impact on the country's drug manufacturing industry, as it stipulates the adoption of several minimum standards by member countries. With regard to India's compliance with these standards, a major debate is underway within the country.

The most significant aspect of TRIPS for the industry is its requirement that patents be provided for inventions in all fields of technology. The minimum term of patenting is 20 years from the date of filing (The Crucible Group 1994). Further, it is generally felt that patents should cover products, and not simply processes, in order to provide more effective protection for rights-holders.

India's present system, based on the Patent Act of 1970, essentially defines process patents. However, the implications of developing product patents could involve higher investments in research and development by the traditional industry, given the likely returns through patent protection. This might then result in the availability of new drugs for primary health care, as well as improvements in quality and production standards for existing drugs. Furthermore, it might have a relaxing effect on the secretive and defensive nature of the trade.

Enforcement of such patents is however difficult in a country with such large informal markets. Cheap and often adulterated imitations are already known to abound in the marketplace. Few companies have the resources which would be necessary either to ensure through legal action that their patents are secure, or to undertake massive and effective advertising campaigns which would create a niche for their own brands of innovative products. Hence the change to a product patent system might have less impact than in developed countries.

In addition, although companies might be inclined to invest more in research and new product development, the monopoly guaranteed to them by a product patent regime may encourage higher prices, such that access to the product would be difficult for poor consumers. Furthermore, if a market was developed for such new products among the upper and upper-middle classes, companies might begin to divert resources towards production of these more profitable products, and away from the low profit-margin products purchased by the poor.

Of all these issues, the major dilemma confronting India is how to apply patent law to formulations and products which have been developed over thousands of years. In a sense, no one can claim 'innovation' of the medicines of the ISM. Yet, it is also argued that upgrading a simple production technology to a more sophisticated one, or adding or subtracting a single ingredient, does constitute an innovation of sorts. In addition, awarding rights to a single company or individual, when entire communities of practitioners have been involved, is also a difficult proposition-few would claim that it is fair for a private company to benefit exclusively from knowledge that was generated in the public domain. At the same time, the government is facing pressure to encourage this very situation as foreign companies already have access to patenting, and many fear that India's wealth of traditional knowledge may be damaged by these interests if the government does not act quickly to protect this knowledge.

Quality Controls/Standards

Quality control and standards constitute another area where policy making is still a 'work in progress.' The Drugs and Cosmetics Act, 1940, was amended in 1964 to include Ayurveda, Unani and Siddha, and provides for a limited set of controls over the production and sale of traditional medicines. The provisions include the following:

- Manufacturing should be carried out under prescribed hygienic conditions, and also under the supervision of a person having the prescribed qualifications
- The raw materials used in the preparation of drugs should be genuine and properly identified
- The formula or the accurate list of all the ingredients contained in the drugs, should be displayed on the label of every container

One difficulty in implementing the Act was due to this fact that specific sets of standards were lacking for the preparation of these traditional medicines. To fill this void, the Pharmacopoeial Laboratory for Indian Medicine (PLIM) was created in Ghaziabad by the Ministry of Health and Family Welfare (Department of Health). PLIM houses the Drug Standardization and Testing Unit, the Drug Depot, and the Herbarium and Reference Museum. Pharmacopoeias are also now available for each of the major ISM.

Nevertheless, a universally recognized set of quality control standards has still not been developed for the preparation of ISM drugs, which pose serious challenges as they often contain a number of constituent plants, unlike the single principle allopathic medicines. Quality standards and guidelines would by necessity differ from those for allopathic drugs, as the means of production for each type of drug is different. Some of the unique aspects of traditional medicine preparation that would need to be considered include specific means of identifying and collecting constituent plants, including seasons for collections and appropriate ages of plants; ecological origins; cleanliness in processing; and adherence to documented procedures in the ancient texts of relevance (Bajaj and Williams 1995).

5.4 Interventions to Date

Interventions to date have been of three kinds: encouraging research and development; promoting traditional medicine; and developing partnerships among the ISM private sector.

The Government has recently recognized that with the signing of GATT and the reduction of the entailed protectionist measures, the allopathic drugs industry is very likely to suffer. It has been predicted by the Drug Controller General of India that by the time trade ceilings are reduced to the agreed ceiling of 25 percent in the year 2000, most bulk drugs produced in India will have been priced out of the market by imports.

In an attempt to give a greater edge to the indigenous industry, several incentives have been developed to encourage research and development in the private sector, and to improve its chances of being internationally competitive. These include (Gupta 1995):

- 100% income tax deduction of R & D expenditure from profits;
- Accelerated depreciation allowance at 40% instead of 25% if a plant is making goods based on indigenous technology;
- Exemption from price control for bulk drugs based on indigenous technology; and
- Weighted tax deduction at 125% for sponsored research in approved national laboratories.

As in most fields in India, research in traditional medicine continues to be largely the province of public sector institutions. The major national bodies for the Indian Systems of Medicine and Homeopathy are the Central Councils for Research, all based in New Delhi—one in Ayurveda and Siddha (CCRAS); one in Unani Medicine (CCRUM); one in Homeopathy (CCRHY); and one in Yoga and Naturopathy (CCRYN).

In addition, a Working Group on Indian Systems of Medicine and Homeopathy was recently set up by the government, bringing together policy makers from the various ministries and departments dealing with traditional medicine and medicinal plants. This Group was convened to make recommendations for the Ninth Five Year Plan, which started in 1997. The Group has proposed an investment of Rs. 18.4 billion (approximately USD 525 million) for a broad range of activities designed to provide support to the sector, as itemized in Table 5.3.

Table 5.3 Recommended Ninth Five Year Plan Budget for Indian Systems of Medicine and Homeopathy Developed by the Working Group on ISM&H
(all figures in Rs. 10 million)

Item	Amount Budgeted
Effective Use of ISM&H for Health for All	50
ISM&H Treatment Facilities at Block Level Covering 25% of All Blocks	110
ISM&H Facilities at the Central Government Health Scheme (Branches in Dispensaries)	50
Support for NGOs and Government Hospitals	100
Upgrading of Facilities and Standards for Undergraduate/Postgraduate Studies	225
Medicinal Plants and Herbs Development/Germplasm Banks/Agrotechniques	125
Research and Development in ISMH	350
Professional Upgrading Program	50
Strengthening of Institutions, Building Centres of Excellence	100
Strengthening of Laboratories	50
Strengthening of Government Pharmacies	20
Other	610

CCRUM (1996)

Another major intervention necessary to promote the Ayurvedic system concerns the development of a detailed pharmacopoeia. This task, began in 1962, and by 1986, the Ministry of Health and Family Welfare presented the Ayurvedic Pharmacopoeia of India, Volume 1, Part 1, with subsequent volumes being published as further experimental data becomes available (Dhanoo 1986).

At the international level, the Global Initiative for Traditional Systems of Health, (GIFTS), an NGO committed to the perpetuation of traditional medical systems, sponsored regional workshops in Asia, Africa and Latin America which culminated in an international meeting held in the UK in 1995. India was a major participant during these conferences due to the emphasis placed on the Indian Systems of Medicine. A common theme throughout all the conferences was the need for clearly defined policies promoting the safe utilization of traditional medicine, and the need to strengthen these systems in order to ensure that they continue to provide health care to the millions who depend on them.

National interests are linked to those of the World Health Organization through the Gujarat Ayurveda University, Jamnagar, which is a WHO centre for traditional systems of medicine.

Developing Partnerships among the ISM Private Sector

Although the traditional drug processing and manufacturing companies are relatively unknown (with a few exceptions such as Zandu, Dhootapapeshwar, and the larger companies such as Indian Herbs and Dabur), conventional wisdom holds that these companies are the major culprits accounting for the rapid depletion of the resource base (Chapter 1); and for the continuing market inequities (Chapter 3). On the other hand, realizing that such practices are unsustainable in the long run for achieving profitable business, many of these companies have shown an interest in working together to address these problems. In many cases, too, the people engaged with these companies feel a strong sense of moral obligation regarding the resource base and people who harvest it.

Many of the larger companies have already begun to form alliances, with the government and other agencies to address areas of mutual concern. CHEMEXCIL, the Basic Chemicals, Pharmaceuticals and Cosmetics Export Promotion Council, is one such example of this kind of trade association, which looks into issues in the medicinal plants sector. The Council recently published a monograph in 1992, *Selected Medicinal Plants of India*, which took up issues of identity, efficacy, safety and clinical usage of medicinal plants (Lambert 1996). It also maintains trade statistics and supports the development of a conservation policy for medicinal plants.

There are relatively fewer efforts underway to form partnerships with the smaller companies involved in the drug production sector, and it is difficult to gauge the significance of their participation in the absence of reliable statistics. However, an ongoing study sponsored by the IDRC Medicinal Plants Network is undertaking a major survey of these companies in India and elsewhere in order to begin to understand their role in the process, as well as to identify constraints and opportunities for their growth and success, and the potential for partnership in activities designed to promote the sustainable and equitable development of the sector.

Chapter 6

**Information and
Coordination in the Sector**

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Information and Coordination in the Sector

The great diversity of the resource base, systems of medicine and actors involved in the medicinal plants sector makes the provision of reliable information as well as coordination a necessity for planning interventions. This chapter briefly examines the institutional base and the types of information currently available in India.

6.1 Databases

In December 1995, the Centre for International Forestry Research (CIFOR) organized a workshop on non-wood forest products databases, to assess current information resources. Among the databases accounted for in India, three covered medicinal plants, two of which were located at the Kerala Forest Research Institute (KFRI), and the Centre for Minor Forest Products (COMFORPTS), Dehra Dun, respectively and covered a wide variety of NTFPs, including medicinal plants. The databases at KFRI are primarily descriptive, while those at COMFORPTS include descriptive bibliographic information.

