

MANAGEMENT OF THE HERBAL WEALTH OF INDIA

REPORT ON THE PROCEEDINGS OF
A MULTI-STAKEHOLDER CONSULTATIVE WORKSHOP



Hosted by:



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at India Habitat Centre, New Delhi

Conducted by:



CONTENTS



	<i>Page No</i>
Introduction	3
Background to the workshop	3
Structure of the workshop	4
Session Summary Day 1 (4th October, 2007)	8
Inaugural Session	9
Address by the Chief Guest: Mr. Chandi Prasad Bhatt	9
Guest Lecture: Mr. B.S. Sajwan (CEO, NMPB)	10
Keynote Address: Dr. A.K. Sharma (Scientist, FRI)	12
Working Session 1: Prioritisation of Species	15
The framework for prioritisation	15
The national priority list	20
The regional lists	21
Working Session 2: Guiding Strategy for Supply Side Issues	25
The framework for discussions	25
Supply side scenario: the bottlenecks	26
Action options for conservation	28
Action options for cultivation	31
Session Summary Day 2 (5th October, 2007)	35
Working Session 3: Guiding Strategy for Demand Side Issues	36
The framework for discussions	36
Demand side scenario: the stumbling blocks	37
Action options for demand management	38
Working Session 4: Guiding Strategy for R&D Requirements	42
The framework for discussions	42
Action options for R&D requirements	42
Working Session 5: Perspectives~ from the Grassroots and from Policysapers	45
Interaction with Himalayan community	45
A Policy-shaper's Perspective	51
Conclusions	53
Recommendations for Policy & Practice	53
Post-workshop Actions	64
ANNEXURES	66
<i>Annexure I: National List of Priority Species</i>	67
<i>Annexure II: List of Priority Species for Central Region</i>	69
<i>Annexure III: List of Priority Species for Western Himalayan Region</i>	70
<i>Annexure IV: List of Priority Species for Northern Plains</i>	71
<i>Annexure V: List of Priority Species for Western Region</i>	72
<i>Annexure VIa: List of Priority Species for North Eastern Region</i>	73
<i>Annexure VIb: List of Priority Species for Eastern Region</i>	74
<i>Annexure VII: List of Priority Species for Southern Region</i>	75
<i>Annexure VIII: Regional Species Lists by Action Recommendations</i>	76
<i>Annexure IX: List of Participants</i>	83

INTRODUCTION



Background to the workshop

India has an enormous diversity of plant wealth spread over multiple agro-climatic zones, which includes several thousand species of medicinal plants. The Indian systems of medicines use about 1500 species of medicinal plants, of which 500 species are most commonly used in the preparation of ISM&H drugs. In recent times, the demand for alternative medicine is spreading worldwide, and with it the demand for medicinal plants. Use of medicinal plant material from India has increased manifold. In last one decade there has been a dramatic increase in the exports of medicinal plants, with India being the second major international player after China.

This trend constitutes an opportunity as well as a threat to the medicinal plant wealth that require a strategic approach and management. Studies report that the increasing demand is primarily met from the wild, with estimates suggesting that close to 90% of the medicinal plant material used in traditional medicine is collected from the wild, much of it being destructively harvested. This puts our herbal resource base at a great risk with species survival seriously threatened and the associated social and ecological functions performed by these species also jeopardized. Hundreds of species are now threatened because of over-harvesting, destructive collection techniques, and conversion of habitats to crop-based agriculture or other land-use. The situation appeals for urgent need of conservation both in their natural habitat as well as outside their natural habitats.

At the same time, this exploding demand for medicinal plant material in the national and international markets is also an opportunity that should be seized to help improve the economic status of farmers in India. If cultivated, they could prove to be high value cash crops and help farmers benefit from the burgeoning herbal trade sector. However non-availability of cultivation packages, marketing problems, quality assurance issues, are some of the bottlenecks. There is a critical need to promote research, support and extension work to train and facilitate farmers to undertake medicinal plant cultivation; it is also necessary to ensure that the farmers are provided post-harvest facilities and linkages which would in turn enable them to get a fair share of the revenues.

