Priority Species of Medicinal Plants in South Asia

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IDRC/SARO
Priority Species of Medicinal Plants in South Asia

Report of an Expert Consultation on Medicinal Plants Species Prioritization for South Asia held on 22 - 23 September, 1997 New Delhi, India

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Foreword

This report summarizes the findings of an Expert Consultation on Medicinal Plants Species Prioritization for South Asia, held on 22-23 September, 1997 at the WWF-India headquarters at New Delhi. The consultation was jointly organized by the South Asia Regional Office (SARO) of the International Development Research Centre (IDRC), Canada through its Medicinal and Aromatic Plants Program in Asia (MAPPA) and the WWF-India. Its objective was to examine key issues facing the medicinal plant sector in South Asia, focusing on the rationale and need for selecting general criteria for the prioritization of medicinal and aromatic plant species used for livelihood support and primary health care from a regional perspective. Preparation of a list of prioritized species of medicinal plants applicable partly or fully to all the countries and regions within South Asia was the other objective.

The major outcome of the consultation was the formulation of a framework of criteria of selecting prioritized species based on their usefulness to primary health care; sensitive to socio-environmental issues such as biodiversity conservation, drug development, cultivation and commercialization; and applicable to national and local conditions. It is felt that the list of species recommended by the Consultation can be used as a reference for a more focused and coordinated regional level research attention as well as for targeted development action for the upliftment of the livelihoods of poor and marginalized communities of the region.

The invited participants of the consultation mainly comprised IDRC partners in Bangladesh, India, Nepal, Pakistan and Sri Lanka and regional experts in the field. They shared their knowledge, experience and information resulting from both the Centre supported medicinal plant research projects as well as other activities they were involved in. The focus of their presentation was on the need for prioritized attention to in-situ and ex-situ conservation strategies, development oriented research approach and preservation of traditional knowledge particularly with an orientation towards supporting the traditional health care systems prevalent in the region. In general, the participants represented expertise in a wide range of specialized fields concerning the utilization and conservation of medicinal plants. As a result, a multi-disciplinary approach was adopted and a regionally acceptable consensus was reached with regard to the commonly applicable criteria and general priority list of species.

It is hoped that these recommendations will be translated into concrete benefits for the primary users of medicinal plants - the plant biodiversity dependent communities in South Asia - whose future to a large extent depends on their continued availability and sustainable utilization of these natural resources.

New Delhi
April, 1998

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Acknowledgments

First of all, the authors would like to express their sincere thanks to IDRC, Canada for funding the publication of the Expert Consultation on Medicinal Plants Species Prioritization. We also express our sincere appreciation to the WWF-India for facilitating and co-hosting the consultation. The information gathered in this publication entitled Priority Species of Medicinal and Aromatic Plants (MAPs) in South Asia reflect the contribution of the researchers and experts from Bangladesh, India, Nepal, Pakistan and Sri Lanka in the field of conservation and use of Medicinal and Aromatic Plants (MAPs). The consultation was useful in initiating a process of discussion on methods and strategies to be used in prioritizing species of MAPs many of whom are facing severe pressure due to unsustainable use.

We hope this publication will be useful reference to researchers, conservation scientists and development organizations engaged in promotion of community-based conservation, equitable commercialization and sustainable use of MAPs that can meet both socioeconomic needs and primary health care related medicinal benefits.
Executive Summary

There are between 35,000 and 70,000 plant species which have been used at one time or another in one culture or another for medicinal purposes in the world. At least 6,500 species are used in Asia as home remedies. It is estimated that in India, around 3,000 species are used of which 540 find major uses as herbal drugs. Similarly, in Nepal about 100 species are currently exploited for commercial uses and the numbers for other countries are: about 300 in Bhutan; around 250 in Bangladesh; and 400 in Pakistan.

However, these lists are too large to be of practical use in concentrating the limited research and development resources these countries have for investment in the medicinal plants sector. In order to effectively utilize the human and financial resources available, a small number of species—perhaps 25-30—need to be selected for an intensive research and development focus. These species, if properly and holistically examined and improved in terms of biological, medical, ecological, and economic benefits, could then be the base of a larger effort to improve and sustain a vibrant and socioeconomically sound medicinal plants sector.

It was with these objectives that the two-day consultation on Medicinal Plants Species Prioritization in South Asia was organized by MAPPA. Participants were invited with diverse interests in medicinal plants comprising of botanists, health practitioners, conservationists, development planners etc. The wide spread of expertise suited the goal of the meeting which was to devise an agreeable mechanism to select some limited numbers of medicinal plant species for focused and a goal oriented research support—a which would result in tangible benefits for people whose livelihoods are largely dependent on sustainable use of these plant resources. Scarce capital and human resources need to be heavily focused to provide improved benefits to the marginalized people who are largely dependent on the medicinal plants for their livelihood. This means concentrating efforts on intensive management of keystone species.

The importance of medicinal plants to the individual South Asian nation's economy and primary health care system needs no emphasis. However, there remains a wide gap between the potential and the current achievements. One of the reasons for this is, we believe, a lack of focused R & D efforts by governments, the private sector and NGOs. As a result, impact on both the biodiversity and socioeconomic, of the region has been generally negative.

The two-day consultation agreed upon five criteria for selection of species and their prioritization, categorized five eco-geographical zones for prioritization and a list of 30 priority species for South Asia. The meeting also identified priority research areas and recommended coordinated research and an effective system of information exchange among the researchers and scientists working in the region.
Introduction
Introduction

Current estimates point to the existence of approximately 26,000 species of higher plants in South Asia, of which not less than 7000 species are used for their medicinal properties in the traditional medicine systems practiced in the region. This latter figure is probably an underestimate since many of the tribal systems using these plants have not been fully documented. In essence it is likely that well over 30 percent of the region's flora is utilized in medicinal preparations. However, due to the fact that some species are more important than others in this respect, and face varying degrees of exploitation, there is a need for prioritization of species as a means of providing a focus for research efforts in this sector, as well as to ensure the sustainable use of the resource base. This point was emphasized during the FAO Regional Expert Consultation on Breeding and Improvement of Medicinal and Aromatic Plants in Asia in 1993, which was followed by a number of workshops organized by the IDRC Medicinal Plants Network (IMPN), to explore issues and priorities faced in the medicinal plant sector.

During a workshop on medicinal plants organized by IMPN from 6 - 8 February, 1995 in Calicut, India, the main issues which need to be addressed by researchers working in this sector were discussed. The major conclusion that emerged was that despite the broad array of research strategies and activities being implemented across the region, major gaps exist with regard to regional networks and collaboration between projects as well as between researchers. The adoption of a strategic approach by IMPN could therefore help to fill a number of these gaps. It was also agreed during the workshop that any efforts to work on all of the useful medicinal plants occurring in the region would prove to be both unfeasible as well as impossible. Thus, "prioritization of species for research would constitute an essential first step in strategy definition." Studies have shown that about 500 species constitute the therapeutic core of the traditional systems of medicine in South Asia. The workshop further recommended that a limited number of species should be targeted for domestication and cultivation in order to alleviate the problems of over-collection from the wild, thereby aiding efforts to conserve biodiversity. Subsequent meetings held at Pokhara (May 1996) and at Tirupati (September 1996) reaffirmed these conclusions and recommendations, which provide the rationale for the present consultation.

A second directive for this consultation stems from the realization that for a strategic approach to be effective in this area, it must involve a synthesis of a people-centered and conservation-based approach. Any efforts to aid conservation of plant resources would on one hand involve attempts to manifest the spirit of the International Convention on Biological Diversity into tangible results, and on the other hand, would be targeted to addressing the primary healthcare needs of a very large number of people living below the poverty line in the region. These people remain largely unaffected by government public health programmes and budgets. Cultivation targets would therefore require a strategy involving research on subjects such as vegetative propagation, production systems and building up a genetic resource base such that the variation available for future use is enhanced. Local communities who use the species would also have to be involved in such research efforts in order to ensure a flow of benefits towards them, as well as to facilitate poverty alleviation and provide improved health care.
Priority Species of Medicinal Plants in South Asia

This strategy would require a change in focus, which currently tends towards economically important medicinal plants. This is highlighted by the fact that a number of past and present attempts at cultivation have primarily been determined by export potential and industry-oriented needs as opposed to common people’s needs. Furthermore, the global conservation movement often cites recent uses in treating refractory diseases in the West as a major reason for conserving medicinal plants. Such an approach is predominantly oriented towards bio-prospecting and the tapping of indigenous knowledge for such purposes, with far less emphasis being placed on crucial needs such as income generation, poverty alleviation and the provision of affordable health care, which is the key to sustainable development, especially when crafted into local agrosilvicultural systems.

In light of the above insights, participants of this expert consultation have come together from across the region to share their expertise and agree upon the criteria required for the selection of medicinal plant species from a range of climatic zones, as well as their prioritization. In addition, they have made recommendations on the specific research strategies and tasks required for the species identified. This consultation will hopefully pave the way towards the achievement of the development objectives outlined above.
Chapter 1

Background to and Rationale for Selecting and Prioritizing Medicinal Plant Species for Enhanced Research Attention
Chapter 1

Background to and Rationale for Selecting and Prioritizing Medicinal Plant Species for Enhanced Research Attention

It is a well known fact that the rich and diverse heritage of traditional systems of medicine in the subcontinent is being increasingly threatened by the interplay of a number of factors affecting the harvesting, trade and use of medicinal plants in herbal remedies. These include rapid deforestation; habitat destruction; over exploitation and destructive harvesting; unfair and exploitative trade practices, policies and regulations; the entry of cheap and frequently adulterated materials into the market, and paucity of research and resources directed at the systematic cultivation of some of these species. Concomitantly, demands for medicinal plants are rapidly rising in order to meet requirements for products such as medicines, phytochemicals and biocides. It is therefore evident that the setting of priorities for the conservation and use of medicinal plants is essential in order to ensure the efficient allocation of limited resources of time, funds and manpower. However, the process of compiling a list of priority plant species invariably creates confusion, particularly when this is attempted using a multidisciplinary approach which is necessary in this sector. This paper therefore seeks to provide a background to and rationale for this expert consultation, as well as to outline some of its objectives.

Given the multi-dimensional values of medicinal plants - indigenous, medical, cultural, economic, ecological, environmental and biological - any research and development strategies in this sector must involve a synthesis of a people-centered and conservation-based approach. Thus, while any efforts directed at the conservation of the medicinal plants resource base are laudable, unless utilization of these resources is carried out in a prudent and sustainable manner, the people who depend on them are being denied their future.