Table 6.1 Institutions Participating in INMEDPLAN

Institution	Location	Responsibility
Ayurvedic Research Institute	Trivandrum	Pharmacognosy
Botanical Survey of India	Dehra Dun	Taxonomy
Central Drug Research Institute	Lucknow	Pharmacology
Central Institute for Medicinal and Aromatic Plants	Lucknow	Agro-technology
Foundation for Revitalization of Local Health Traditions	Bangalore	Coordination; Graphics
Lok Swasthaya Parampara Samvardhan Samiti	Coimbatore	Traditional Medicine
National Tropical Botanical Garden and Research Institute	Trivandrum	Traditional Medicine
Publication and Information Directorate	New Delhi	Bibliography
Regional Research Laboratory (CSIR)	Jammu	Phytochemistry

Source: INMEDPLAN (1994)

In addition to the databases described above a large national database on medicinal plants is being developed by the INMEDPLAN initiative. This involves the participation of 9 nodal agencies responsible for the provision of different kinds of data based upon their own research and development activities (Table 6.1).

The ultimate aim of INMEDPLAN is to offer an on-line, real-time accessible version of the data held at each institution. The organizations involved in the initiative have recognized that serious gaps exist in the data currently held, and that many thousands of records maintained require updating. Further, the non-availability of standard recording formats to facilitate the computerization of data has been a long standing problem. This is therefore being addressed by a series of meetings held since 1994, which have begun to identify such standards in each specialized field.

Complementing these databases is one maintained by the IDRC Medicinal Plants Network, which contains a list of researchers and institutions working on various aspects of medicinal plants.

6.2 Publications

By far the most active force in medicinal plant publications is the Council of Scientific and Industrial Research (CSIR), chiefly through its Publication and Information Directorate (PID) in New Delhi. PID brings out one of the world's foremost abstracting services on medicinal plants, the bimonthly *Medicinal and Aromatic Plants Abstract (MAPA)*, which scans some 600 journals published in 22 languages from 55 countries around the world. Each issue also includes information on recent patents filed and papers presented at international workshops, and is also available for on-line screening through MAPIS (Medicinal and Aromatic Plants Information Service).

PID is associated with similar services throughout the world: the Japanese Information Centre for Science and Technology, Tokyo; Thailand National Development Centre; DSIR, Wellington, New Zealand; and the National Library for Agricultural Sciences, Bogor, Indonesia. The work on medicinal plants carried out by PID is also done in collaboration with the Indian Council of Medical Research (ICMR), the government-sponsored Central Councils for Research in Ayurveda, Siddha, Unani, and Homeopathy, and INMEDPLAN.

The Central Institute for Medicinal and Aromatic Plants (CIMAP), Lucknow, publishes a quarterly journal, *Current Research on Medicinal and Aromatic Plants (CROMAP)*, which includes reviews, abstracts, and marketing information, while The NGO, FRLHT, Bangalore, publishes a quarterly magazine *Amruth*, which focuses on issues of relevance to conservation of medicinal plants.

6.3 International and Regional Networks

Networks dealing with medicinal plants in which India is represented have been established by international organizations including the United Nations Educational, Scientific and Cultural Organization (UNESCO), the Food and Agriculture Organization (FAO), and the International Development Research Centre (IDRC).

Asia-Pacific Information Network on Medicinal and Aromatic Plants (APINMAP)

The APINMAP network was established in 1987 by UNESCO, with the primary objective of collecting, collating, and disseminating information on research, production, processing, trade, and development among the participating countries. India has been represented in the network since its inception; other countries participating include Australia, China, Korea, Nepal, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, and Vietnam. APINMAP's primary focus is on the sharing of information between participating representatives. The Network organized a series of meetings which led to the drafting and endorsement of the Chiangmai Declaration, "Saving Lives by Saving Plants," a combined undertaking by experts in health care and plant conservation. This has helped to articulate the basic issues of conservation and the role of medicinal plants in health care for all at a relatively early stage in terms of awareness of medicinal plants in the greater international community. APINMAP also plans to distribute directories of institutions and researchers in its member countries.

Asian Network on Medicinal and Aromatic Plants (ANMAP)

FAO supports and coordinates ANMAP, the Asian Network on Medicinal and Aromatic Plants, whose main objective is to assist member nations in developing their resource base of medicinal plant raw materials, whether through exchange of information, know-how, or germplasm. Countries represented in the network include China, India, Indonesia, Korea, Nepal, Pakistan, Philippines, Sri Lanka, Thailand, and Vietnam. ANMAP publishes a bimonthly newsletter, *NANMAP*, and organizes Asian symposia on medicinal plants, spices, and other natural products. A symposium held in the Philippines in 1992, resulted in the Manila Declaration, which emphasizes the ethical responsibilities of those involved in the utilization of Asian biological resources and which was endorsed by 283 scientists from 31 countries.

IDRC Medicinal Plants Network (IMPN)

The IDRC Medicinal Plants Network (IMPN), which is headquartered in New Delhi, with a Secretariat operating out of IDRC's South Asia regional office; has an active portfolio of projects in the country. Other countries represented in IMPN include Bangladesh, Bhutan, Nepal, Pakistan, and Sri Lanka; active collaborators and advisers are based in Canada, the US, UK, and Sweden. In addition, IMPN is closely linked to networks on medicinal plants sponsored by IDRC in Latin America and Africa.

IMPN's general objective is to provide the research and networking foundations required for developing medicinal plants in ways which benefit the health, environment and economies of the people of South Asia. In particular, it has targeted the well-being of women, the very poor, and tribal peoples. The Network's activities fall into three main categories: A Strategic Research Portfolio; A Country Studies Program; and Networking Services.

The Strategic Research Portfolio has been organized in terms of three thematic areas identified as priorities during a meeting of regional experts in the disciplines of botany, anthropology, pharmacology, chemistry, and forest products and forestry, held in Calicut in 1994. The priority areas identified were Biodiversity Conservation; Marketing and Enterprise; and Health and Medicines. IMPN sponsors a range of researchers, NGOs, government agencies, and the private sector in each of these focus areas, the idea being to cover all aspects of the medicinal plants trade from production through to consumption. Projects are development-led, that is, research is oriented to provide tools and information which lead to successful development interventions. IMPN has recently been converted into an IDRC program called the Medicinal and Aromatic Plants Program in Asia (MAPPA).

Some major Indian institutions active in the Network include the M.S. Swaminathan Research Foundation, the Bharatiya Agri-Industries Foundation (BAIF), the Indian Institute of Science (I I Sc.), the Vital Mallaya Scientific Research Foundation (V M S R F), and the Arya Vaidya Sala (A V S), Kottakal.

Chapter 7

**Towards A Sustainable
and Equitable
Medicinal Plants Sector**

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Chapter 7

Towards A Sustainable and Equitable Medicinal Plants Sector

Medicinal Plants sector in India operates in policy and institutional vacuum. The sector faces a number of policy and legal constraints.

7.1 Constraints, Opportunities and Targets

Earlier chapters of this report have highlighted three overall constraints relating to the medicinal plants sector in India. These are:

Depletion of the Resource Base, which is the foundation of the entire sector;

Decline of Folk Traditional Medicine, a source of primary health care for an estimated five hundred million people in the country; and

Impoverishment of Rural People, who are the stewards of the resource and the holders of traditional ecological and medical knowledge, through inequitable marketing channels.

The report has also identified three major opportunities in this sector:

India's Comparative Advantage and her Potential to Play a Leading Role in the International Market, as a result of the growing importance of Indian exports in providing a source of revenue for the country;

The Existence of a Strong Classical Traditional Medicine Sector with Developed Industrial and User Bases, which employs millions and provides for the health care needs of hundreds of millions of peoples.

A Growing Information Resource Bases, which can be built upon through collaborative efforts, and which links India to the international scientific community.

The constraints and opportunities described above are closely related. Any initiative directed at one is very likely to have an impact on the others. It is thus essential that these issues should remain at the forefront, from the planning stage onwards, when considering new interventions for the sector, as well as when assessing the potential effects of proposed projects.

It is also evident that the medicinal plants sector spans a number of different agencies and organizations. Whether or not their efforts can be effectively coordinated remains to be seen. They include:

The Government of India and relevant State Governments, including the Ministries of Agriculture, Environment and Forests, and Health;

The Private Traditional Medicine Sector, including companies active in each of the Indian Systems of Medicine and Homeopathy;

The Public Sector Research Institutions and Universities, including those focusing both on agricultural as well as medical research;

Relevant Non-Governmental Organizations, which are locally involved in activities related to the medicinal plants sector, and which serve as representatives of the communities of collectors and users of plants and plant-derived drugs; and

International networks in which India is represented, and international organizations concerned with the broader aspects of biodiversity.

In terms of sustainable development, there are four obvious targets, most of which are recognized by the government and by donors:

Focus on Women, Tribal Communities, and the Rural and Urban Poor who together constitute the largest group, both in terms of the people involved in the harvesting and collection of medicinal plants, as well as the users of folk and classical traditional medicines;

Focus on Environmental and Biodiversity Conservation, especially forests, as these continue to be the primary habitat for medicinal plants, and linkages with incentives related to the sustainable management and rehabilitation of degraded lands;

International Trade. India has a comparative advantage in the market and can generate a stronger presence globally; and

Public Health Improvement, with a wider and higher-quality range of naturally-derived products being made available in the market, which are accessible to the poor as well as the rich.

7.2 Recommended Interventions

With regard to interventions for the medicinal plants sector, there are three key inter-related areas which need to be addressed in light of the following considerations: longer-term actions, existing information gaps and policy considerations.

Area 1: Sustaining the Resource Base

Immediate Actions

A. *Ex-situ* conservation

Several medicinal plants are already threatened, rare, or endangered. In addition, the 'precautionary principle' applies to those whose status is currently unknown and to segments of genebanks. There is an immediate need to consolidate and officially link the existing herbal gardens and genebanks, as well as reference specimens in herbaria, to ensure that the 540 species of highest importance in the major classical systems, as well as those supplied to the international market, are protected in *ex-situ* reserves. This requires strategic planning since the range of germplasm obtained for each species must be representative. Plant collections need to evolve from being species reference collections to being genetic resources collections.