Objectives of the workshop

In the context of the Eleventh Plan, the National Medicinal Plants Board of India sought to prioritize medicinal species based on conservation needs as well as market demand and commercial value, and devise intervention strategies, including both conservation strategies and herbal sector development strategies. A consultative process was adopted and the required strategies were to be crystallized through a Consultative Workshop with participation from various stakeholder groups in the herbal sector.

The specific objectives of this effort were:

- *To prioritize medicinal plant species for immediate attention by NMPB programmes, based on conservation and commercial considerations, and covering all agro-climatic zones of the country*
- *To facilitate the design of special programmes for the support of interventions for conservation and cultivation of the prioritized medicinal plant species, comprising crystallization of guiding strategies, package of support and partnering and recipient agencies*

People behind the workshop

The Multi-Stakeholder Consultative Workshop 'Management of the Herbal Wealth of India' was hosted and sponsored by the National Medicinal Plants Board of India and conducted by Pragma.

The **National Medicinal Plants Board (NMPB) of India** has the responsibility for coordination of all matters relating to medicinal plants including drawing up policies and strategies of conservation, proper harvesting, cost-effective cultivation, research and development, post-harvesting activities including processing and value addition, marketing of raw material in order to protect and sustainable development of the sector.

Pragma, a non-profit development organization, has been involved for the last 12 years in promoting conservation and large-scale cultivation of medicinal plants.

Structure of the workshop

The Participants

The medicinal plants sector has a number of stakeholders (e.g. collectors and cultivators, traders or middlemen, processors, retailers and consumers) having divergent interests, all of whom are interested in strengthening specific aspects of their sector. However, unless there is a coordinated effort for an overall development of the sector, addressing and safeguarding the interests of all stakeholders, the growth of the sector would not be equitable and hence sustainable. Hence, the workshop was an effort to bring together all the different stakeholders at a common platform for a deliberation on the issues that confront the sector and determination of strategies for a holistic and sustainable development of the sector, so that appropriate policy recommendations be made for the 11th plan period.

Thus participants included a **Vertical Cross-section of Stakeholders**:

- government officials and foresters
- representatives from NGOs and civil society groups
- MAP traders and representatives from herbal industry
- research and academic institutes
- traditional healers and representatives of traditional medicine establishments
- MAP cultivators and representatives of cooperatives

The participant group composition also ensured that there was consideration of regional differences in the examination of issues and determination of strategies. Hence participants ensured **Agro-climatic Regional Representation** of all above groups:

- Western Himalayan Region
- Eastern & North Eastern Region
- Central Region
- Northern Plains
- Western Region
- Southern Region

Workshop Process

In order to ensure focused attention, Pragma developed a framework to prioritize the medicinal plants species based on their **Supply Side Status** comprising conservation

priorities and cultivation prospects, as well as their **Demand Side Status** including market demand and commercial value. The framework was designed to facilitate a thorough assessment of the **Development Value** of each species and the crystallization of **Species-specific Intervention Strategies**.

The process followed involved intensive discussions in **Region-specific, Multi-stakeholder Groups**, with deliberations on conservation strategies (in-situ and ex-situ), R&D needs, and strategies for herbal sector development. The nature of support for each of the determined strategies was also devised through along with the nature of organizations/agencies through which these interventions would be channelised.

Objectives of the workshop

- *To prioritise medicinal plants based on conservation and commercial considerations*
- *To develop conservation & cultivation strategies for prioritized medicinal plants*
- *To design the mechanisms for implementation of the strategy developed comprising package of support for prioritized species and partnering and recipient agencies*

Workshop Structure

Day 1

The first day of the workshop began with the inaugural session that included a brief introduction to the workshop agenda and reflections on the MAP sector from the conservation and the commercial points of view. This was followed by two working group sessions. The objective of this day's effort was to arrive at the focal MAP species for each agro-climatic zone in the Himalayas and the development strategies for addressing the supply side issues of the herbal sector in the country.