Similarly, while all efforts to document indigenous knowledge are commendable, the resulting ethnobotanical database is leading to ever expanding lists of valuable species used in the traditional health care systems. Given limited resources, it is becoming increasingly difficult to establish the scientific validation of the efficacy of all of the identified species.

The above points to a crucial need for target-oriented prioritization in terms of research strategies as well as selection of medicinal plant species. One such target which poses a considerable challenge involves provision and implementation of Primary Health Care (PHC) for an ever increasing human population. PHC can be defined according to the specifications set out by WHO as being, "essential health care based on practical, scientifically sound and socially acceptable methods." It follows from this definition that the practice of traditional systems of medicine must involve the use of safe and effective medicines, particularly with regard to herbal remedies.

Given that the South Asian region contains the highest percentage of people living below the poverty line, and given that this percentage has shown a steady increase over the past decade,
as opposed to the decrease noted for other parts of Asia by UNDP studies, the social aspect of medicinal plants, involving provision of PHC is clearly of paramount importance.

In a region where herbal remedies continue to remain the primary vehicle for the delivery of PHC, it is essential to ensure that in addition to maintaining confidence in the quality of materials, adequate supplies are provided to the primary health centers. Furthermore, the Indian experience has highlighted the relationship of trust which exists between patients and traditional practitioners who prescribe herbal remedies. This rapport has not generally been demonstrated with regard to conventional community health workers.

The above clearly emphasizes the importance of the role played by medicinal plants in the primary health care systems which are prevalent in South Asia. In addition, it points to a number of issues which need to be addressed when tackling questions as to how to extend and make available health care systems to as wide a spectrum of people in as short a time as possible. These relate to the combined role which should be played by the government and by the scientific community working in consultation with each other.

Thus, for example, the scientific community should be more concerned with standardization of herbal medicines in order to solve the problem of the wide variation which occurs between batches, as well as with the development of guidelines for the collection of correctly identified material from the right place and at the right time. While international guidelines regarding standardization have been in existence since the early 1980's, progress on this front has been slow and the guidelines are as yet incomplete.

With regard to action on the government front, policies and interventions clearly need to focus on the continued expansion of validated formularies, as well as on the provision of adequate training for traditional practitioners. In addition, the question of whether or not to integrate traditional systems of medicine into other systems needs to be addressed.

This brings us to an examination of the specific scope of PHC in order to tackle questions regarding prioritization and selection of medicinal plants for PHC. When considering species to be used for provision of PHC, we are not primarily concerned with seeking the origins of a new world drug. While there is definite scope for research in this area, particularly with regard to refractory diseases such as AIDS, cancer, asthma, arthritis and many others, it must be borne in mind that such research is time-consuming in addition to requiring the allocation of considerable funds. Furthermore, while clinical trials are essential for assessing the properties and efficacy of plants, they are relatively less important in the case of herbal remedies which are widely used and have stood the test of time.

In approaching the task of selecting medicinal plants, pharmacognosy has a valuable role to play in providing a focus on medicinal plants used for specific purposes in PHC. These include the treatment of common ailments and diseases such as malaria, dysentery, diabetes and respiratory problems amongst others. However, the following constraints and limitations with regard to the selection of plants should be recognized.

Firstly, efforts in this area are limited to some degree by the lack of an interactive multidisciplinary database. Nonetheless, a number of projects conducted in the past involved
the prioritization and selection of a manageable number of particular species out of an available wide range of medicinal plants. Consequently, tests on the efficacy of these species for treating various medical conditions were facilitated and accelerated. A good example of such a project was one implemented at the Banaras Hindu University in India.

With regard to selection criteria, while public health care specialists all devise their own criteria for preparing lists of priority species, these all share a common rationale in that they are in essence based on medical ailments which are addressed by PHC. These include gastrointestinal, respiratory and skin diseases; fever; inflammation and pain; wounds/burns; allergies; parasitic infections; eye infections; urinary tract infections; bites of snakes and scorpions and so forth. The prioritization of herbs is thus largely based on local availability of reliable information regarding the efficacy of the plant. (Chaudhury 1992). In this regard, seven countries, mainly from the Eastern Mediterranean region, but including Pakistan and Afghanistan, were able during a regional WHO meeting to identify a core list of herbal remedies for seventeen medical conditions or requirements.

A second problem or constraint involved in the selection of a short list of plants for use in PHC concerns the fact that specific medicinal plant species are often used to treat a broad spectrum of conditions. Their application to particular ailments therefore varies from area to area. There are many cases in which despite its existence and availability, pharmacological data is not even applied in local PHC. The following illustration is a case in point.

The random selection of ten species used by traditional practitioners in Pakistan, Bangladesh and Manipur, India, resulted in some very interesting findings which emphasized how little interpretation is placed on existing data. The findings showed for example that Adhatoda vasica is used to treat three medical conditions in Pakistan and Bangladesh and seven conditions in Manipur, with only two of the three mentioned above coinciding. Further available data from materia medica point to the value of the herb in treating six conditions - two concurring with its use in Manipur and two with its use in Pakistan and Bangladesh. This leaves three conditions for which the herb could be used but for which it is not in the areas described above. (Data extracted from IMPN reports and from Sinha 1996).

Moving beyond the scope of PHC, prioritization exercises have been conducted on the basis of phytopharmaceutical research and development with the primary objective of guaranteeing the supply base of medicinal plants and exploring the possibility of cultivation to ensure this. The commercial aspect of cultivation is often a decisive factor leading to the prioritization of species. Thus, in some instances it may be based on a desire to reduce imports, while in others, where plants have known export potential and/or are already being exported, there is a desire to increase exports and export earnings. Thus in India, for instance, there are a number of examples of cultivation efforts, combined with selection and breeding being initiated for plants with a sizable export market, leading to the development of commercial varieties.

More recently, efforts are being made to bring into cultivation selected plants used in the traditional systems of medicine for which the bulk demand for raw materials is rapidly growing. Unfortunately, however, research efforts in this area may be duplicative and may lack focus in determining priorities beyond the local level.
Priority Species of Medicinal Plants in South Asia

An assessment of current efforts devoted to the promotion of cultivation of medicinal plant species highlights the need for a priority list of target species. In order to achieve this, three spheres of activity need to be implemented. The first involves cultivation and exploration of the gene pool, the second, mutual exchange of materials between areas and countries at the research project level, and the third involves development of suitable farming or silvicultural systems.

With regard to the first group of activities, while bringing a species into cultivation is a relatively easy task, this must be accompanied by a careful exploration of the gene pool of the species. This would result in the identification of specific genetic materials to be used in later stages involving the selection process for production of plants with good yields of the target herbal product. At a still later stage, selection of commercial varieties can be carried out as has been done in South Asia in the case of around twenty important medicinal and aromatic species.

Thus simply bringing a species into cultivation in a herb garden may end up being a futile exercise unless adequate genetic diversity is sampled from populations, and unless materials adapted to different ecological or climatic zones have been explored. In order to achieve the above objectives, networking of scientists from different countries or areas within the region is critical, as is dissemination of information on such activities. For instance, a species which is rare in northern India may be abundant in Nepal, or a species which is rare in Bangladesh may be common in India. Collaborative work is therefore essential in order to achieve adaptation in the gene pool such that it can be cultivated and produced more easily away from the area in which its occurrence is rare. Such efforts would go a long way towards achieving sustainable production and conservation.

Finally, with regard to the third sphere of activities, the domestication of medicinal plants is essentially a component of crop research. However, it is an arduous task, extending over decades, and is costly. As a result, it has always been viewed as the responsibility of the public sector, and with the exception of cases involving major plantation crops and trees, has been underfunded everywhere. It is therefore vital to promote alternative and strategically determined mechanisms for the medicinal plant sector through the formation of innovative partnerships between public, private and non-governmental organizations. However, this can only be achieved through the setting of targets based on prioritization and through the revision of these targets from time to time.

Other recent developments include a growing interest and concern with regard to assessing the sustainable use of wild species which provide countless communities with essentials such as food, fibre, medicine, forage etc. (Prescott-Allen and Prescott-Allen 1996). The task of determining and enhancing the sustainability and social benefits of such uses is a difficult one for which guidelines are needed, as stressed by UNCED and Agenda 21, and as requested by IUCN in 1990. However, through the availability of a grant from IDRC, an IUCN Species Survival Commission Specialist Group was able to develop preliminary guidelines for assessing the sustainability of uses of wild species for social benefits.

In line with the people-centered approach to conservation and utilization of the medicinal plants resource base, recent years have also seen the emergence of an upsurge of interest in
Background to and Rationale for Selecting and Prioritizing Medicinal Plant Species for Enhanced Research Attention

Community management of areas and resources through fora such as joint forest management groups. This approach is based on the realization that management and utilization of the resource base can only be sustainable if economic incentives exist, which in the case of medicinal plants usually relate to cultivating, processing and marketing herbal products.

Of interest to the subject matter of this paper is the need to adopt a special approach towards the question of prioritization, which is inherent in a people-centered focus. Such a focus necessarily involves a different perspective to that adopted by specialists whose primary concerns may be the invention of new drugs, conservation, or the promotion of medicinal plant species in general. Thus, the IUCN Species Survival Commission Specialist Group on Medicinal Plants relies on an assessment of the following factors in identifying the highest global priorities:

1. Identification of major sale sites;
2. Identification of medicinal plant species used in trade;
3. Short-listing species used in trade which are subject to special considerations, for example, slow-growing species and species which are being subjected to destructive harvesting methods;
4. Further refining the above list using criteria such as abundance;
5. Setting priorities based on the above factors.