Longer-Term Action

A. Promoting Cultivation and Selection of Superior Genotypes

The low number of medicinal plants currently being cultivated should be increased, in order to meet the demands of industry for continuous and uniform material supplies, and to take some of the pressure off medicinal plants originating from natural ecosystems. The selection of plants for cultivation must be market-driven: as has been shown, the species currently under study are largely for export, and there is a need to focus on others needed domestically by Indian industries.

At present, commercial varieties have been developed for about 16 species, most of which are cultivated for export. Much more needs to be done to select superior genotypes of many more species.

To achieve this initiative, it will be necessary to make extensive use of the network of nurseries and gardens in the country, in order to establish high quality plant supply systems. Greater dissemination of information to farmers, regarding these holdings is also necessary, and should involve the agricultural extension organizations since these serve as a primary interface with farmers in the country.

B. Promoting Responsible, Sustainable Wild-Harvesting

Wild-harvesting practices are presently highly unsustainable and are likely to remain so. The lack of sufficient information and of relevant scientific procedures are important contributing factors to this situation, as is the absence of any land rights regulations, which provide local communities with access to and some degree of control over their resources. There is thus a need to provide solutions to these constraints, as well as guidelines and incentives for sustainable wild-harvesting. Unfortunately little work has been done in this area. Additionally, an examination of the networks of traders and volume of illegal trade suggests that the provision of socio-economic and market information may be the primary need.

C. *In-situ* conservation

It will be necessary, based on an understanding of where medicinal plants are currently distributed, to develop novel programs for their *in-situ* conservation and to designate specific genetic reserves. This intervention also applies to timber species as well as wild relatives of crops, and current government activities relating to protected areas may need to be modified in order to accommodate these species. The implementation of Joint Forest Management schemes in these areas would be the logical approach to use, given the viability of medicinal plants for generating income as well as rehabilitating degraded lands. Due to their position as the major stewards of the resource base, women and tribal groups, especially, should be given some control over these lands.

The approach adopted should encompass existing initiatives introduced by organization such as the Bangalore-based NGO, FRLHT, and its Medicinal Plant Conservation Areas Network. In addition, these *in-situ* conservation areas should be made to serve several functions, such as the provision of education and awareness- building, as well as training for sustainable harvesting methods.

Information Gaps

A. Distribution of Resources

It will be critical to understand the actual distribution of the resources and to research their genetic diversity for policy and strategies formulation. This is a long-term process and a research framework needs to be developed to this end.

B. Market Status of Certain Crops

The other major information gap continues to relate to the lack of socio-economic information. It will be vital for cultivation efforts to identify, in collaboration with local industry, which medicinal plants are in greatest demand and are suitable for cultivation. This first step is essential and research will be needed to gauge the demand and profit-making potential of plants. In addition, prior to the introduction of the plants into cultivation, research will be necessary to clarify how market linkages can be most effectively, established in order to assess the gains to the producers. This is a significant gap which has to be addressed.

C. Agro-Technical Packages for Intercropping and Farm Forestry

For the identified plants of major market significance, agro-technical packages need to be developed for cultivation and propagation. In general, most medicinal plants when cultivated have been sole crops in restricted ecological regions. Farm forestry and intercropping systems will have to be devised, as has already been done for the major species cultivated for export, and there will have to be shift to a more farm-centered approach which recognizes, that in most cases, medicinal plants will only constitute one of many crop types adopted by farmers.

Policy Considerations

A. Domestic policy

There are two areas in which policy should to be reconsidered: firstly, in terms of delegating control of resources to local people, through JFM and related initiatives, and secondly, in terms of its implementation and enforceability.

As regards this second area, policies frequently lack evaluation and follow up. Thus, for example, the Forest Policy of 1988, proclaiming tribal rights to forests, is yet to receive official sanctioning through the passing of Acts, while the fact that many of the supposedly regulated plant species have not been identified in manuals, means that their collection cannot be determined and therefore stopped. Also, forest policy which requires that forest lands should not be used for agricultural activities of any kind may be usefully amended in some cases to allow for medicinal plants cultivation, within farm and agroforestry systems.

B. Accordance with Conventions

India is a signatory to a number of Conventions related to the medical plants resource base. CITES and CBD are obvious examples. The latter has many policy implications concerning the medicinal plants sector. These should be resolved in such a way that India does not become monopolistic and recognizes its interdependence with other countries. This evidently gives the strong representation of introduced materials amongst the raw plant materials exported, and India will continue to benefit from advances made in medicinal plant research in other countries.

Area 2: Measures for Achieving A Thriving Folk Medical Tradition

Immediate Actions

A. Establishment of Village Level Germplasm Collections

Apart from the commercially important plants and those important in the classical traditions, there is also a need to conserve important plants used in folk and tribal medical practices for the benefit of those people. To this end, the development of village germplasm collections is a useful intervention which should be undertaken.

Longer-Term Action

Overall, the major orientation of a program in this area should be focused first and foremost on the health care needs of the communities which practise folk and tribal medicine. There are two activities which can be undertaken to achieve these results.

A. Village "Self-Health" Program

Following the recommendations of the South Asia Conference on Tribal and Folk Plant-Based Medicines, a network of pilot projects should be developed, focusing on the generation of sustainable and self-sustaining

tribal medicine. These projects would involve communities joining hands with development specialists to assess the current status of their plant-based remedies, as well as of the resource base of the plants themselves. Based upon these findings, more comprehensive projects could be planned and implemented to ensure that their health care becomes sustainable (in terms of the natural resource base) and self-sustaining (through fair marketing and cultivation where suitable). The development of a network of such pilot projects could thus serve as a foundation for further actions and ongoing work, as well as solve the problem of the current isolation experienced by projects of this nature.

B. Development of a Tribal Materia Medica

This could build upon the existing databases, with the addition of detailed information regarding methods of use and preparation. It should record the innovations of local communities, thereby ensuring that these are recognized, and should be linked to awareness building and the promotion of tribal and folk medicine.

Filling Information Gaps

A. Social and Economic Studies

Little information exists regarding the social and economic context of folk medicinal practices. There is therefore a need to undertake studies which document the full range of situations at the village level, in order to understand how interventions can be targeted to assist in developing sustainable and self-sustaining medicinal plants practices. This research can be undertaken by the communities in collaboration with researchers.

B. Toxicology Studies and Standard Preparations

It is important to ensure that the plants used as medicines by the rural people are not also toxic in other ways. This is therefore one area in which modern technology can be of great service. In addition, standard preparations need to be developed to improve the quality, efficacy and effectiveness of the traditional drugs.

Policy Considerations

Current policies have neglected the folk traditional sector, which should be included in legislation and policy development especially in relation to primary health care centres and folk practitioners.

Policies regulating safety and efficacy need to be evolved based on a recognition of the uniqueness of tribal and folk medicine, and these should be linked to intellectual property rights which ensure that communities benefit from the use made of their technologies.

Area 3: Measures for Achieving an Equitable Marketing System and a Thriving Medicinal Plants Industry

Immediate Actions

A. Setting Up a National Level Authority

Following the lead of the private sector, the government or a related body could set up a national board specifically for the purpose of sustainably developing the sector, and addressing all the concerns entailed. Such a body would comprise of representatives from the various stakeholders, as well as resource persons with significant expertise in economics and socio-economics.

B. Making Cooperatives More Responsive and Representative

A second need relates to cooperatives. The fundamental thinking behind cooperatives has in most cases been flawed, and experience has shown that such organizations cannot replace the middleman, who processes valuable information as well as the scope to provide credit and advances. Although the scope of cooperatives has usually been limited to simply being a group of producers working together to create their own market linkages, it would be useful to build these up into more comprehensive organizations, with skills in collecting, cultivation and semi-processing where appropriate.

Longer-Term Action

A. Formalizing and Organizing the Market

A key task is to bring a greater degree of formality and organization to a market which has been shown to be inefficient, imperfect, informal, and opportunistic. If a greater degree of formality cannot be achieved in the market, it is unlikely that other efforts will be of significant use in preserving traditional medicine and its resource base.

The call for formality is not, however, a call for state intervention per se; nor is it a call for a Marketing Board, as some have suggested. Rather, the transformation of the market should be accomplished through a number of coordinated small steps taken by different actors, who together agree upon an agenda specifying their roles through the coalition body proposed above. This will require a type of 'social contract' between government, the private sector, research institutions, and NGOs representing the local people. Rather than enacting new laws or legislation, this group would rather formulate novel projects and programs which could be undertaken together, and for which each member would provide funding as well as implementation and oversight functions. A number of suggested projects which would be of use include:

B. Dissemination of Market Information and Adding Value at the Local Level.

Both of these need longer-term planning and action since the major Indian markets currently require virtually no processing before the plants reach wholesalers. Goals would include devolution of resource management authority and the establishment of reliable markets with regular returns for inputs.

Filling Information Gaps

A. Making Sense of the Domestic Market

Most essential to the process of developing the industry and the sector will be the gathering and dissemination of information. Currently little is known about the market, especially of the informal sector. This information will be essential to the coordinated planning required for the sector in order to deal effectively with all stakeholders. Donor agencies and the government will need to work with the private and public sector research communities to finance such studies which will follow plants through the market, documenting margins, numbers of people involved, and the like. Such studies will also serve to highlight the major players, the degree of concentration in the market, and the opportunities for new interventions.

B. Finding Opportunities in the International Market

However, a priority intervention must be to enable companies in India to compete effectively in the global market and to exploit the comparative advantage of India in terms of its medico-cultural expertise and biological diversity. Research is needed which will identify opportunities in the global market in which Indian ventures would be uniquely suited to participate and perform strongly.

Policy Considerations

A. Support for the Traditional Industry

Given that the highly-subsidized allopathic industry could become outmoded as a result of global competition, the government needs to consider whether or not some of the support extended to allopathic companies might be transferred to its own traditional industry as a supplier of finished drugs.