Inaugural Session:

The inaugural session had eminent personalities of the herbal sector providing their guiding inputs on both the conservation imperative and the commercial prospects of the sector and sharing their expectations of the workshop participants.

Working Session 1: *Prioritization of Species*

The first working session focused on zone-wise prioritization of medicinal plants species based on conservation and commercial considerations and collation of an all-India priority list of MAPs. Parallel group discussions were held with multi-stakeholder working groups for six broad agro-ecological zones. The list of species of national importance emerged from the resulting prioritized species lists.

Working Session 2: *Guiding Strategy for Supply side Issues*

The second working session focused on the supply side needs and policy options. Six parallel multi-stakeholder working groups deliberated on the issues from various stakeholder standpoints and worked on crystallization of holistic support needs for the medicinal plants species in following aspects:

- *Regulatory actions*
- *Extension & grassroots work*
- *Education & promotion*
- *Research and technology development*
- *Financial and infrastructural support*

The session aimed at formulating region specific Action Options for:

- *Conservation (in-situ and ex-situ)*
- *Cultivation (and propagation)*

Day 2

The second day of the workshop was initiated with a revisit of the outcomes of the previous day's deliberations, followed by two working group sessions and an interactive face-to-face. The objective of this day's effort was to arrive at the development strategies for addressing the demand side issues and R&D needs of the herbal sector in the country, and to ensure an enhanced understanding of diverse stakeholder viewpoints within the herbal sector.

Working Session 3: Guiding Strategy for Demand side Issues

The third working session held on Day 2 of the workshop focused on critical needs in various aspects of the demand side of the herbal sector and potential actions to address these, taking care to incorporate the following action categories, viz.

- *Regulatory actions and fair & responsible trade*
- *Linkages & promotion*
- *Infrastructure & services*
- *Quality management mechanisms*
- *Value addition & branding*

The session aimed at formulating region specific Action Options, through six parallel working group discussions for:

- *Post Harvest Processing*
- *Quality Assessment and Certification*
- *Marketing and Promotion*
- *Procedural Aspects*

Working Session 4: Guiding Strategy for R&D and Facilitation Needs

Multi-stakeholder working groups also reflected on the needs of the herbal sector, in terms of R&D and facilitation inputs, to enable the deserved quantum leap, and determined the action options for R&D facilitation for both the demand and supply side with special attention to:

- *Agro techniques and micro-propagation*
- *Post-harvest processes and technologies*
- *Value addition, packaging*
- *Quality standards and processes*
- *Market information*

Interactive Session: Feedback from the Grassroots

This session facilitated a face-to-face interactive session between the Government officials, representatives from NGOs, trade sector, scientists from research institutes and the people from grassroots related to collection and cultivation of medicinal and aromatic plants.

Standing out

The process brought together the various stakeholders of the medicinal plants sector, i.e. the government, scientists, development organizations, industry and the primary producers, and helped in getting an overall sectoral perspective, while facilitating a cross-stakeholder understanding of the various issues as well as deliberations for a holistic outcome. It also brought together various stakeholder representatives from all the agro-climatic zones of India, and thus ensured adequate consideration of regional differences. It provided an

interactive platform for people from different strata to participate in policymaking - from community members to government representatives. As a result of the participative/consultative process followed, the policy directions and programmes shaped through the workshop are expected to be far closer to the stakeholder needs and total-sector requirements.

The workshop also took a comprehensive look at all the issues plaguing the herbal sector with a view to holistic management of these. The framework included species prioritization, discussions on demand side, supply side and R&D and facilitation issues for devising an overall growth strategy for the herbal sector.