The preceding discussion clearly reveals that while efforts in the region are being focused on the prioritization of medicinal plants for the achievement of target-oriented objectives, they are considerably hampered by lack of access to relevant information and findings, and inaccessibility of this data both within countries as well as across boundaries. Any study of the medicinal plants sector of a South Asian country immediately highlights huge gaps in information flow between groups of researchers. These include community-based development organizations; scientific and health-related research communities working in fields such as botany, ethnobotany, health care, pharmacognosy, drug development etc.; medical and health practitioners and conservation organizations. It should however be noted that the problem does not lie in the lack of availability of information but rather in the compilation and presentation of information to provide ready access of data to those involved in strategic planning in this area. In this regard, the IDRC Medicinal Plants Network, which is one of the hosts of this consultation, is attempting to address some of these gaps by facilitating information exchange between very diverse research projects which are currently being implemented in India, Bangladesh and Sri Lanka, but which are slowly expanding throughout South Asia. (Bajaj and Williams, 1995)

In light of the above-mentioned strategy, this expert consultation aims to provide a forum where networking of scientists and researchers working in the medicinal plant sector can occur, and where regional as well as individual country perspectives and experiences can be shared. It is not the objective of this consultation to produce a definitive list of priority species. Rather, the focus is on the selection of important species of value in PHC implemented across South Asian countries, on which research strategies and efforts can be focused. The results of such efforts will hopefully have a speedy impact on the poor of the region and will provide a framework for targeted development action for which there is no shortage of donors.
Priority Species of Medicinal Plants in South Asia

It must however be borne in mind that the framework adopted should not be agreed upon in isolation. While the central focus has to be socio-economic in emphasis, given the necessary impact on the human system in terms of health, income, knowledge and empowerment (Anwar Islam and Wiltshire 1996), it must be sensitive to other frameworks used for developing priorities for biodiversity conservation, drug development and the macroeconomics of trade. In many instances, the problem does not lie in the availability of knowledge regarding the value of a particular species, but rather in the application of such knowledge with speedy and positive impacts not only on the human system but also on the ecosystems in terms of maintenance of the resource base and conservation of biodiversity. This is one way of tackling the somewhat elusive concept of sustainability and formed the basis for developing a Code of Conduct of Research in 1995.

In conclusion, it is to be hoped that this Consultation adopts a broad perspective in relation to the agreement of a framework of criteria for priority species of medicinal plants. In addition, we hope that it is able to formulate a set of target-oriented research objectives which can be promoted and implemented as soon as possible.
Chapter 2

Criteria for the Prioritization and Selection of Species for Enhanced Research Attention
Chapter 2

Criteria for the Prioritization and Selection of Species for Enhanced Research Attention

During discussions held on individual medicinal plant species, and using a multidisciplinary approach, the following categories, classified under different headings, were agreed upon by participants for use in the selection of species for prioritization.

1. High Value in Local Uses

1.1 Value in primary health care (should be high).
1.2 Value in treating common ailments (should be high).
1.3 Should be multi-purpose if possible, that is, used to treat a range of ailments.
1.4 Should be widely accepted on the basis of traditional knowledge/practices.
1.5 Value in enhancing family income.

2. Suitable To Area’s Agro-ecology And Farming Systems

2.1 Should be natural to a specific eco-geographical zone.
2.2 Methods of cultivation known/need more work/unknown.
2.3 Macro propagation techniques known/need more work/unknown.
2.4 Micro propagation techniques known/need more work/unknown.
2.5 High value to rural farming/forestry enterprises.

3. Processing Technology Known To Capture Part Of The Value Addition

3.1 Standard preparation agreed (or not) by practitioners.
3.2 Potential for value addition if better processed.
3.3 Potential for value addition if better packaged/stored.
3.4 Active principles should preferably be known.

4. Wide Distribution And Easy Availability Of Genetic Materials

4.1 Assessment of availability regarding size and distribution of wild resource base.
4.2 Assessment of status of genetic erosion of resource base (high, medium, low, nil)

5. Importance in Genetic Resources/Biodiversity Conservation

5.1 Known species status (IUCN/CITES categories).
5.2 Need for genetic resources conservation programs (high, medium, low, nil).
5.3 Need for evaluation of genetic resources (chemotypes, specific types for farming systems etc.).
5.4 Need for provenance trials.
Chapter 3

The Major Priority Species
Chapter 3

The Major Priority Species

During the course of the discussions held by participants of the expert consultation on the selection of major priority species of medicinal plants, it was agreed that any priorities selected on a regional basis would necessarily exclude a number of significant species used locally within individual countries. However, the participants affirmed that the consensus reached should in no way inhibit continued research on these species, some of which are listed under the countries/areas in which they occur in the following chapter.

A second area of concern identified during the consultation relates to the problem of limited exchange of information and materials between researchers. This is an issue requiring the attention of the responsible government agencies within the region. The following examples illustrate this point.

_Acorus calamus_, for example, is widely used for the treatment of gastro-intestinal disorders, asthma, epilepsy, as a heart tonic and as a memory enhancer. More specifically, it is commonly used in the area of paediatrics with regard to primary health care. Until the time of its export being restricted from India through the issuance of Public Notice No. 47 in 1994, it was amongst the top 22 exported medicinal plants. According to available data, its occurrence is critical in North Eastern India; vulnerable in South India and threatened in Nepal. Supplies are also limited in Sri Lanka due to heavy demand. By contrast, the plant’s occurrence is more common in other parts of India, where at least 4 recognized species are known to exist. While cultivation techniques for this plant are available, what is required is research related to germplasm exploration and the exchange and application of known techniques through collaborative efforts between researchers in the region.

A second example which illustrates the need for collaboration is provided by _Rauvolfia serpentina_, which is well known as a remedy for the control of high blood pressure. While export of this species has now been banned from Nepal and India due to over exploitation, it is still being heavily used in Bangladesh, Pakistan and Sri Lanka. Cultivation techniques have already been researched in India, leading to the development of commercial varieties. What is therefore required is a simple case of transfer of these technologies to Bangladesh, Pakistan and Sri Lanka. Further, the application of known technologies in Central India would remove this species from its, "endangered," status in this area.

_Aegle marmelos_, is another example which is used to treat a wide range of ailments. While supplies are limited in Bangladesh and Sri Lanka, the plant is cultivated using primitive techniques throughout the region. Thus, research on simple cultivation methods needs to be expanded.

All of the above examples highlight the need to adopt a regional perspective which involves the facilitation and exchange of information between researchers in the area of selection of priority medicinal plant species. In light of the above recognition, the participants of the consultation agreed that the following thirty species or species groups should be accorded high priority with regard to regional research attention.
In the detailed list that follows, relevant information regarding medicinal uses; cultivation methods; propagation methods; supply and demand; processing methods and genetic diversity are provided wherever possible in order to create a profile of each species. In addition, major research priorities are identified for each of the above. At the end of the chapter, a summary of the species selected for each eco-geographical zone is presented for easy reference.

The following abbreviations have been used in the text below:

PHC 1 : Major use in primary health care.
PHC 2 : Other secondary uses in primary health care.
C : Cultivation.
P : Propagation.
Con. : Conservation Status.
S/D : Supply and Demand.
GD : Genetic Diversity.

A. ARID/SEMI ARID ZONES

1. Commiphora wightii. Bhandari

A small shrub from which gum of a resinous nature is extracted. Its distribution is mostly confined to Western India (Rajasthan and Gujarat) and to Pakistan (Sind and Baluchistan), although it is also found scattered in Eastern India. It is used throughout the region.

PHC 1 : Major use is for arthritis; non-destructive extraction.
PHC 2 : Reduction of blood cholesterol levels and to treat obesity.
C : Largely uncultivated, but attempts have been made in this area and require perfecting. Likely to be in pure stands.
P : By cuttings or seed. Tissue culture is unlikely to be feasible since costs would outweigh the product values.
Con. : Endangered in both Pakistan and in India.
S/D : Demand is very high; supply is low.
Proc. : Both primary and secondary processing methods are known. Known to be used in approximately 50 formulations.
GD : Genetically diverse populations need sampling and evaluation

Major research priorities: cultivation and genetic evaluation.

2. Tinospora cordifolia. Miers

A climbing shrub widespread in the sub-tropical and tropical areas of Bangladesh, Pakistan, India and Sri Lanka. However, populations occurring in semi-arid areas provide better materials for medicinal use.

PHC 1: Major uses are for bronchitis and as a hepatic stimulant. The aerial woody parts, particularly the stem and its bark are used.
The Major Priority Species

PHC 2 : Treatment of rheumatism, urinary problems, skin diseases, dyspepsia and as a tonic. Also possesses anti-periodic properties. It has several other uses, e.g. for eyewashes.

C : Cultivation methods are known but need perfecting.
P : By woody vegetative cuttings.
Con. : Not threatened but populations are declining in Bangladesh.
S/D : Demand is high; supply is low.
Proc. : Primary processing methods are known.
GD : Genetic variability has not been studied. The need for evaluation is therefore urgent.

Major research priorities: cultivation; yield studies; germplasm evaluation.

3. **Evolvulus alsinoides** L. and **Convolvulus pluricaulis** Choisy.

These two herbs are used for the same purposes. They are widespread in the arid areas (including the foothills of the Himalayas) of Bangladesh, India, Pakistan and Nepal.

PHC 1 : Major use is as a memory drug. The whole plant is used.
PHC 2 : For the treatment of mental disorders, conjunctivitis and intermittent fever.
C : Cultivation has not been attempted.
P : By seed, but cuttings are also a possibility (needs testing).
Con. : Populations are becoming vulnerable.
S/D : Demand is high; supply is medium.
Proc. : Needs research since content has to be correlated with quality, and since preparations have not been standardized to date.
GD : Species and population evaluation are needed.

Major research priorities: cultivation; processing and identification of genotypes for production.

4. **Bunium persicum** (Boiss.) Fedts.

A rhizomatous herb/undershrub localized in the hill areas of Pakistan (Zarghun and Bolan; NWFP and Baluchistan), and in Himalayan regions of India.

PHC 1 : Carminative and laxative. Seeds are used.
PHC 2 : Food flavoring; eyewashes; astringent, and as a stimulant.
C : Cultivation techniques need to be developed.
P : By seed but selections are needed. Some tissue culture has been attempted. When propagated by seed, harvest occurs in 3 years, whereas when propagated by rhizomes, harvest is possible in 2 years.
Con. : Threatened both in India and in Pakistan.
S/D : Demand very high; supply low.
Proc. : Both primary and secondary methods are known.
GD : Has not been tested.

Major research priorities: cultivation as a field crop; reduction of natural seed shedding; need for evaluation and genetic selection.
Priority Species of Medicinal Plants in South Asia

5. *Azadirachta indica* A. Juss.

The neem tree is widespread in the region.