B. Regulations on Domestic and International Trade

Trade regulations are currently unenforced for the most part, at every level of the marketing chain. In some cases, in fact, it is necessary for the government to reconsider whether the systems of permits and licences required for forest use can be simplified, and made more friendly to the users of the resource. Current policies are cumbersome and not well integrated, and also uniformly eliminate certain possibilities and opportunities.

For international trade purposes, the major requirement is for better enforcement of existing policies, such as the CITES Convention and related export regulations. Currently, the lack of identification methods for some plants, and of training for customs officials, result in a very large amount of trade being impossible to accurately monitor and control. India could take a lead in this area.

Acronyms

Acronyms

AICRPE	All India Coordinated Research Project on Ethnobotany
AICRPMAP	All India Coordinated Research Project on Medicinal and Aromatic Plants
ANMAP	Asian Network for Medicinal and Aromatic Plants
APEDA	Agricultural and Processed Food Export Development Authority
APINMAP	Asia-Pacific Information Network for Medicinal and Aromatic Plants
BCN	Biodiversity Conservation Network
BGCI	Botanic Gardens Conservation International
CBD	Convention on Biological Diversity
CCRAS	Central Council for Research in Ayurveda and Siddha
CCRH	Central Council for Research in Homeopathy
CCRUM	Central Council for Research in Unani Medicine
CDRI	Central Drug Research Institute
CIMAP	Central Institute for Medicinal and Aromatic Plants
COMFORPTS	Centre for Minor Forest Products
CROMAP	Current Research on Medicinal and Aromatic Plants
CSIR	Centre for Scientific and Industrial Research
CITES	Convention on International Trade in Endangered Species
DBT	Department of Biotechnology
DGCIS	Directorate General of Commercial Intelligence and Statistics
DST	Department of Science and Technology
FAO	Food and Agriculture Organization
FRLHT	Foundation for the Revitalization of Local Health Traditions
GATT	General Agreement on Trade and Tariffs

GSCS	Girijan Service Cooperative Society
G-15 GEBMAP	Group of 15 Genebanks for Medicinal and Aromatic Plants
GIFTS of Health	Global Initiative for Traditional Systems of Health
GOI	Government of India
ICAR	Indian Council for Agricultural Research
ICFRE	Indian Council for Forestry Research and Education
ICMR	Indian Council for Medical Research
ICRISAT	International Centre for Research in the Semi-Arid Tropics
IDRC	International Development Research Centre
INMEDPLAN	Indian Medicinal Plants Database
IMPN	IDRC Medicinal Plants Network
INMEDGREN	Indian Medicinal Genetic Resources Network
ISM	Indian Systems of Medicine
ITC-HS	International Trade Classification-Harmonized System
IUCN	The World Conservation Union
LAMPS	Large Area Multi-Purpose Cooperative Societies
MAPA	Medicinal and Aromatic Plants Abstracts
MAPPA	Medicinal and Aromatic Plants Program in Asia
MFP	Minor Forest Produce
MPCA	Medicinal Plants Conservation Areas
MPSG	Medicinal Plants Specialist Group
NABARD	National Bank for Agriculture and Rural Development
NBPGR	National Bureau for Plant Genetic Resources
NGO	Non-Governmental Organization
NTFP	Non-Timber Forest Product(s)

NWFP	Non-Wood Forest Product(s)
OECD	Organization for Economic Cooperation and Development
PA	Protected Area
PID	Public Information Directorate
SAARC	South Asian Association for Regional Cooperation
SC/ST	Scheduled Caste/Scheduled Tribe
SITC	Standard International Trade Classification
TFRI	Tropical Forest Research Institute
TRIFED	Tribal Federation
TRIPS	Trade-Related Intellectual Property
UNCED	United Nations Conference on Environment and Development
WCMC	World Conservation Monitoring Centre
WHO	World Health Organization
WWF	World Wide Fund for Nature
UN	United Nations

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Appendices

Appendix 1

A Red Data List of South Indian Medicinal Plants*

Species Name	Status
<i>Acorus calamus</i>	VU/R
<i>Adenia hondala</i>	VU/R
<i>Adhatoda beddomei</i>	CR
<i>Aegle marmelos</i>	VU/R
<i>Aerva wightii</i>	EX
<i>Amorphophallus paeonifolius</i>	VU/R
<i>Ampelocissus araneosa</i>	VU
<i>Ampelocissus indica</i>	EN/R
<i>Andrographis paniculata</i>	LR
<i>Aristolochia bracteolata</i>	LR
<i>Aristolochia tagala</i>	VU/R
<i>Artemisia nilagirica</i>	LR
<i>Asparagus rottleri</i>	EX
<i>Balanites aegyptica</i>	LR
<i>Buchanania lanzan</i>	LR
<i>Cayratia pedata var. glabra</i>	CR
<i>Cleome burmanni</i>	DD
<i>Commiphora mukul</i>	VU/R
<i>Coscinium fenestratum</i>	CR
<i>Cycas circinalis</i>	CR/R
<i>Cyclea fissicalyx</i>	EN
<i>Drosera indica</i>	LR
<i>Drosera peltata</i>	VU/R
<i>Elaeagnus conferta</i>	LR

<i>Embellia ribes</i>	LR
<i>Garcinia indica</i>	VU
<i>Garcinia morella</i>	VU/R
<i>Gardenia gummifera</i>	LR
<i>Gloriosa superba</i>	LR
<i>Glycosmis macrocarpa</i>	LR
<i>Hedychium coronarium</i>	LR
<i>Heliotropium keralense</i>	EN
<i>Holostemma annulare</i>	VU/R
<i>Hydnocarpus macrocarpa</i>	VU
<i>Janakia arayalpatra</i>	CR
<i>Kaempferia galanga</i>	CR/R
<i>Kingiodendron pinnatum</i>	EN
<i>Lamprachaenium microcephalum</i>	EN
<i>Madhuca diplostemon</i>	EN
<i>Madhuca insignis</i>	EX
<i>Michellia champaca</i>	VU
<i>Moringa concanensis</i>	VU
<i>Myristica malabarica</i>	EN
<i>Nervilia aragoana</i>	EN
<i>Nilgirianthus ciliatus</i>	EN
<i>Ochreinauclea missionis</i>	VU
<i>Operculina turpethum</i>	LR
<i>Oroxylum indicum</i>	VU/R
<i>Paphiapedilium druryi</i>	CR
<i>Phoenix pusilla</i>	LR
<i>Piper barberi</i>	CR
<i>Piper longum</i>	LR
<i>Piper mullesua</i>	VU/R
<i>Piper nigrum</i>	VU

<i>Plectranthus vetiveroides</i>	EW
<i>Pterocarpus santalinus</i>	EN
<i>Pseudarthria Viscida</i>	LR
<i>Puereria tuberosa</i>	LR
<i>Rauwolfia serpentina</i>	EN/R
<i>Saraca asoca</i>	EN/R
<i>Schrebera sweitenodes</i>	VU/R
<i>Symplocos cochinchinsis subsplaurina</i>	VU
<i>Symplocos racemosa</i>	LR
<i>Syzygium travancoricum</i>	CR
<i>Tinospora sinensis</i>	VU/R
<i>Tragia bicolor</i>	VU
<i>Trichopus zeylanicus subsp. travancoricus</i>	VU
<i>Utleria salicifolia</i>	CR
<i>Vateria indica</i>	LR
<i>Vateria macrocarpa</i>	CR
<i>Vernonia anthelmintica</i>	LR
<i>Woodfordia fruticosa</i>	LR

CR = Critically Endangered; EN = Endangered; EX = Extinct; VU = Vulnerable; LR = Low Risk;
DD = Data Deficient; EW = Extinct in Wild; /R = Regional Assessment

* Based on FRLHT Threat Assessment using IUCN guidelines, 1994-95.

Appendix 2

Some of the Major Commercial Cultivation Areas of Medicinal and Aromatic Plants

No.	Crop	Area (ha)	States where grown
1.	Psyllium (<i>Plantago</i>)	50,000	North Gujarat and Northwest Rajasthan
2.	Senna (<i>Cassia</i>)	10,000	Coastal districts of Tamil Nadu
3.	Opium poppy	18,000	Madhya Pradesh, Rajasthan and Uttar Pradesh
4.	Asgand, Aswagandah (<i>Withania somnifera</i>)	4,000	Central Parts of Madhya Pradesh
5.	Cinchona	6,000-8,000	Darjeeling district (West Bengal) Ooticamund district (Tamil Nadu)
6.	Ipecac	100	Northern West Bengal
7.	Khasi kateri (<i>Solanum viarum</i>)	3,000	Maharashtra
8.	Japanese Mint	10,000	Uttar Pradesh and Punjab
9.	Basil	500	Uttar Pradesh
10.	Aniseed	3,000-5,000	Punjab and Western Uttar Pradesh
11.	Lemon grass	20,000	Kerala
12.	Palmarosa grass	2,000	Uttar Pradesh, Karnataka
13.	Citronella grass	2,000	Assam, Meghalaya, Andhra Pradesh
14.	Vetiver	Scattered	Kerala, Karnataka, Tamil Nadu
15.	Jasmine	2,000	Tamil Nadu, Karnataka
16.	Rose geranium	1,000	Tamil Nadu, Karnataka
17.	Damask	3,000	Uttar Pradesh

Notes 1. For most of these species intercropping is practised.

2. To this list should be added *Rauwolfia serpentina*, indigenous; *Artemisia annua*, introduced; and *Catharanthus roseus*, introduced (Authors). Of the species listed in the table, 5 of the 17 are indigenous to India, 2/17 are Mediterranean, 1/17 European, 1/17 S.W. Asian, 1/17 S.E. Asian, 1/17 N. American, 1/17 S. American, 1/17 E. African, 1/17 E. Asian, 1/17 S. African and 2/17 Sri Lankan-Indo Chinese in origin.