PHC 1: Major use is for skin diseases and for intestinal worms.
PHC 2: Anti-diabetic; dozens of other uses, though mostly not validated.
C: Cultivation methods are known.
P: Known.
Con.: No problems.
S/D: Demand is high; supply is relatively abundant.
Proc.: Much work is needed on validation of medicinal uses, including use of different plant parts - roots, bark, leaves, flowers, fruits, gum and seed oil.
GD: There is a great need to evaluate genotypes for medicinal purposes.

Major research priorities: validation of medicinal uses and evaluation of populations from across its range of habitats for these specific purposes.

B. TROPICAL ZONES

6. *Saraca asoca* (Roxb.) de Wilde

A small to medium evergreen tree occurring in the evergreen forests of India and Sri Lanka. Cultivated in gardens for its beautiful flowers all over the region, including in Nepal since the tree is sacred to the Hindus. Natural variation is thought to be centered in Sri Lanka.

PHC 1: Major use is for menstruation and as an endometrium stimulant. The bark is primarily used.
PHC 2: Wide range of uses for dysentery, haemorrhoids, diabetes and scorpion stings.
C: Basic cultivation methods are known and silvicultural trials are underway for plantations.
P: Presently by seed, but cuttings can be used.
Con.: Vulnerable in many parts of its habitat range.
S/D: Demand is very high; supply is low and decreasing, partly because supply from the Western Ghats has been banned.
Proc.: Known for bark. Processing methods for leaves and flowers are not known.
GD: Provenance trials are needed.

Major research priorities: provenance testing; establishment of plantations and yield studies/yield economics.


The former is distributed in South India while the latter occurs in Sri Lanka. Both are used for the same purposes. They are perennial rhizomatous herbs yielding essential oils and are used widely in the Ayurveda and Siddha systems of medicine in South India and in Sri Lanka.

PHC 1: As anti-inflammatories; the rhizomes are used.
PHC 1 : As anti-inflammatories; the rhizomes are used.
PHC 2 : Many secondary uses. Rhizomes are used in polyherbal preparations due to their anti-allergic properties, and for the treatment of spondylitis.
C : Cultivation methods are known but are only practiced in Kerala. Tolerates shade.
P : By seed and rhizome cuttings.
Con. : Vulnerable.
S/D : Demand medium; supply low.
Proc. : Primary processing methods are known. Chemical constituents are known.
GD : Needs evaluation of germplasm.

Major research priorities: economics of cultivation, e.g. under irrigated coconut need investigation. It should be domesticated as a crop.

8. *Bacopa monnieri* L.

An annual herbaceous creeper found in wetlands or in marshy areas in the tropical and subtropical regions of Bangladesh, Central and Eastern India, Pakistan and Sri Lanka. The entire aerial portion of the plant is used in Ayurveda, Siddha and folk systems of medicine.

PHC 1 : Major use is as a memory drug.
PHC 2 : Sedative.
C : Cultivation methods have not been studied.
P : Seeds, but cuttings are a possibility.
Con. : Vulnerable.
S/D : Demand high; supply low.
Proc. : Primary processing methods are known; chemical analysis completed.
GD : There is a need to explore and evaluate populations.

Major research priorities: cultivation.

9. *Centella asiatica* L.

A perennial horizontal creeper rooting at the nodes, found especially in moist areas, e.g. river banks, in Bangladesh, India, Pakistan, Nepal and Sri Lanka. The whole plant is used in the Ayurvedic, Siddha and Unani systems of medicines.

PHC 1 : Healing of wounds; skin diseases and as a memory aid.
PHC 2 : Many other uses including for the treatment of digestive disorders; swollen scrotum and female sterility.
C : Cultivation methods known but need detailed study. Plants tolerate shade.
P : By rooted runners.
Con. : Vulnerable.
S/D : Demand high; supply low.
Proc. : Known.
GD : Population sampling and evaluation are high priorities.

Major research priorities; cultivation as a field crop or intercrop; selection of genotypes.
Priority Species of Medicinal Plants in South Asia


A perennial woody climber found mostly in evergreen and deciduous tropical forests, particularly in the Western Ghats of India and in Sri Lanka. The root is used extensively in the Ayurveda and Siddha systems of medicine.

PHC 1 : Used for treating eye disorders.
PHC 2 : Gastro-intestinal problems; bronchial disorders and as a tonic.
C : Cultivation methods not known.
P : Not known.
Con. : Endangered and becoming extinct in many areas.
S/D : Demand medium; supply low.
Proc. : Primary processing methods known.
GD : There is a need to evaluate populations.

Major research priorities: cultivation and selection of genotypes.


A perennial climber occurring in the tropical forests of Bangladesh, India and Sri Lanka, and used in Ayurveda, Siddha and other traditional systems.

PHC 1 : Diabetes; leaves are used.
PHC 2 : Used in polyherbal preparations for stomach disorders and as an astringent.
C : Cultivation methods need study.
P : By seed but needs perfecting.
Con. : Vulnerable; populations are small.
S/D : Demand is high; supply is low.
Proc. : Primary processing methods and chemical constituents are known.
GD : The need for germplasm collection and evaluation is very high.

Major research priorities: cultivation as a field crop; selection of genotypes.

C. SUB-TROPICAL ZONES


A small to medium sized tree, widespread in most sub-tropical areas of Bangladesh, India and Nepal. Though just the bark is used in medicinal preparations, entire branches are currently being sold.

PHC 1 : Diarrhoea.
PHC 2 : Epilepsy; gastro-intestinal disorders; rheumatism; tonic.
C : Not known.
P : Not known but regenerates from seed.
Con. : Vulnerable throughout the habitat range.
S/D : Demand medium; supply low.
The Major Priority Species

Proc. : Primary processing methods known. There is a need to study the content of active principles in various plant parts.

GD : There is a need to sample populations.

Major research priorities: cultivation in agroforestry systems.


An epiphyte with a narrow distribution range occurring in North Eastern India and in Nepal. The whole plant is used.

PHC 1 : Used as a tonic in combination with other herbs.
PHC 2 : Not known.
P : Not known.
Con. : Threatened.
S/D : Demand high; supply low.
Proc. : Primary processing known; chemical constituents need study.
GD : Evaluation of populations is needed.

Major research priorities: cultivation; selection of genotypes.


An annual herb with a wide distribution range important throughout South Asia. Although the entire plant is used, the most commonly used components are powdered leaves, roots and freshly extracted juice.

PHC 1 : Hepatic protectant; diphtheria.
PHC 2 : Used for several paediatric conditions and as a tonic.
C : Primitively cultivated but methods have not been studied.
P : Not known.
Con. : Threatened.
S/D : Demand high; supply medium.
Proc. : Primary processing methods are known.
GD : Collection and evaluation are very important needs.

Major research priorities: cultivation; provenance and regional trials


A perennial herbaceous climber with wide distribution in Bangladesh, India, Nepal and Sri Lanka.

PHC 1 : To increase milk production after childbirth; root is used.
PHC 2 : Diuretic; anti-dysenteric; demulcent.
C : Cultivated in gardens but methods need to be standardized.
P : By seed but needs refining.
Con. : Not threatened but vulnerable in certain areas.
Priority Species of Medicinal Plants in South Asia

S/D : Demand high; supply medium.
Proc. : Primary processing methods need perfecting to avoid blackening.
GD : There is a need for a range of germplasm.

Major research priorities: cultivation; selection of annual woody strains; multiple cropping systems.

16. *Phyllanthus amarus*.

An annual herb with a medium distribution range in the sub-tropical regions of South India and Sri Lanka. The root is used.

PHC 1 : Hepatic protectant.
C : Cultivation methods known but need standardization.
P : By seed.
Con. : Not threatened but vulnerable in certain areas.
S/D : Demand high; supply low.
Proc. : Primary processing methods and constituents known.
GD : Provenance trials are needed

Major research priorities: cultivation and trials.

17. *Terminalia arjuna* Bedd.

A large tree with a wide distribution range in Bangladesh, India, Nepal and Sri Lanka. It is cultivated in Pakistan although wild populations may be in existence in Sind and NWFP. The root and bark are used for medicinal purposes.

PHC 1 : Cardiac tonic.
PHC 2 : General tonic; astringent to wash ulcers.
C : Cultivation methods known but economics have not been analyzed. Bark yield only occurs after 8 to 10 years.
P : Seed.
Con. : Vulnerable.
S/D : Demand high; supply low.

Major research priorities: silvicultural techniques.


A large fast growing tree commonly occurring in India; rarer in Bangladesh and Pakistan (Punjab); introduced into Nepal. The root is used though stems are often substituted.

PHC 1 : Cardiac tonic.
PHC 2 : Tonic; stomachic; laxative; fever.
C : Cultivation methods known but economics need to be studied.
The Major Priority Species

19. Aconitum heterophyllum. Wall.

A perennial herb found under shade in the Western Himalayan belt (Pakistan, India and Nepal).

PHC 1 : Pain relief; tonic.
PHC 2 : Astringent; stomachic; anti-periodic and anti-pruritic.
C : Needs study.
P : Needs study.
Con. : Endangered.
S/D : Demand high; supply low.
Proc. : Primary processing methods and chemical constituents known.
GD : Evaluation of population samples is needed.

Major research priorities: cultivation.


A tuberous perennial herb distributed in the Central and Eastern Himalayas (India and Nepal).

PHC 1 : Cardiac tonic.
PHC 2 : Many uses.
C : Needs study.
P : Needs study.
Con. : Endangered.
S/D : Demand high; supply low.
Proc. : Primary processing methods known.
GD : Evaluation of population samples is needed.

Major research priorities: cultivation.


A perennial herb distributed in the Himalayas (India, Nepal).

PHC 1 : Treatment of rheumatism.
PHC 2 : Treatment of skin diseases.

Other details as for A. spicatum.
Priority Species of Medicinal Plants in South Asia

22. *Rheum australe*. D. Don

A perennial herb, the root of which is used widely in the region. It occurs naturally in the Western Himalayan regions of Pakistan, India and Nepal.

- **PHC 1**: Used as a tonic; astringent; purgative.
- **PHC 2**: Used for a very wide range of ailments.
- **C**: Cultivation methods known to some degree but require further study.
- **P**: Seeds, but vegetative means of propagation require study especially since harvests are usually from 6 to 8 year old plants.
- **Con.**: Endangered.
- **S/D**: Demand high; supply low.
- **Proc.**: Primary processing methods and chemical constituents known.
- **GD**: Evaluation of population samples is needed.

Major research priorities: cultivation of pure stands.


A perennial herb occurring in the temperate Himalayas (Pakistan, India, Nepal) on moist slopes in the undergrowth of bushes and trees. Dried rhizomes and roots are used in the herbal remedy, valerian.

- **PHC 1**: Sedative.
- **PHC 2**: Used for leprosy; as a tonic; several other uses.
- **C**: Requires further study.
- **P**: By rhizome pieces but requires further study.
- **Con.**: Vulnerable.
- **S/D**: Demand high; supply low.
- **Proc.**: Primary and secondary methods known.
- **GD**: Germplasm evaluation is crucial especially in relation to rhizome production and time of harvest.

Major research priorities: cultivation as a crop under shade; genotype selections.

24. *Berberis aristata*. DG.

A shrub which is found scattered in Pakistan, India, Nepal and Sri Lanka. The bark of the root is used in Ayurvedic, Unani and Tibetan medicine.

- **PHC 1**: Treatment of stomach disorders; malaria; haemorrhoids; emmenagogue.
- **PHC 2**: Conjunctivitis; premature ejaculation; jaundice and many other diseases.
- **C**: Requires further study.
- **P**: Usually grown from seeds. Vegetative propagation techniques require further study.
- **Con.**: Vulnerable.
The Major Priority Species

S/D : Demand high; supply medium.
Proc. : Primary and secondary processing methods known.
GD : Provenances require testing.

Major research priorities: cultivation as live hedges.


A herb with a narrow localized distribution range in the region - mostly found in Sikkim and Nepal. The root is used.

PHC 1 : Tonic.
PHC 2 : A wide range of uses for tuberculosis; cough; nausea; diabetes; gout; rheumatism etc.
C : Primitively cultivated in places. Cultivation methods require further study.
P : Needs study and standardization.
Con. : Endangered.
S/D : Demand very high; supply virtually nil; mostly imported from China.
Proc. : Known.
GD : Population samples require evaluation.

Major research priorities: cultivation as a cash crop.

E. ALPINE ZONES.

*Aconitum heterophyllum*

See temperate zones.


A perennial herb with a narrow distribution range in the Himalayas. The root is used.

PHC 1 : Hepato-protective.
PHC 2 : Fevers; asthma; threadworm; dyspepsia; tonic.
C : Needs to be studied.
P : Probably through root cuttings and seeds. Needs study.
Con. : Endangered.
S/D : Demand high; supply low.
Proc. : Processing methods and chemical constituents known.
GD : There is an urgent need for population sampling and evaluation.

Major research priorities: Germplasm exploration; cultivation; regional trials; reduction of harvest time.

A rhizomatous perennial herb with a narrow distribution range in the moist alpine Himalayan region (Pakistan, India and Nepal). Roots are used for their resin content.

| PHC 1 | Purgative. |
| PHC 2 | Hepato-stimulant (cholagogue); allopathic anti-cancer drug. |
| C    | Needs study. |
| P    | Seed; rhizome parts. |
| Con. | Endangered; populations are also small in size. |
| S/D  | Demand high (since much is exported); supply is low. |
| Proc. | Processing methods and chemical constituents known. |
| GD   | There is an urgent need for sampling and evaluation. |

Major research priorities: germplasm exploration; cultivation as a cash crop; regional trials; harvest time reduction.

28. *Saussurea costos*

A rhizomatous perennial herb with aromatic roots, sparsely distributed on moist shady slopes of the Western Himalayas. Short growing period.

| PHC 1 | Treatment of respiratory problems. |
| PHC 2 | Treatment of blood, liver and kidney ailments; dysentery; arthritis and as a tonic. |
| C    | Cultivation methods are well known. |
| P    | Propagation methods are well known. |
| Con. | Endangered. |
| S/D  | Demand high; supply medium. |
| Proc. | Known. |
| GD   | Very important for evaluation for shorter growth cycles. |

Major research priorities: cultivation as an agroforestry crop; crop cycles need shortening.

29. *Nardostachys grandiflora* DC

A perennial herb with long woody rhizomes. Has a narrow distribution range throughout the alpine Himalayas. The rhizomes are primarily used, though sometimes the entire plant may be used for medicinal purposes.

| PHC 1 | Sedative. |
| PHC 2 | Tonic; carminative. |
| C    | Cultivation methods need to be studied. |
| P    | Propagation methods need to be studied. |
| Con. | Endangered in India; vulnerable in Nepal. |
| S/D  | Demand high; supply medium. |
| Proc. | Processing methods are known. |
| GD   | Need for germplasm sampling and evaluation. |

Major research priorities: cultivation as a cash crop.

A herb reaching a height of 1 to 5 meters. Widespread in alpine areas of Nepal, but with low population sizes. The entire plant is harvested at the flowering stage.

PHC 1: Bitter tonic; anti-malarial; used for other fevers.
PHC 2: Laxative; normal functioning of the digestive tract.
C: Cultivation methods need further study.
P: Through seeds, but technique needs perfecting.
Con.: Endangered in India and Pakistan; vulnerable in Nepal.
S/D: Demand high; supply low.
Proc.: Processing methods are known.
GD: Need for germplasm exploration and evaluation.

Major research priorities: cultivation as a cash crop; genotype selection.

**Summary List of Prioritized Species By Eco - Geographical Zones**

**A. ARID/SEMI-ARID ZONES**

1. *Commiphora wightii* syn. *C. mukul*.
5. *Azadirachta indica*.

**B. TROPICAL ZONES**

6. *Saraca asoca*
7. *Alpinia species*, particularly *A. calcarata* and *A. galanga*.
8. *Bacopa monnieri*
9. *Centella asiatica*.
10. *Coscinium fenestratum*.
11. *Gymnema sylvestre*.

**C. SUB-TROPICAL ZONES**

12. *Oroxylum indicum*.
14. *Andrographis paniculata*.
15. *Asparagus racemosus*.
16. *Phyllanthus amarus*.
17. *Terminalia arjuna*.
18. *Gmelina arborea*.
Prionty Species of Medicinal Plants in South Asia

D. TEMPERATE ZONES

19. *Aconitum heterophyllum.*
20. *A. spicatum.*
23. *Valeriana jatamansi.*
24. *Berberis aristata.*

E. ALPINE ZONES

*Aconitum heterophyllum.*
28. *Saussurea costos.*
30. *Swertia chirayita.*

Before concluding this chapter, it should be noted that in the event that research funding is limited, the participants of the consultation reached a consensus with regard to the selection of a core list of five top priority species, one from each eco-geographical zone. They further focused on specific research priorities for each of the selected species, as outlined below.

<table>
<thead>
<tr>
<th>Species</th>
<th>Research Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Commiphora wightii</em></td>
<td>C GD</td>
</tr>
<tr>
<td><em>Andrographis paniculata</em></td>
<td>C GD RT</td>
</tr>
<tr>
<td><em>Saraca asoca</em></td>
<td>GD RT Pr.</td>
</tr>
<tr>
<td><em>Berberis aristata</em></td>
<td>C P GD</td>
</tr>
<tr>
<td><em>Picrorhiza scrophulariiflora</em></td>
<td>C P GD RT</td>
</tr>
</tbody>
</table>

*C = cultivation; P = vegetative propagation; GD = genetically diverse populations need collection and evaluation; RT = regional trials required; Pr. = processing.*
Chapter 4

Other Priority Species of Individual Countries or Regions
Chapter 4

Other Priority Species of Individual Countries or Regions

The previous chapter stressed the need for the adoption of a regional perspective with regard to the selection of priority species of medicinal plants. However, it also pointed out that such a perspective should not inhibit continued research on significant species used locally within individual countries in the region. The following lists have therefore been produced by participants of the consultation, identifying priority species in their respective countries or regions.

Bangladesh

<table>
<thead>
<tr>
<th>Species</th>
<th>Country</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ocimum sanctum</td>
<td>Aegle marmelos</td>
</tr>
<tr>
<td>Adhatoda vasica</td>
<td>Abrus precatorius</td>
</tr>
<tr>
<td>Datura metel</td>
<td>Alangium salvifolium</td>
</tr>
<tr>
<td>Coccinia cordifolia</td>
<td>Butea monosperma</td>
</tr>
<tr>
<td>Mimosa pudica</td>
<td>Rauvolfia serpentina</td>
</tr>
<tr>
<td>Nerium indicum</td>
<td>Terminalia bellerica</td>
</tr>
<tr>
<td>Salmalia malabaricum</td>
<td>Itolarrhenia antidysenterica</td>
</tr>
<tr>
<td>Calatropis procera</td>
<td>Ricinus communis</td>
</tr>
<tr>
<td>Mucona pruriens</td>
<td>Acalypha indica</td>
</tr>
<tr>
<td>Tragia involucrata</td>
<td>Alstoia scholaris</td>
</tr>
<tr>
<td>Achryanthites aspera</td>
<td>Euphorbia hirta</td>
</tr>
<tr>
<td>Boerhavia repens</td>
<td>Peadaria foetida</td>
</tr>
<tr>
<td>Gloriosa superba</td>
<td>Bryophyllum calycinum</td>
</tr>
<tr>
<td>Vitex negundo</td>
<td>Cassia fistula</td>
</tr>
</tbody>
</table>

Source: M.I. Zuberi, 1997

Central India

A. Species with maximum economic and medicinal value and facing major population decrease - in some cases, extinction:

1. Crataeva nurvala: Very restricted occurrence only in the wild.
2. Fegonia cretica: Frequency and population has declined to decimal range.
3. Pterocarpus marsupium: If present trends of over exploitation continue, this species may hardly be traced in the forests
5. Sarcostemma acidum: Has only been observed growing in two patches of Sarguja District in Madhya Pradesh and is therefore facing extinction.
6. Acorus calamus: Occurrence is restricted to southern districts of Madhya Pradesh. It is facing extinction.
7. Rauvolfia serpentina: Now restricted to the Bastar area.
8. Plumbago zeylanica: If current rates of exploitation continue, the species may hardly be traced in the forests of Madhya Pradesh.
9. Chlorophyllum tuberosum: Has maximum economic value and is facing extinction.
Priority Species of Medicinal Plants in South Asia

B. Species under threat but declining more slowly.

1. *Abelmoschus moschitus*: Very useful; demands cannot be met from wild populations.
2. *Uraia picta*: Very restricted occurrence; high demand.
3. *Mimosa pudica*: Only found as an ornamental plant, not in the wild.
4. *Consore decussta*
5. *Ipomoea digitata*: Very useful; facing extinction threats.
7. *Curcuma zedoana*: Useful species; very restricted in occurrence.
8. *Abrus precatorius*: Very useful; facing extinction threat.
10. *Curcuma caesia*

C. Species now scarce and overexploited.

1. *Amoora rohitika*: Useful; very scarce.
2. *Leea macrophylla*
3. *Dracera bursmanni*: Less medicinal importance but very rare. Only collected from one locality - Main pat, Sarguja in Madhya Pradesh.
4. *Citrus colocythis*: Very commonly used; rare.
5. *Coelipeda minima*: Very useful; very restricted in availability - overexploited.
7. *Holostemma annulare*: Though of less importance, it is becoming rarer.
8. *Andrographis paniculata*: Very useful; very scarce in occurrence.