Appendix 3

Development of Standardized Agrotechnology Underway at Indian Research Centres

No.	Centre	Plants Under Investigation
1.	National Bureau of Plant Genetic Resources, New Delhi	<i>Papaver somniferum</i> , <i>Catharanthus roseus</i> , <i>Hyoscyamus niger</i> , <i>Ocimum basilicum</i> , <i>Vetiveria zizaniodes</i>
2.	Indian Institute of Horticultural Research, Bangalore	<i>Catharanthus roseus</i> , <i>Solanum sp.</i> , <i>Pogostemon patchouli</i> , <i>Vetiveria zizaniodes</i> , <i>Jasminum sp.</i>
3.	Dr Y. S. Parmar University of Horticulture & Forestry, Solan, H. P.	<i>Digitalis lantana</i> , <i>Solanum laciniatum</i> , <i>Swertia chirata</i> , <i>Valeriana wallichii</i>
4.	J. N. Krishi Vishwa Vidyalaya, Agriculture College, Indore, and Research Station, Mandasaur, M. P.	<i>Papaver somniferum</i> , <i>Withania somnifera</i> , <i>Glycyrrhiza glabra</i> , <i>Hyoscyamus niger</i> , <i>Vetiveria zizaniodes</i>
5.	Rajasthan College of Agriculture, Udaipur	<i>Papaver somniferum</i> , <i>Chlorophyllum tuberosum</i>
6.	A. N. D. University of Agriculture and Technology, Faizabad, U. P.	<i>Papaver somniferum</i> , <i>Hyoscyamus niger</i>
7.	Gujarat Agriculture University, Anand Campus, Anand, Gujarat	<i>Plantago ovata</i> , <i>Glycyrrhiza glabra</i> , <i>Cassia angustifolia</i> , <i>Commiphora mukul</i> , <i>Chlorophyllum tuberosum</i>
8.	Kerala Agriculture University, Trichur	<i>Pogostemon patchouli</i>
9.	Harayana Agriculture University, Hissar, Harayana	<i>Plantago ovata</i> , <i>Glycyrrhiza glabra</i> , <i>Mentha spp.</i>
10.	Punjab Agriculture University, Ludhiana	<i>Mentha spp.</i>
11.	National Botanical Research Institute, Lucknow	<i>Papaver somniferum</i>
12.	Tamil Nadu Agriculture University, Coimbatore	<i>Jasminum sp.</i>
13.	University of Agriculture Sciences,	<i>Gloriosa superba</i> , <i>Artemisia sp.</i>
14.	Central Institute of Medicinal and Aromatic Plants, Lucknow	<i>Duboisea myoporoides</i> , <i>Dioscorea spp.</i>
15.	Punjabrao Krishi Vidyapeet, Akola, Maharashtra	<i>Rauwolfia serpentina</i> , <i>Solanum sp.</i> , <i>Ocimum kilimandscharicum</i> , <i>Catharanthus roseus</i>

*Data from Amruth (1994)

Appendix 4

Species Under Study by CIMAP for Tissue Culture Propagation

Name of plant

Aconitum heterophyllum ***
Chrysanthamum cinerariaefolium * (Pyrethrum)
Cymbopogon flexuosus (Lemon grass)
Cymbopogon martinii (Palmarosa)
Dactylorhiza hatagiera * (Orchid)
Dioscorea deltoidea (Yam)
Duboisia myoporoides * (Corkwood)
Mentha arvensis *** (Mint)
Nardostachys jatamansi *** (Jatamansi)
Panax quinquefolia * (American ginseng)
Picrorrhiza kurroa ***
Pogostemon cablin * (Patchouli)
Rauwolfia serpentina *** (Rauwolfia)
Rauwolfia vomitoria ***
Rheum emodi * (Rhubarb)
Valeriana wallichii (Valerian)
Vetiveria zizanioides (Vetiver)

* Introductions

** Originally from SE Asia

*** Mid to high Himalayas

Annotations by the Authors

Source : Amruth (1994),

Appendix 5

Herbal Gardens In India

No.	Address	Size of Gardens	No. of Species	Objectives Areas	Problem
1	Regional Research Laboratory Jorhat, Assam 785 006	100	47	Research	Shortage of funds
2	Gujarat Agriculture University Anand Campus, Anand Gujarat 388 110	0.65	150	Research	Shortage of funds, lack of technical expertise
3	Directorate of Indian Medicine Dhanavantari Vana, GCIM Campus Near Bangalore University Bangalore, Karnataka 560 009	37	200	Education	-----
4	Forest Research Centre Terakanahalli, Sirai Taluka Uttara Kannada District, Karnataka	25	300	Training, Education	Shortage of funds
5	Indian Institute of Horticultural Research, Hessarghatta Lake Bangalore, Karnataka 560 080	1	65	Research	Shortage of funds, water shortage
6	Taralabalu Rural Development Foundation, Sirigere, Chitradurga Taluka, Karnataka 577 541	1	16	Training, Education	Water shortage
7	University of Agricultural Sciences Division of Horticulture G K V K Campus, Bangalore Karnataka 560 065	5	38	Research, Education	Shortage of funds

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8	Arya Vidya Sala Kottakal, Malappuram District Kerala 676 503 Contact Person : Mrs Indira Balachandran	8	600	Education	Water shortage
9	AVREFA Herbal Garden AVP Factory Complex, Kanjikode District Palghat Kerala 678 621	15	300	Education	Shortage of funds
10	Chittayil Memorial Trust Olivayappu, Allapuzha District Kerala 688 560	2	300	Education, Research, Training	-----
11	Kerala Forest Research Institute Peechi, District Trichur Kerala	2	250	Education, Research, Training	Shortage of funds, inadequate land area
12	Tropical Botanical Garden & Research Institute Palode P O , Karimancode District Trivandrum, Kerala 695 562	300	750	Education, Research, Training	Shortage of funds
13	Regional Research Centre Ayurveda Gwalior Road, Jhansi Madhya Pradesh 284 003	45	250	Education, Research	-----
14	State Forest Research Polipather, Jabalpur Madhya Pradesh 284 006	15	45	Education, Research	-----
15	Academy of Development Science Kashele, Karjat, District Raigarh Maharashtra 410 201	22	450	-----	Shortage of funds, water
16	Janeeva Mandal Kotri Road, Nandurbar Maharashtra 425 412	0.5	120	-----	Shortage of funds
17	Jawaharlal Nehru Ayurvedic Medicinal Plants Garden and Herbarium Kothrud, Pune, Maharashtra 411 029	19.5	145	Education, Research	-----

18	Punjabrao Krishi Vidyapeeth Nagarjun Medicinal Plants Garden Krishi Nagar P O , Akola Maharashtra 444 104	-	100	Research, Education, Training	-----
19	NBPGR Base Centre CRRRI Campus, Cuttak, Orissa 753 006	0.02	15	Research	-----
20	Regional Research Centre (Ayurveda)Guddal Herbal Farm, P O Mangliawas Ajmer District, Rajasthan	142	45	Education, Research	-----
21	Centre for Rural Health & Social Education A-11, Ashok Nagar, Tiruputtur N A A District, Tamil Nadu 635 601	2	60	Education, Training	Shortage of funds, Lack of technical expertise
22	Forest Research Institute MPF Division, P O New Forest Dehra Dun, Uttar Pradesh 248 006 FRI Dehra Dun Garden	12.5	45	Research, Education	-----
23	National Botanical Research Institute Rana Pratap Marg, Lucknow Uttar Pradesh 226 001	6	220	Research, Education	-----
24	N D University of Agriculture & Technology, Narendra Nagar (Kumargunj) Faizabad, Uttar Pradesh 224 229	0.65	27	Research, Education	Shortage of funds, infertile soil, inadequate land area

Appendix 6

Important Species in the Herbal Garden, Tropical Forest Research Institute, Jabalpur

S.No.	Botanical Names	Local Names
1.	<i>Abelmoschus moschatus</i>	Mushkadana
2.	<i>Abroma augusta</i>	Ulatkambal
3.	<i>Abrus precatorius</i>	Ghungchi (White seeded)
4.	<i>Acorus calamus</i>	Bach
5.	<i>Aerva lanata</i>	Gorukh ganja
6.	<i>Allium porrum</i>	Van lasun
7.	<i>Aristolochia bracteolata</i>	Kiramar
8.	<i>Argyrea speciosa</i>	Kapur bashi
9.	<i>Artemisia speciosa</i>	sp. Vidhara
10.	<i>Barleria prionitis</i>	Brahmi
11.	<i>Bombax ceiba</i>	Katsareya
12.	<i>Butea monosperma</i>	Semal
13.	<i>Caesalpinia crista</i>	Palas(White flowered)
14.	<i>Caesalpinia crista</i>	Palas (Yellow flowered)
15.	<i>Celastrus paniculatus</i>	Gataran
16.	<i>Centella asiatica</i>	Malkangani
17.	<i>Chlorophytum tuberosum</i>	Bramhi
18.	<i>Cissus quadrangularis</i>	Safed musli
19.	<i>Clerodendrum siphonathus</i>	Hadjod
20.	<i>Clitoria ternatea</i>	Bharangi
21.	<i>Cochlospermum religiosum</i>	Aparajita (White flowered)
22.	<i>Convolvulus pluricaulis</i>	Gongal
23.	<i>Curcuma amada</i>	Shankhapushpi
24.	<i>Curcuma caesia</i>	Amahaldi
25.	<i>Dioscorea daemona</i>	Kali haldi
26.	<i>Eryngium foetidum</i>	Baichandi
27.	<i>Eulophia nuda</i>	Jangali Dhania
28.	<i>Gloriosa superba</i>	Bilai kand