D. Species facing potential future threat if exploitation continues.

1. *Alhagi pseudoalhagi*
2. *Careya arborea*
3. *Salvadura oleoides*
4. *Oroxyum indicum*
5. *Steriospermum suaveolens*
6. *Aristolochia indica*
7. *Bombax ceiba*
8. *Utsea chinenses*

Source: A.A. Boaz, 1997
### Nepal

<table>
<thead>
<tr>
<th>Plant Species</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acacia rügata</td>
<td>CW; TR</td>
</tr>
<tr>
<td>Aconitum bisma</td>
<td>ECW; TM-SA</td>
</tr>
<tr>
<td>Allium hypsistem</td>
<td>CW; AL</td>
</tr>
<tr>
<td>A. wallichii</td>
<td>ECW; TM-AL</td>
</tr>
<tr>
<td>Alstonia scholaris</td>
<td>EC; TR</td>
</tr>
<tr>
<td>Bergenia ciliata</td>
<td>ECW; ST-SA</td>
</tr>
<tr>
<td>Brachycorythis obcordata</td>
<td>ECW; ST</td>
</tr>
<tr>
<td>Cinnamomum tamala</td>
<td>ECW; TR-ST</td>
</tr>
<tr>
<td>Cordyceps sinensis</td>
<td>ECW; AL</td>
</tr>
<tr>
<td>Dactyrorhiza hatagirea</td>
<td>ECW; TM-SA</td>
</tr>
<tr>
<td>Daiswa polyphylla var. wallichii</td>
<td>ECW; TM</td>
</tr>
<tr>
<td>Dioscorea deltaoida</td>
<td>ECW; TR-SA</td>
</tr>
<tr>
<td>Fritillaria cirrhosa</td>
<td>ECW; SA-AL</td>
</tr>
<tr>
<td>Juniperus indica</td>
<td>ECW; TM-AL</td>
</tr>
<tr>
<td>Lilium nepalense</td>
<td>ECW; TM-SA</td>
</tr>
<tr>
<td>Piper longum</td>
<td>ECW; TR</td>
</tr>
<tr>
<td>Rauwolfia serpentina</td>
<td>EC; TR</td>
</tr>
<tr>
<td>Taxus baccata</td>
<td>ECW; TM-SA</td>
</tr>
</tbody>
</table>

E: Eastern Nepal; C: Central Nepal; W: Western Nepal
TR: Tropical zone (up to 1000 m); ST: Sub-tropical zone (between 1000 m and 2000 m); TM: Temperate zone (between 2000 m and 3000 m); SA: Sub-alpine zone (between 3000 m and 4000 m); AL: Alpine zone (above 4000 m).

Source: S.B. Malla and N.K. Bhattarai, 1997

### Pakistan

<table>
<thead>
<tr>
<th>Plant</th>
<th>Local Name</th>
<th>Conservation Status</th>
<th>Ecological Region</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paeonia emodi</td>
<td>Mamekh</td>
<td>E</td>
<td>Temperate Himalayas</td>
</tr>
<tr>
<td>Dioscorea deltaoida</td>
<td>Kanis</td>
<td>E</td>
<td>Temperate Himalayas</td>
</tr>
<tr>
<td>Onosma echoides</td>
<td>Ratanjot</td>
<td>E</td>
<td>Cold dry mountains</td>
</tr>
<tr>
<td>Colchicum luteum</td>
<td>Suranjan talkh</td>
<td>V</td>
<td>Subtropical Himalayas</td>
</tr>
<tr>
<td>Bergenia ciliata</td>
<td>Zakham-e-Hayat</td>
<td>V</td>
<td>Temperate Himalayas</td>
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<tr>
<td>Atropa acuminata</td>
<td>Angoor-shafa</td>
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<td>Temperate Himalayas</td>
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<td>Berberis lycium</td>
<td>Dardald</td>
<td>V</td>
<td>Hindukush, Himalayas</td>
</tr>
<tr>
<td>Coccinia macranthera</td>
<td>Gaozaban</td>
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<td>Hindukush Himalayas</td>
</tr>
<tr>
<td>Acorus calamus</td>
<td>Warch or ghorbach</td>
<td>V</td>
<td>Temperate Himalayas</td>
</tr>
<tr>
<td>Adiantum capillus-veneris</td>
<td>Persoshan</td>
<td>V</td>
<td>Temperate Himalayas</td>
</tr>
<tr>
<td>Pistacia integerrima</td>
<td>Kakar Singhi</td>
<td>V</td>
<td>Subtropical Himalayas</td>
</tr>
</tbody>
</table>
Priority Species of Medicinal Plants in South Asia

Glycyrrhiza glabra  Malathi  V  Hindukush, Karakoram
Mallotus philippinensis  Kamila  V  Subtropical Himalayas
Plantago ovata  Isabgol  V  Cold arid hills
Polygonum emplexicaule  Anjabur  E  Temperate Himalayas
Citrus colocynthis  Tumba  V  Deserts
Artemisia spp.  Afsantin  V  Hindukush, Himalayas
Ziziphus sativa  Unab  V  Subtropical Himalayas

E = Endangered; V = Vulnerable

Source: Rubina A. Rafiq, 1997

Sri Lanka

Species  

Acorus calamus  Wadakaha
Aegle marmelos*  Beli
Alpinia calcarata  Heen aratta
Asparagus gonocladus  Hataveriya
Berberis aristata*  Daruharidra
Baliospermum montanum  Deththa
Cissampelos pareira  Diyameththa
Coleus elongatus*  Gal kapparawalliya
Coscinium fenestratum*  Weniwel
Curculigo orchiodes*  Heen bintal
Cryptocoryne walker*  Athiudan
Erythroxylum monogynum  Agil
Munronia pinnata*  Bin kohomba
Ocimum sanctum  Heen madurutala
Pterocarpus santalianus*  Rat handun
Rubia cordifolia*  Welmadata
Rauvolfia serpentina  Ekaveniya
Santalum album*  Sudu handun
Saraca asoka*  Asoka
Sida retusa  Babila
Stereospermum suaveolens  Palol
Terminalia chebula  Aralu
Tragia hispida  Wel kahambiliya
Tribulus terrestris  Heen nerenchi
Withania somnifera*  Amukkara
Woodfordia fruticosa  Mahtha

* Plants which are threatened as well as heavily used.

Source: Lakshmi Arambewela, 1997
Priority Species in the Region Classified According to Family

**A. TREES**

Aegle marmelos
Aquilaria agallocha
Gmelina arborea
Oroxylum indicum
Taxus baccata
Santalum album

**B. SHRUBS**

Berberis aristata
Cassia angustifolia
Commiphora wightii
Embelia ribes

**C. HERBS**

Aconitum heterophyllum
Acorus calamus
Bacopa monnieri
Centella asiatica

**D. CLIMBERS**

Asparagus racemosus
Gymnema sylvestre

**E. BAMBOOS**

Banslochan or tabashir is a siliceous deposit occurring in the joints of the interior of the hollow stem of a number of species of bamboo. Due to its use in the treatment of a wide range of conditions, its production has to be stepped up.

Source: D.N. Tewari, 1997
Chapter 5

Country-specific Situations and Approaches to the Prioritization and Conservation of Medicinal Plants
Chapter 5

Country-specific Situations and Approaches to the Prioritization and Conservation of Medicinal Plants

Madhya Pradesh, Central India

The state of Madhya Pradesh, being centrally located at a latitude of 17-48' to 26-52' North, and a longitude of 74-2' to 84-24' East, occupies the heart land of India and contains the largest forest area in the country. According to the Forest Survey of India Report 1993, 15.5 million hectares out of the state's total geographical area of 44.3 million hectares can be categorized as forest land, and 13.5 million hectares is under forest cover.

The elevation of the state varies from 61 metres to 1438 metres above sea level, while temperatures exceed 40 degrees Celsius in summer in all parts of the state except the hilly regions, for example, Pachmarhi. Winter temperatures generally range between 5 degrees Celsius and 10 degrees Celsius except in the plains of Chhattisgarh where winter is not pronounced. In addition to ranges in temperature and elevation, rainfall shows marked variation, ranging between 1500 mm. In the Eastern and Southern regions to less than 800 mm. In the Western zone.

The combination of the factors described above has resulted in a wealth of biodiversity in Madhya Pradesh. However, pressure resulting from over exploitation and habitat destruction for commercial benefits is increasingly being exerted on the natural resource base. This has led to the endangerment of a number of plant species whose continued survival is under threat in many parts of the state.

The threat to biodiversity is thus considerable and has received top priority in the agenda of local authorities. Recognizing that the only means of ensuring the survival of endangered flora is through legislation, habitat preservation, rotational extraction and cultivation of species, state authorities have initiated a programme involving the conservation and development of medicinal plants through the establishment of a special Medicinal Plants Task Force. The Task Force not only oversees programmes and activities relating to the sustainable exploitation of medicinal plants but also works through the 1944 primary cooperative societies established throughout the state, with a total membership of 2,421,000 families, mostly tribals. Encouraging the active participation of local communities is vital in order to promote conservation and sustainable use of the medicinal plant resource base. This is therefore being fostered through the program of Joint Forest Management which is being implemented in remote areas and which has led to the development of concern and interest amongst tribals in the conservation of their valuable resources.

Source: A.A. Boaz, 1997

Nepal

Nepal occupies the central portion of the great Himalayan chain, forming a meeting point between the eastern and western ranges. Consequently, it contains flora representative of both
these zones - Sino-Japanese species as well as western Himalayan elements. The country also includes plants representative of Tibet, found along its numerous northern frontiers, especially in the trans-Himalayan regions, as well as of the Indo-Gangetic plains occurring in the tropical and subtropical belts.

Nepal's vast wealth of flora is primarily due to the considerable altitudinal variations in the country, which range from less than 100 metres above sea level to above the snow line, and the corresponding climatic variations, resulting in the presence of 35 major forest types and 75 major vegetation types. Approximately 7,000 species of vascular plants, including 252 endemic species occur within the country's small geographical area of 147,181 square kilometres. Furthermore, over 1,000 species of economic value, including about 700 species of medicinal plants occur naturally, of which approximately 100 are harvested for commercial and industrial purposes, including medicinal. (Malla et al. 1995)

Nepal possesses a very strong and well established tradition with regard to the use of medicinal plants, both within the Ayurvedic system of medicine as well as in the context of folk herbal remedies. Due to the availability of limited facilities as well as shortages of manpower, modern health services have not penetrated the greater part of the rural areas where the majority of the population resides (Bhattarai 1989). Consequently, this sector of the population is dependent on indigenous systems of medicine including herbal home remedies. Approximately 85 per cent of the rural population are thought to use these traditional herbal remedies. (Dani 1986). Medicinal plants used in these traditional herbal preparations therefore play a vital role with regard to the health care and services available to the rural Nepalese population.

However, demands for medicinal species are increasing at an alarming rate. Ten to fifteen thousand tons of crude medicinal herbs are collected annually from forests and pastures, many of which are exported abroad. This trade is an important source of livelihood and cash income (estimated to be in the order of 10 million US Dollars in Nepal) for rural communities. In certain areas, non-timber forest produce, including medicinal and aromatic plants, provide up to 50 per cent of a family's income. Out of a total contribution by the forestry sector of approximately 4 per cent to the national economy, revenue earned from non-timber forest produce, including medicinal herbs, account for 50 per cent. (Edwards 1996). Tremendous pressure is thus being exerted on the medicinal plants resource base.

Source: Bhattarai and Malla, 1997

Pakistan

Traditional uses of medicinal plants in Pakistan

The use of medicinal plants in traditional medicine dates back to the Indus civilization as has been verified by excavations conducted in the former sites of the ancient cities of Mohenjodaro and Harappa, as well as of the University of Taxila which flourished during the Gandhara period. These findings clearly reveal the importance of medicinal plants in the lives and religious teachings of these civilizations.
Country-specific Situations and Approaches to the Prioritization and Conservation of Medicinal Plants

Contemporary users of medicinal plants include numerous tribal societies which inhabit the rough and rugged mountains in the northern and western regions of the country and which to a large extent have remained isolated from the developed world. Confined to inaccessible mountain valleys, they lack access to modern health facilities and are consequently dependent on the medicinal plants available in the surrounding mountains for their health care needs. However, increasing demands have resulted in the depletion of these resources and a number of species have become endangered and are on the threshold of extinction.

Approximately 400 to 600 medicinal plants are more frequently used in herbal preparations and while several species which are common in certain areas are known to be used locally in traditional preparations, they have not been scientifically investigated for wider use. A lot more work therefore needs to be done with regard to collecting and compiling indigenous knowledge of plants, especially amongst tribes living in the western mountains.

Reasons for the decline of the medicinal plants resource base

Over exploitation of medicinal plants coupled with habitat degradation due to factors such as livestock grazing, land clearing for agriculture and expansion of human settlements are the main reasons for the decline of the medicinal plants resource base. The degradation process has been further accelerated by development activities such as large scale construction of dams, roads etc. In addition, the global climatic changes are further complicating factors, resulting in global warming and increasing aridity. These two factors alone will have a direct impact on the alpine and desert ecosystems which are the most vulnerable habitats of medicinal plants.

Ecological diversity and major habitats of commercially exploited medicinal plant species

Geographically, Pakistan is located in a transitional zone where the summer monsoon-influenced climate of the east gradually merges with the winter precipitation-dominated Mediterranean climate of the west.

The northern section of the country comprising of Karakoram, Hindukush, Sulaiman and the Central Brahui range in Baluchistan etc. is predominantly mountainous, while South Balochistan also includes the sandy and desert regions of Kharan which continue up to the coastal area of Makran. Moving towards the west, aridity increases in the Chagai desert region. Out of the total land area of Pakistan, 88 per cent is classified as arid and semi-arid, with only 12 per cent being humid and sub-humid, primarily located in the Himalayan and Karakoram ranges. 5 per cent of the country’s total area is under forest cover, which includes temperate conifer forest and subtropical forest.

The climatic and topographical variations described above have resulted in a diverse range of habitats with their unique flora and vegetation types extending from the southern coastal region to the mountainous region of the north which alone contains diverse mountain ranges. There are four genera endemic to Pakistan which are confined to the dry western mountains and between 350 and 400 endemic species are found in the country.

With regard to medicinal plants, commercially exploited species, which are therefore endangered to varying degrees, are mainly found in the four major ecological zones described below.
Priority Species of Medicinal Plants in South Asia

1. Alpine and High Altitude Areas

Several important species of medicinal plants are collected from moist alpine and sub-alpine Himalayan meadows which are confined to the north eastern regions of the country. However, due to increasing human and livestock populations, these habitats are being subjected to ever increasing pressure and several areas are displaying signs of degradation as indicated by decreasing species diversity and increasing numbers of unpalatable species as well as soil erosion.

Most of the alpine plants are slow growing perennial species which require several years of vegetative growth for reproduction by seed. Further, due to the fact that in many cases underground rhizomes are being collected for medicinal purposes, reproduction by vegetative propagation is also being limited. Many of these species have been classified as threatened and endangered given the continuation of present rates of collection. Some important endangered medicinal species found in these habitats include Podophyllum hexandrum; Saussurea costus; Picrorhiza kurrooa; Aconitum heterophyllum and Corydalis spp.

2. Temperate Montane Forests

A second major ecological zone from which medicinal plants are collected is the temperate coniferous forest zone of the Himalayas, which provide most of the country's timber requirements. During the last 100 years, these forests have been subjected to major structural changes leading to a decrease of about 50 per cent of the potential forest area. The decrease in forest cover, combined with major changes in community structure have also been responsible for the decline in medicinal plant populations resulting from disturbances of habitats. Some of the more common species collected from these forests include Atropa acuminata; Angelica glauca; Paeonia emodi and Geranium wallichianum.

Temperate broadleaf forests form a very small proportion of the temperate montane forest belt and are confined to specialized habitats situated on moist ravines and along streams on the valley floors. The root bark of Juglans regia is extensively collected from these natural forests, with annual consumption rates of between 50 to 100 tons. Extraction of the young roots of this species not only damages the trees but also disturbs the surrounding soil and vegetation.

Finally, the dry temperate forests are mainly confined to the western mountain ranges such as the Karakoram, Hindukush and Sulaiman ranges, and include important timber species, for example, Cedrus deodara and Pinus girardiana. These forests have been heavily exploited during the last two decades, especially by Afghan refugees settled in these areas, leading to increased demands for items such as fuelwood and timber. Local tribes inhabiting these forests, living below subsistence levels, also depend on forest resources. Consequently, increasing pressure is being exerted on this zone. With regard to medicinal plants collected from the dry temperate montane forests, some of the important species include Artemisia spp., Glycyrrhiza glabra and Perowskia abrotanodes.
Subtropical Himalayan foothill forests constitute an important eco-geographical zone with regard to species diversity and forest density, with several important medicinal species being found in these areas. These include several species originating in the Indo-Malayan tropical forests which extend to the west of these hills, for example, *Terraialia* spp., *Mallotus philippinensis*, *Phyllanthus emblica* and *Butea monosperma*.

Expansion of urban areas and encroachment of agricultural land have greatly reduced the area of subtropical forests in the country, while increasing demands for fuelwood and fodder have contributed towards their further degradation. Some species such as *Holarrhena pubescens* and *Cinnamomum tamala*, which were in any case rare in these forests have already been eradicated and conservation measures along with sustainable use are urgently needed to protect these resources.

4. *Arid and Semi-Arid Deserts*

While vegetative cover is very sparse in about 88 per cent of the country which is classified as arid and semi-arid, nevertheless some of the commercially important medicinal species are found in these areas.

The hot desert areas are mainly located in the south of the country and extend from Cholistan and Thar through Kharan and Makran to Chagai in the west. Factors such as aridity, soil structure and topography display considerable variation extending from east to west, as do plant species and vegetative cover. These deserts are amongst the least developed areas of the country and require attention with regard to the sustainable use of their resources. Medicinal plants of commercial value collected from this zone include *Commiphora wightii*, *Capparis decidua*, *Citrus colocynthis* and *Peganum harmala*.

The cold arid areas are mainly located in the Hindukush and Karakoram mountain ranges in the western and northern sections of the country. Some important species of medicinal plants of commercial value occurring in these habitats include *Artemisia* spp., *Ephedra germariana*, *E. procera* and *Bunium persicum*.

**Priorities for habitat and species conservation**

Most of the medicinal plants used commercially are collected from the Himalayan range, primarily from the alpine and temperate zones.

Several species of alpine plants used for medicinal purposes, which in Pakistan are confined to the north eastern humid alpine meadows, are now being increasingly threatened. These include *Picrorhiza kurrooa*, *Saussurea costus*, *Podophyllum hexandrum* and *Valeriana jatamansi*.

The temperate Himalayan forests also contain some of the most threatened habitats which are facing rapid degradation. Important species found in these areas include *Polygonium emplexicaule* and *Rheum emodi*, which are becoming increasingly rare with significant reductions in the sizes of their populations during the last few decades.
Priority Species of Medicinal Plants in South Asia

The last few decades have also seen significant pressure being exerted on the dry western mountains due to the movement of Afghan refugees. Species specially affected include Pinus girardiana in the Sulaiman range and Cedrus deodara and Pinus wallichiana in the Hindukush range. These habitats are subject to very harsh climatic conditions with extremes of temperature and aridity, and are very sensitive to increasing pressures due to over exploitation by human populations.

The juniper forests of Baluchistan contain some of the most unique ecosystems of the world and are associated with several species of endemic shrubs. Many of these shrubs are used in local systems of medicine as well as in by the pharmaceutical companies. However, these forests are also under threat due to increasing human activity, livestock grazing and global environmental changes.

Desert areas are especially influenced by increasing aridity resulting from global warming which has wide-ranging impacts on their vegetation. Some plant species with restricted distribution confined to these specialized habitats are also facing threats of over exploitation to meet increasing demands. These include species such as Commiphora wightii, which is endemic to the desert areas of India and Pakistan, probably extending up to Oman.