29.	<i>Kaempferia galanga</i>	Kalihari
30.	<i>Luffa acutangula</i>	-----
31.	<i>Malaxis rheedi</i>	Kadu torai
32.	<i>Nervilia prainiana</i>	-----
33.	<i>Oroxylum indicum</i>	Shyonak
34.	<i>Peucedanum sp.</i>	Balraj
35.	<i>Plumbago rosea</i>	Lal chitrak
36.	<i>P.zeylanica</i>	Chitrak
37.	<i>Pogonia carinata (Nervilia carinata)</i>	-----
38.	<i>Premna herbacea</i>	Bajragantt
39.	<i>P. serratifolia</i>	Arni
40.	<i>Rauwolfia serpentina</i>	Sarpagandha
41.	<i>Stereospermum suaveolens</i>	Patola
42.	<i>Thalictrum foliolosum</i>	Piyaranga
43.	<i>Tinospora cordifolia</i>	Giloy
44.	<i>Tribulus terrestris</i>	Gokhru, chhota
45.	<i>Tylophora indica</i>	Anta mool
46.	<i>Urginea indica</i>	Jangali pyaj

Appendix 7

Medicinal Plants Conservation Areas in South India

Tamil Nadu

MCPAs	District
Petchiparia	Nagarcoil
Mundanthurai	Thirunelveli
Kutallam	Thirunelveli
Alagarkovil	Ramanathapuram
Kodaikanal	Madurai
Kodikarai	Nagapattinam
Anamalai	Coimbatore
Kollihills	Salem
Marakanam	Kanchipuram
Thenmalai	Thiruvannamalai

Karnataka

MCPAs	District
BRT Hills	Mysore
Talacauvery	Madikeri
Savandurga	Bangalore
Subramanya Temple	Mangalore
Charmadi	Mangalore
Devarayanadurga	Tumkur
Kudremukha	Chikkamagalur
Kemmangundi	Chikkamagalur
Agumbe	Shimoga
Devimane	Karwar
Sandur	Bellary
Karpakkapalli	Bidar

Kerala

MCPAs	District
Agastiamalai	Thiruvananthapuram
Triveni	Pathanamthitta
Eravikulam	Idukki
Peechi	Thrissur
Athirapally	Thrissur
Silent Valley	Palakkad
Wyanadu	Wyanadu

Source : FRLHT (1995)

Appendix 8

Some of the Most Important Medicinal Plants Used by Local Tribes

No.	Species	Local Name	Habit	Uses
1.	<i>Abrus precatorius</i>	Rati Gunubi	Perennial climber	Root used for abortion, leaves used for liquorice, Cough
2.	<i>Abutilon indicum</i>	Kanghi	Shrub	Root used in fever, Leaves demulcent, seed aphrodisiac and demulcent
3.	<i>Acacia catechu</i>	Khair	Tree	Used as astringent
4.	<i>Acanthospermum hispidum</i>	Bichiya	Herb	Fruit is used in scorpion bite
5.	<i>Achyranthes aspera</i>	Latjira Apamarg	Herb	Dropsy, skin eruptions & leprosy. Stems used as toothbrush.
6.	<i>Adhatoda vasica</i>	Adusa	Shrub	Leaves & roots, in asthma, bronchitis and fever
7.	<i>Adiantum capillus veneris</i>	Pather	Herb	Leaves used in piles, root in dysentery
8.	<i>Aegle marmelos</i>	Bel	Tree	Used in chronic dysentery, stomach pain and fever
9.	<i>Ageratum conyzoides</i>	Ganguon	Herb	Leaf juice styptic
10.	<i>Alangium salvifolium</i>	Akola	Tree	Tonic in refricent
11.	<i>Allanthus exelsa</i>	Maharuk	Tree	Bark used to stop bleeding and for skin disease
12.	<i>Aloe vera</i>	Ghigwar	Herb	Juice of plant is used in piles, malaria, stomach ache
13.	<i>Alysicarpus hamosus</i>	Lipti	Herb	Root decoction is used in cough
14.	<i>Andrographis paniculata</i>	Chirata	Herb	Decoction of plant is used in dysentery, malaria
15.	<i>Anisomeles indica</i>	Bhandari	Herb	Leaf decoction used in cough
16.	<i>Arisaema tortuosum</i>	Birbanka	Herb	Root juice used in diptheria
17.	<i>Argyreia speciosa</i>	Kapat	Climber	Root used in rheumatism, nervous disorders, leaves used in skin disease

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No.	Species	Local Name	Habit	Uses
18.	<i>Asparagus racemosus</i>	Satawar	Herb	Root is used as diuretic and as tonic
19.	<i>Atylosia scarabaeoides</i>	Balar pati	Herb	Plant juice used for diarrhea in cattle
20.	<i>Azadirachta indica</i>	Neem	Tree	Leaves applied to boils in eczema and ulcer
21.	<i>Barleria strigosa</i>	Badimohel	Shrub	Root power used in whooping cough
22.	<i>Bauhinia vahlii</i>	Mahul	Tree	Seed used as tonic, root decoction used in fever
23.	<i>Bauhinia variegata</i>	Kachnar	Tree	Bark powder is a tonic
24.	<i>Bidens pilosa</i>	Dhus	Herb	Used in urinary tract disease
25.	<i>Begonia picta</i>	Khatti, patti	Herb	Root used in cholera, juice of leaves anthelmintic
26.	<i>Blumenopsis flava</i>	Kakranda	Shrub	Root used in cholera, juice of leaves anthelmintic
27.	<i>Boerhavia diffusa</i>	Santh Punarnava	Herb	Leaves for snake bite and root for skin inflammation
28.	<i>Borreria auriculiformis</i>	Meelnaghant	Herb	Vapour is inhaled to kill tooth worms
29.	<i>Borreria stricta</i>	Singwala	Herb	Juice of plant is used in scorpion bite
30.	<i>Buchanania lanzan</i>	Achar	Tree	Leaves, roots, fruits used in skin disease
31.	<i>Butea superba</i>	Palas Bel	Tree	Bark, flowers, leaves, seeds and gum used in pain, swelling and heat eruption of children
32.	<i>Careya arborea</i>	Kumbhi	Tree	Seeds used in pain, swelling and rheumatism
33.	<i>Cassia fistula</i>	Amaltas	Tree	Bark, leaves, flowers and fruits used for fractures and dislocation of bones
34.	<i>Cassia occidentalis</i>	Kasondi	Shrub	Leaves and seeds used for skin disease, root used for snake bite
35.	<i>Cassia tora</i>	Chekoda	Shrubs	Leaves, seeds used for skin disease and in leprosy
36.	<i>Celastrus paniculata</i>	Malkanghi	Climbing shrub	Seed used in leprosy and paralysis

No.	Species	Local Name	Habit	Uses
37.	<i>Centella asiatica</i>	Brahmi Manduk parmi	Herb	Whole plant used in skin disease, leprosy and blood purification
38.	<i>Chlorophytum tuberosum</i>	Safed musli	Herb	Root used as tonic
39.	<i>Chloroxylon swietenia</i>	Bhiriva	Tree	Leaf paste is applied on wounds
40.	<i>Cissampelos pareira</i>	Kudupad	Climbing shrub	Root used in snake bite
41.	<i>Cissus quadrangula</i>	Horijori	Climber	Whole plant used for bone fracture and asthma
42.	<i>Clematic triloba</i>	-----	Climber	Whole plant used in leprosy and blood disease
43.	<i>Clerodendrum indicum</i>	Bhormal	Shrub	Root decoction used in malaria
44.	<i>Cochlospermum religiosum</i>	Galgal	Tree	Gum-used in cough, bark used as antipyretic
45.	<i>Colebrookea oppositifolia</i>	Bihinda	Shrub	Root is useful in epilepsy, leaves are applied to wounds
46.	<i>Canscora diffusa</i>	Shankarphuli	Herb	Juice of shoot is used for nervous disease
47.	<i>Costus speciosus</i>	Keokand, Keu	Herb	Rhizome used as tonic
48.	<i>Crotalaria albida</i>	Ban methi	Herb	Root is used as purgative
49.	<i>Curculigo orchioides</i>	Kali musle	Herb	Used for asthma, jaundice, cuts, wounds
50.	<i>Curcuma angustifolia</i>	Jangli tikhur	Herb	Rhizome used as digestive
51.	<i>Curcuma aromatica</i>	Jangali haldi	Herb	Rhizomes used for digestion, skin disease
52.	<i>Cuscuta chinensis</i>	Amrbel	Climber	Plant boiled in water is taken for pain in chest
53.	<i>Cyathocline purpurea</i>	Komdu	Herb	The plant contains an essential oil
54.	<i>Cymbopogon flexuosus</i>	Gheeghas	Herb	Plant juice used as a tonic
55.	<i>Datura metel</i>	Dhatura	Shrub	Various parts used for head ache, malaria and asthma
56.	<i>Dendrocalamus strictus</i>	Bans	Woody grass	Seeds used as astringent, as tonic and in asthma
57.	<i>Dendrophthoe falcata</i>	Banda	Parasitic shrub	Bark - used for wounds and menstrual trouble
58.	<i>Desmodium gangeticum</i>	Sarivan	Herb	Root used as tonic and in asthma
59.	<i>Desmodium triflorum</i>	Anti	Herb	Leaf juice is used in diarrhea