Finally, agricultural practices in the lands which surround the Eastern deserts have resulted in water logging and excess salinity of the soil, leading ultimately to habitat degradation.

Source: Rubina A. Rafiq, 1997

Sri Lanka

Sri Lanka has a rich diversity of fauna and flora including 3350 species of higher plants of which 50 per cent have medicinal properties and approximately 25 per cent are endemic. Thus despite its small size (65, 610 square kilometres), the country’s biological diversity is of global significance.

Medicinal plants have been used in Sri Lanka for almost 3000 years in traditional systems of medicine on which a large portion of the population depends for their primary health care needs. Of the species used in Sri Lanka for the production of Ayurvedic medicines by the Ayurvedic drug factory, hospitals, practitioners as well as 80 registered drug manufacturers, around 40 per cent are collected within the country from forests, wastelands, marshes and savannahs. However, collection is generally haphazard and unmanaged, and there is no doubt that the practice of indiscriminate harvesting, coupled with land clearance schemes for hydroelectric power and irrigation projects is having a strongly deleterious effect on Sri Lanka’s foremost natural resource - its biodiversity.

Recognizing the need to preserve its natural resource base, Sri Lanka ratified the Convention on Biological Diversity in 1994 and has declared both a National Forest Policy as well as a National Wildlife Conservation Policy, both of which emphasize the conservation of biodiversity. Sri Lanka was also one of the first countries to prepare a National Environmental Action Plan, based on the major findings and recommendations of the National Conservation Strategy which is in the process of being implemented.
Country-specific Situations and Approaches to the Prioritization and Conservation of Medicinal Plants

In addition to focusing on the conservation of biodiversity, the Sri Lanka Forest Sector Master Plan acknowledges the vital role of community participation in the management of forests which are state-owned and managed by the Forest Department or the Department of Wildlife Conservation. However, implementation of the Plan is yet to commence.

Finally, with specific regard to the traditional medicine and medicinal plants sector, the Government of Sri Lanka is conscious of the need to develop and promote this national heritage and has appointed a Cabinet Minister to look after its forests. It has also established six medicinal plant gardens with the assistance of UNDP, WFO and WWF, and a project funded by the Global Environmental Facility, focusing on the conservation and sustainable use of medicinal plants is soon to commence.

Source: Lakshmi Arambewela, 1997
Chapter 6

Conclusions and Recommendations
Chapter 6

Conclusions and Recommendations

In addition to agreeing upon a framework of criteria to be used for the prioritization of medicinal plants, as well as selecting species of important value for Primary Health Care in South Asia, the Consultation made a number of recommendations related to specific research targets and objectives as summarized below.

- Firstly, with regard to research activities on medicinal plants, there is an urgent need for the sampling of gene pools/populations of priority species; the assessment and evaluation of gene pools which produce effective materials for use in herbal preparations, and the selection of suitable genotypes for cultivation within specific agro-silvicultural systems.

- In most instances, the research activities described above would require the implementation of trials either within individual countries or collaboratively between countries in the region. In order to ensure that these are successful, a disciplined approach using standardized methodologies would have to be adopted as happened in the case of *Azadirachta indica* (neem).

- Pending the availability of further information relating to patterns of diversity as well as to evaluation for continued use and cultivation, most conservation efforts would have to be confined to *in situ* reserve areas. This would yield data regarding which samples should be selected for conservation in *ex situ* gardens. Furthermore, the seeds of a number of priority species can theoretically be preserved in cold storage, and while in many cases seed germination is thought to be low using such storage techniques, it is not clear whether this is due to other factors such as harvesting, handling and temporary storage rather than this method of preservation. Further research is therefore necessary in order to clarify this point.

- It is widely recognized that in many cases, priority species are becoming endangered due to the fact that the necessary harvesting techniques used are destructive to the plant. The introduction of cultivation of these species would reduce such threats and permit monitored regeneration of natural populations, providing that educational programs stressing the need for cultivation are implemented at the local level. The role of NGO's would be crucial in this regard.

Cultivation research must involve a much wider scope of strategies and targets than just production in specific agro/silvicultural environments. Attention must be focused on the maximizing of benefits to the communities involved in cultivation. In this regard, attempts to shorten the time span required for harvesting are extremely important for many of the priority species.

- Finally, the Consultation stressed the point that the selection exercise carried out for the prioritization of major species should be seen as a first attempt aimed at the provision of improved primary health care, in light of current herbal production to consumption systems.
and the threats posed to their continuation. There are a number of other species, as identified by the expert participants of the consultation for their regions and countries, which require attention. The priorities agreed upon from a regional perspective should therefore be used as a framework for guiding research efforts in this area, but should not be seen as exhaustive.
References


Boaz A.A. 1997, *Rare and Threatened Plants in Madhya Pradesh*. A Paper Presented at the Expert Consultation on Medicinal Plants Species Prioritization for South Asia, IDRC/WWF-India, New Delhi, India.


Appendix 1

Agenda

22 September, 1997

9.30  Opening
      Welcome by Mr. Krishna Kumar, WWF-India.
      Welcome by Mr. Roger Finan, Regional Director, IDRC, New Delhi.
      Welcome by Dr. Cherla Sastry, Director, IMPN.
      Introduction to the Consultation, Dr. Madhav Karki, Coordinator, IMPN.
      Background to the Consultation, Dr. J.T. Williams, Adviser, IMPN

10.15  Break.

10.30  Presentation and Discussion of Country Reports.

12.15  Discussion and Agreement of Criteria for Prioritizing Species.

14.00  Lunch.

15.00-16.45 Discussion on Species for Prioritization.

23 September, 1997

9.30  Continuation of Discussions.

13.00  Other Recommendations.

14.00  Lunch.

15.30  Conclusions by Dr. Madhav Karki, Coordinator, IMPN
       Closing Remarks by Mr. Samar Singh, Secretary General, WWF-India.
Appendix 2

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Through support for research, Canada’s International Development Research Centre (IDRC) assists scientists in developing countries to identify long-term, workable solutions to pressing development problems. Support is given directly to scientists working in universities, private enterprise, government, and nonprofit organizations. Priority is given to research aimed at achieving equitable and sustainable development worldwide. Projects are designed to maximize the use of local materials and to strengthen human and institutional capacity.

Led by the dedication and innovative approach of Third World scientists — often in collaboration with Canadian partners — IDRC-supported research is using science and technology to respond to a wide range of complex issues in the developing world.

IDRC is directed by an international Board of Governors and is funded by the Government of Canada. At the United Nations Conference on Environment and Development (UNCED), IDRC’s mandate was broadened to emphasize sustainable development issues. IDRC’s international network and expertise will be used to help the world move toward implementation of UNCED’s Agenda 21 program of action.

Le Centre de recherches pour le développement international (CRDI) soutient des travaux et des activités de recherche dans les pays en développement de manière à assurer un développement durable et équitable à l’échelle mondiale. Les recherches sont menées par des scientifiques affiliés à des institutions, à des entreprises, à des gouvernements ou à des organismes de développement. Des partenaires canadiens y contribuent régulièrement.

Les projets soutenus financièrement ou techniques par le CRDI privilégient le recours aux ressources locales et s’appuient sur le génie, l’intelligence et le sens de l’innovation des chercheurs des pays en développement.

Le CRDI contribue au renforcement des connaissances et des capacités de recherche des pays en développement pour lutter contre la pauvreté et pour améliorer les conditions de vie et l’environnement des populations affectées.

Le CRDI est dirigé par un Conseil des gouverneurs international. Ses fonds proviennent du gouvernement du Canada. La Conférence des Nations unies sur l’environnement et le développement (CNUED) a choisi le CRDI pour participer à la mise en oeuvre du développement durable à l’échelle planétaire. Le CRDI verra à concrétiser le programme Action 21 élaboré lors du Sommet de la Terre.

Con el fin de asegurar un desarrollo sostenible y equitativo a escala mundial, el Centro Internacional de Investigaciones para el Desarrollo (CIID) financia trabajos y actividades de investigación en los países en desarrollo. Las investigaciones están a cargo de científicos que trabajan en instituciones, empresas, gobiernos u organismos dedicados al desarrollo. Estos científicos reciben regularmente la colaboración de sus colegas canadienses.

Los proyectos apoyados financiera o técnicamente por el CIID favorecen el uso de recursos locales y se apoyan en el talento, la inteligencia y el sentido de innovación de los investigadores de los países en desarrollo.

El CIID contribuye al fortalecimiento de los conocimientos y a la capacidad investigativa de los países en desarrollo para luchar contra la pobreza y mejorar las condiciones de vida y el medio ambiente de las poblaciones afectadas.

Un Consejo de Gobernadores Internacional tiene a su cargo la dirección del CIID, cuyos fondos provienen del Gobierno de Canadá. La Conferencia de Naciones Unidas sobre el Medio Ambiente y el Desarrollo (CNUED) ha seleccionado al CIID para participar en la realización del desarrollo sostenible a escala mundial. El CIID se encargará de hacer realidad el programa Agenda 21, elaborado durante la Cumbre de la Tierra.

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This report summarizes the findings of an Expert Consultation on Medicinal Plants Species Prioritization for South Asia, held between February 22-23, 1995. The Consultation, which took place in New Delhi, India, was jointly organized by WWF-India and the IDRC Medicinal Plants Network (IMPN), now known as the Medicinal and Aromatic Plants Program in Asia (MAPPA). The participants consisted of IMPN research partners from Bangladesh, Nepal, Pakistan and Sri Lanka, who shared their expertise on the needs for the conservation, research and development of medicinal plant species, particularly with regard to the primary health care sector in the South Asian region.

The primary objective of the Consultation was to examine key issues faced by the medicinal plant sector in South Asia, focusing on the rationale and need for selecting criteria for the prioritization of medicinal plants used for the provision of primary health care, from a regional perspective. In addition, locally significant medicinal plants occurring in individual countries and regions within South Asia were prioritized. The main outcome of the Consultation was the formulation of an agreed framework of criteria, and a selection of prioritized species used in primary health care, sensitive to related issues such as biodiversity conservation, drug development and the macroeconomics of trade. The framework and selection developed through group participation at the Consultation can be used as a focus for regional research attention, as well as for targeted development action for the upliftment of the poor of the region.