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No.	Species	Local Name	Habit	Uses
60.	<i>Dillenia pentagyna</i>	Kallu, Aggai	Tree	Fruit used as tonic and for abdominal pain
61.	<i>Dioscorea bulbifera</i>	Kand, Ratalu	Climber	Tuber is used for piles, dysentery, syphilis and applied to ulcers
62.	<i>Dioscorea pentaphylla</i>	Baraki, Kanta-alu	Climber	Tuber is used for dispersing swelling and as tonic
63.	<i>Diospyros melanoxylon</i>	Tendu	Tree	Leaves used for eye, skin and blood diseases
64.	<i>Elephantopus scaber</i>	Gophi, Gojiva	Herb	Root powder is used for pneumonia, wounds, and paralysis
65.	<i>Eleusine indica</i>	Malnkuri	Herb	Plant is used as a tonic
66.	<i>Emblica officinalis</i>	Amla, Aonla	Tree	Fruits used for dysentery, bitter tonic and triphala medicine
67.	<i>Emilia robusta</i>	Badidong	Tree	Bark of root used in toothache
68.	<i>Emilia sonchifolia</i>	Hirankhun	Herb	Plant juice used in fever
69.	<i>Eranthemum purpureum</i>	Gulsham	Herb	Whole plant promotes growth of fetus in cattle
70.	<i>Euphorbia hirta</i>	Dudhi	Herb	Juice used for dysentery
71.	<i>Evolvulus alsinoides</i>	Shankhuli	Herb	Whole plant used for vomiting, dysentery
72.	<i>Exacum petiolare</i>	Barocharayrla	Herb	Plant used as tonic
73.	<i>Ficus benghalensis</i>	Bargad, Bar	Tree	Bark used in diabetes
74.	<i>Flemingia bracteata</i>	Mukhanada	Shrub	Root powder is used as tonic
75.	<i>Gloriosa superba</i>	Kalihari	Herb	Root-Anticlysenm, refiring, aphrodisiac
76.	<i>Grewia tiliaefolia</i>	Chikti, Damon	Tree	Bark used in diabetes
77.	<i>Gymnema sylvestre</i>	Gudmar	Woody Climber	Leaves used in diabetes
78.	<i>Hardwickia binata</i>	Anjan	Tree	Bark and leaves used in gonorrhoea disease
79.	<i>Helicteres isora</i>	Marophali, Marod phali	Shrub	Fruit used for pain, dysentery, diarrhea, diabetes
80.	<i>Hemidesmus indicus</i>	Anat mul	Twiner	Root used for gonorrhoea disease and as tonic
81.	<i>Heteropogon contortus</i>	Shurval	Herb	Root is stimulant and diuretic
82.	<i>Hibiscus sabdariffa</i>	Lalbari	Shrub	Leaves used in diarrhea
83.	<i>Hyptis suaveolens</i>	Dona, Wilayati tulsi	Shrub	Seed oil is applied to chest for colds

No.	Species	Local Name	Habit	Uses
84.	<i>Ichnocarpus frutescens</i>	Karibed	Climber	Decoction of leaves and stem is used in fever
85.	<i>Indigofera linifolia</i>	Torki	Herb	Plant is used in febrile eruptions
86.	<i>Ipomoea pes-tigridis</i>	Michai	Climber	Seeds are purgative, juice of plant is used to dysentery
87.	<i>Ixora parviflora</i>	Lukhandi	Shrub	Root and fruit given to women when urine is lightly coloured
88.	<i>Justicia simplex</i>	Herb	Infusion of leaves given in facial paralysis
89.	<i>Kydia calycina</i>	Pula, Puli	Tree	Leaf paste is applied in rheumatism
90.	<i>Lagerstroemia parviflora</i>	Lendia, Dhaura	Tree	Bark used in rheumatism, and malaria
91.	<i>Leonotis nepetaefolia</i>	Hejurchi	Shrub	Flower ash applied to ringworm root rubbed on the breast when milk does not pass from nipples
92.	<i>Lepidagathis trinervis</i>	Ridhatti	Herb	Plant powder is applied to cure itchy infections of skin, root-powder given in muscular pain
93.	<i>Leucas aspera</i>	Chotta halkusa	Herb	Flower used for colds and leaves for skin disease
94.	<i>Leucas cephalotes</i>	Bhodaki, Dron pushpi	Herb	Flowers used as remedy for cough and cold
95.	<i>Litsea polyantha</i>	Meda	Tree	Bark used in malaria, stomach ache
96.	<i>Mallotus philippensis</i>	Karuala	Tree	Seeds used for tape worm
97.	<i>Milletia auriculata</i>	Golhari	Tree	Root given to cattle to kill worms
98.	<i>Mitragyna parviflora</i>	Mundi, Kaim	Tree	Bark & root are used in fever and colds
99.	<i>Mucuna pruriens</i>	Kewach	Climbing herb	Seed used as aphrodisiac and for scorpion sting, root used in fevers
100.	<i>Ocimum gratissimum</i>	Ram tulsi	Herb	Shoot used in rheumatism, paralysis, Leaves used for seminal weakness
101.	<i>Oldenlandia corymbosa</i>	Dhadra	Herb	Plant juice given in jaundice & liver disease
102.	<i>Oxalis corniculata</i>	Chotakhatua, Amrulsak	Herb	Juice is used in acute diarrhea

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No.	Species	Local Name	Habit	Uses
103.	<i>Phoenix sylvestris</i>	Chindi	Tree	Juice of stem used as cooling beverage
104.	<i>Phyllanthus urinaria</i>	Bhimli	Herb	Root juice used in jaundice
105.	<i>Physalis minima</i>	Tulati Pati	Herb	Juice used in earache
106.	<i>Plectranthus ternifolius</i>	Khatmer	Herb	Flowering twig used for many medicinal purposes
107.	<i>Polygonum barbatum</i>	Herb	Seed used to relieve colic pain
108.	<i>Rungia pectinata</i>	Pindi	Herb	Leaves used to relieve pain and swelling
109.	<i>Scoparia dulcis</i>	Muthipatti	Herb	Used for leprosy and diabetes
110.	<i>Semecarpus anacardium</i>	Bhilwa	Tree	Gum used in venereal disease
111.	<i>Sida cordifolia</i>	Kungyi, Kharenti	Shrubs	Root used in fever, bark used in paralysis
112.	<i>Smilax zeylanica</i>	Ramdaton	Climber	Root used in rheumatism and dropsy
113.	<i>Smithia conferta</i>		Herb	Whole plant used as tonic to cure sterility
114.	<i>Solanum indicum</i>	Bhatkutai, Makoi	Herb	Root used for muscular pain, cholera, dry cough
115.	<i>Solanum nigrum</i>	Makoi	Herb	Leaves, fruits used in eye disease; Hair dye
116.	<i>Sterculia urens</i>	Kulu, Gulu	Tree	Tender leaves, gum used to facilitate delivery and for skin eruptions
117.	<i>Strobilanthes auriculata</i>	Satputa	Herb	Roots used in coughs & colds
118.	<i>Swietenia mahagoni</i>	_____	Tree	Bark used as astringent
119.	<i>Syzygium cumini</i>	Jamun	Tree	Seed powder used for diabetes
120.	<i>Tamarindus indica</i>	Imli, Amlı	Tree	Fruits used as digestive
121.	<i>Tephrosia purpurea</i>	Sarphunka	Herb	Leaf decoction is used in coughs and colds
122.	<i>Terminalia arjuna</i>	Kohua, Arjun	Tree	Juice is used in diarrhea
123.	<i>Terminalia bellerica</i>	Bahera	Tree	Fruits used for intestine trouble
124.	<i>Terminalia chebula</i>	Harra	Tree	Bark used as cardiac tonic, fruit used for gas
125.	<i>Trichodesma indicum</i>	Chota kulpha	Herb	Root used to reduce swelling of joints and flowers used in birth control

No.	Species	Local Name	Habit	Uses
126.	<i>Tridax procumbens</i>	Baramasi	Herb	Leaves used in bleeding piles, peptic ulcer
127.	<i>Triumfetta rhomboidea</i>	Chikti	Shrub	Bark used in diarrhea and dysentery
128.	<i>Urena lobata</i>	Bhinda, Unga	Shrub	Root paste used externally for rheumatism
129.	<i>Ventilago calyculata</i>	Raidhani, Kalibel	Herb	Used for earache
130.	<i>Vernonia roxburghii</i>	Sahdovi	Herb	Root given used in dropsy, seed used as anthelmintic
131.	<i>Woodfordia fruticosa</i>	Dawidhaura Dhau	Shrub	Flowers used for ulcers and rheumatism
132.	<i>Xanthium strumarium</i>	Gokuru	Herb	Flowers used for coughs and colds and for toothache
133.	<i>Zingiber zerumbet</i>	Jangli ardak, Nark achur	Herb	Rhizome used in rheumatism

Appendix 9

Tirupati Declaration On Tribal and Folk Medicinal Plant Resources

On 4-6 September 1996, under the auspices of the IDRC Medicinal Plants Network, and hosted by the Herbal Folklore Research Centre, Tirupati, a group of experts on tribal and indigenous culture and medicine, economic botany, ethnobotany, forest and agricultural resource management, forest and agricultural economics, pharmacology, public health, and socio-economic development, from India, Sri Lanka, Nepal, and Bangladesh came together in the South Asia Conference on Tribal and Folk Medicinal Plant Resources.

These experts came together to discuss the current status of plant-based tribal and folk medicine and to develop an action plan for the successful development of sustainable and self-sustaining tribal and folk medicine, in light of the recognition that:

Tribal communities in South Asia represent the poorest of the poor in the developing world;

The vast majority of people in these communities are dependent upon tribal, folk, and mostly plant-based medicines for meeting their primary health care needs;

These systems of medicine play a significant role in the lives and culture of these peoples; and

The production, processing, and utilization of plants for medicine offers a significant means of income generation for the people, as well as tremendous potential for increasing these socio-economic benefits for poverty alleviation.

On the basis of their discussions, the delegates to the Conference identified six major areas for future actions, and developed a set of priority actions for each area agreed to in the following Declaration:

1. Networking and Coordination

- a. Noting that a number of projects are underway throughout the region, and expertise in particular areas is quite high; and
- b. Recognizing that researchers remain largely isolated from one another, with frequent duplication of effort and lack of a strategic focus;

The Conference is resolved that there is a need for more coordinated action and for development of partnerships between interested agencies.

The Conference recommends that the following activities be undertaken:

- i. Development of a Tribal Medicine Network in the IMPN Secretariat;
- ii. Broad circulation of a newsletter focused on tribal and folk medicine in the region;

- iii. Establishment of an electronic network of interested researchers;
- iv. Networking of industry interest groups for financial support of initiatives; and
- v. Development of an integrated, comprehensive, and accessible database, bringing together already-existing databases and filling in identified data gaps where existent.

2. Broadening of Ethnobotanical Research

- a. Noting that while several studies have been carried out in the region, inventorying plants and their uses, little information regarding the collection, processing, administration, significance of use, and cultural/socio-economic status of the users, has been collected; and
- b. Noting further that participation by the tribal communities themselves remains relatively low and partnerships are lacking which enrol them actively in the collection of information and decisions regarding development, and that this is a significant gap in terms of developing projects which can have immediate and lasting impacts on peoples' lives and on primary health care among tribal communities;

The Conference is resolved that: There is a clear need for more broad-based and comprehensive documentation in ethnobotanical research.

The Conference recommends that the following activities be undertaken:

- i. Development of a comprehensive data collection methodology, beyond enumeration of plants and their uses, to provide a complete picture of the tribal medicinal systems in the locations under study;
- ii. Publication of directories of medicine men and their expertise for consultation; and
- iii. Utilization of the comprehensive methodology to lay the groundwork needed for a Network of pilot projects/model village trials on self-sustaining and sustainable tribal medicine.

3. Raising the Status of Tribal Medicine as an Effective Health Care Resource

Aware that the tremendous financial and moral support given in favor of allopathy, and even more recently to classical traditional systems of medicine, has placed tribal and folk medicinal practices at a great disadvantage in terms of their profile and utility for local people;

The Conference is resolved that there is a need to draw greater attention to these medicinal practices and to provide a scientific basis to increase public confidence and acceptance.

The Conference recommends that the following activities be undertaken:

- i. Comprehensive research on actual use patterns at the local level to establish the importance and value of tribal and folk medicine in primary health care;
- ii. Comprehensive toxicity and pharmacological trials on those formulations reported from a number of locations in the region; and
- iii. Development of green health kits for rural and urban users; including a "green first aid kit" for emergency use.

The Conference further recommends that in all research and development activities undertaken, the following best practices be adhered to:

- iv. Clinical trials and case studies of effects of plant-based medicines be applied consistently and prior to promotion and marketing activities; and
- v. Standards and quality control methods be rigorously applied at each level of development for all drugs under development.

4. Sustainable Management of the Resource Base

Noting that research findings from throughout the region suggests that many of the plants used by tribal communities (as well as in other systems of medicine) are vulnerable, threatened, and rare;

The Conference is resolved that action is needed to ensure that the resource base of medicinal plants continues to be available for the use of local tribal communities first and foremost, as well as for the global community as a whole.

The Conference recommends that the following activities be undertaken:

- i. Development of village-level gardens and community germplasm banks;
- ii. Research on tribal conservation and production traditions and sustenance;
- iii. Training of local groups in sustainable identification, collecting, and harvesting practices;
- iv. Development of planting supply information systems;
- v. Development of propagation and cultivation techniques for selected plants; and
- vi. Development, publication, and broad dissemination of a Tribal Materia Medica--highlighting plants used by different ethnic groups for different ailments.

The Conference further recommends that in all research and development activities undertaken, the following best practices be adhered to:

- vii. Deposition of materials from all studies with national gene banks of medicinal and aromatic plants with appropriate agreements and protection; and
- viii. Use of standardized threat analyses to prioritize locally-needed plants in all areas under study.

5. Equitable Sharing of Benefits and Increased Livelihood Security for the Poor

- a. Noting that current market structures place tribals at a distinct disadvantage in terms of economic benefits;
- b. Aware that this lack of support is resulting in the decline of traditional knowledge as tribals faced with the need for gainful employment choose to learn other profitable income-producing skills; and

- c. Also aware that the lack of strong economic benefits deriving from forests likewise increases continued overexploitation of these natural resources;

The Conference is resolved that there is a need to bring about more equitable sharing of benefits resulting from the use of medicinal plants in healthcare.

The Conference recommends that the following activities be undertaken:

- i. Development, at the village level, of cheap and low-cost post-harvest technology for value addition and increased income;
- ii. Study of the impacts of cultivation and domestication on the distribution of benefits;
- iii. Development of partnerships between tribes and users of the resources, village level gardens, and production and marketing cooperatives.

The Conference further recommends that in all research and development activities undertaken, the following best practices be adhered to:

- iv. Communication and wide dissemination of market and price information, as well as results of related research, to local-level producers and users;

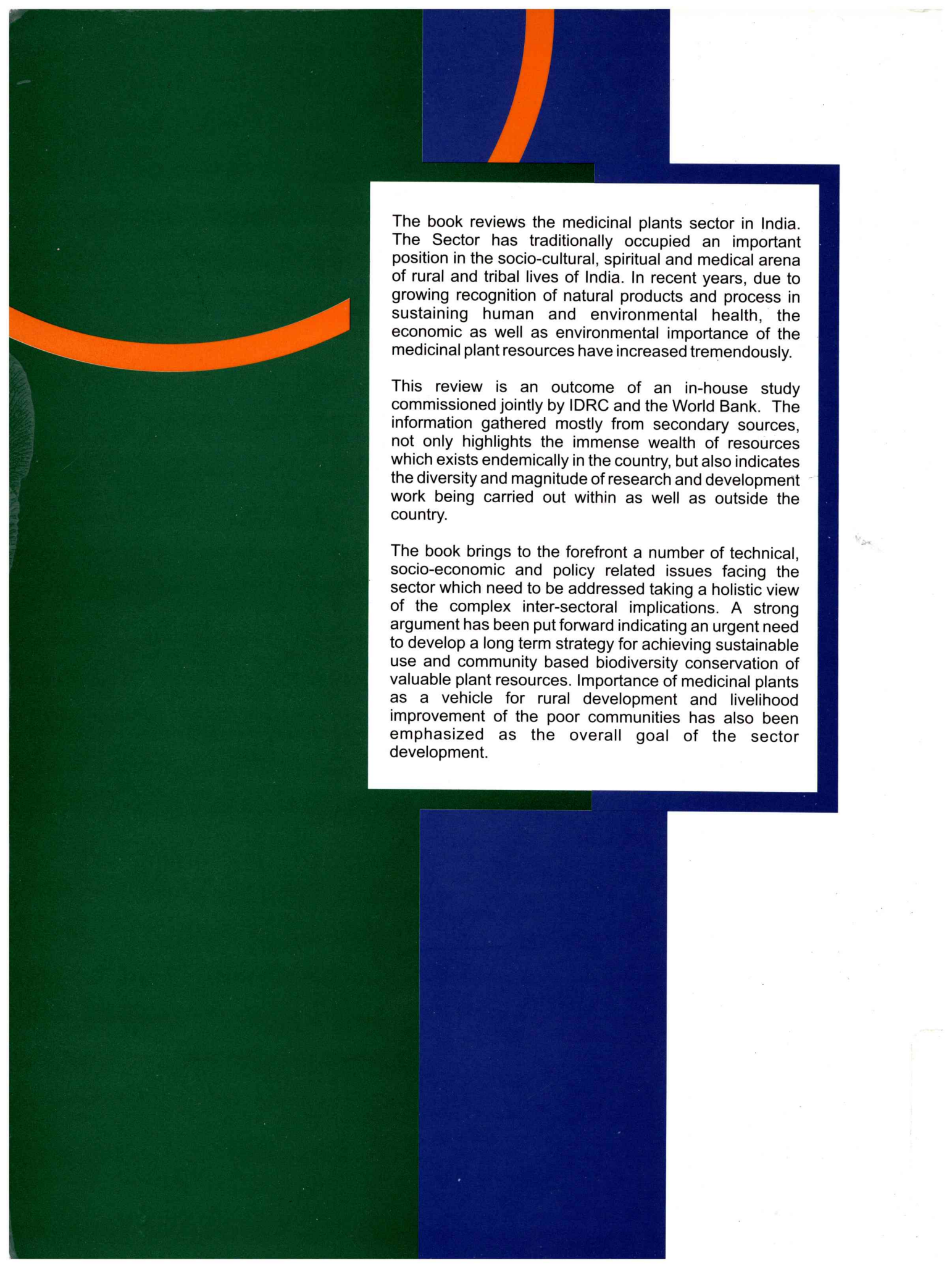
6. Supportive Policy Environment for Development of Tribal Medicine

Recognizing that tribal medicine, subject to policies and regulations administered by a host of agencies, including those of Agriculture, Forestry, Health and Family Welfare, Tribal Welfare, etc., has found itself caught between a number of existing policies and consequently has not benefitted from a coherent and holistic approach to its development;

The Conference is resolved that policies regarding land tenure and rights of access, intellectual property rights, conservation of resources, medical standards and quality controls, require assessment and direction from the perspective of ensuring sustainable and self-sustaining tribal medicinal practice.

The Conference recommends that the following activities be undertaken:

- i. Production of a State-of-the-Art Review of Existing Policies affecting Tribal Medicine in the region;
- ii. Development of Curricula for education on tribal and folk medicine with formal recognition (diplomas, etc.);
- iii. Inclusion with appropriate cautions of tribal medicines in health care dispensaries, and employment of tribal medical doctors for consultations in primary health care centres; and
- iv. Granting of enforceable rights to tribals for self-use of forests within the context of Forest User Groups, Joint Forest Management, and similar programs in effect in particular countries of the region.



The book reviews the medicinal plants sector in India. The Sector has traditionally occupied an important position in the socio-cultural, spiritual and medical arena of rural and tribal lives of India. In recent years, due to growing recognition of natural products and process in sustaining human and environmental health, the economic as well as environmental importance of the medicinal plant resources have increased tremendously.

This review is an outcome of an in-house study commissioned jointly by IDRC and the World Bank. The information gathered mostly from secondary sources, not only highlights the immense wealth of resources which exists endemically in the country, but also indicates the diversity and magnitude of research and development work being carried out within as well as outside the country.

The book brings to the forefront a number of technical, socio-economic and policy related issues facing the sector which need to be addressed taking a holistic view of the complex inter-sectoral implications. A strong argument has been put forward indicating an urgent need to develop a long term strategy for achieving sustainable use and community based biodiversity conservation of valuable plant resources. Importance of medicinal plants as a vehicle for rural development and livelihood improvement of the poor communities has also been emphasized as the overall goal of the sector development.