SESSIONS SUMMARY: DAY 1



Medicinal plants have a special significance in people's lives due to their healing properties as well as their economic and cultural values. Plant-based healthcare continues to meet about 80% of the healthcare needs of the rural population in developing countries like India. In recent times, the demand for alternative medicine has been spreading worldwide, and with it the demand for the medicinal plants that are its inputs. The first day of the two-day workshop on "Management of the Herbal Wealth of India" began by luminaries in the sector providing the participants with their inputs on the status of the sector along with guiding thoughts on the outputs necessary through the processes of the workshop. Following this, the participant body deliberated on Supply Side Issues in the sector, including the species that need focus and thrust, and came out with their suggestions for policies and interventions during the 11th Plan period.

Inaugural Session



The programme began with a welcome address by Mr. Sunil Pillai, Deputy Director of Pragma. He thanked the participants for coming all the way from all over the country to be a part of the workshop. He put forward the agenda of the workshop and highlighted the basic objective: to take a critical look at the herbal sector of the country and catalyze efforts to provide it the much-needed boost. The Chief-Guest Mr. Chandi Prasad Bhatt shared his views on the rich biodiversity of India and the traditional knowledge and conservation practices linked to them. This was followed by a talk by Mr. B. S. Sajwan, CEO, NMPB and the keynote address by Dr. A. K. Sharma, Scientist, FRI.

Address by the Chief Guest

[Mr. Chandi Prasad Bhatt has played an important role in protecting the environment of the hills. He is a revolutionary environmentalist, an actor and thinker of extraordinary range and one of the luminaries of the Chipko movement, for which he has been awarded the Ramon Magsaysay Award for Community Leadership in 1982, followed by the Padma Bhushan in 2005.]

The Chief Guest for the programme, Mr. Chandi Prasad Bhatt began by congratulating Pragma for organizing the workshop and expressed his confidence that the event, with its significant participation of researchers and specialists in medicinal plants, as well as those associated strongly with decision-making processes for the sector, would make an enormous contribution to the herbal sector. He stressed on the importance of a national workshop of this nature in building greater awareness on the need for conservation of the medicinal plants wealth of the country and helping in the revival of our rich heritage.

India's rich natural heritage

Mr. Bhatt spoke about the rich biodiversity of India particularly its medicinal plants. He pointed out that the natural barriers surrounding the country, viz the Himalayas, Western and Eastern Ghats, and the bays and oceans and islands surrounded by them, are hotspots of biodiversity that exhibit a high degree of endemism, and are also least explored. Describing the lifecycle and phyto-sociological associations of medicinal and aromatic plants, he dwelt on the thousands of different species that flower in the Himalayas, in quick succession on the same stretch of land; even the harsh environment of the cold deserts supports a variety of medicinal and aromatic plants. These herbal resources of our country, would, he predicted, play an important role in healthcare in the coming years.

Traditional conservation practices

Mr. Bhatt described the long dependence of the rural people of India on their surrounding biodiversity, as reflected in the Ayurvedic treatise “*Charak Sanghita*”, and their practices of conservation of this biodiversity. Citing several examples from the Central Himalayas, he explained how several of our traditional rituals are backed by a certain scientific logic and actually serve to conserve: traditionally harvesting and fodder collection is done only after the ripening and natural dispersal of seeds so that regeneration is not hampered; traditional healers follow certain norms and restrictions on extraction of plant material; there are traditions and norms for entering the ‘buggyals’ (high altitude meadows that have a concentration of MAPs), so the young plants are not trampled and weed seeds are not introduced accidentally, etc.. He recounted from his experience, how the natives of

Andaman and Nicobar islands and the “Jhum” cultivators of the North-East preserve their medicinal plants wealth through traditions attached to them.

However, these traditions and norms of conservation are being eroded with time. Mr. Bhatt expressed his concern over the destructive harvesting of medicinal species such as the large-scale extraction of *Cordyceps sinensis*, a high value medicinal fungus. He expressed his concern about the eroding traditional values/knowledge, which, along with the tension in the border areas and other anthropogenic disturbances, has led to an increase in habitat destruction and illegal plant trade and export. This is rendering the sensitive ecosystems more vulnerable by the day and pushing more and more species to the brink of extinction.

Preserving traditional knowledge

Emphasizing the need for documentation of traditional knowledge, Mr. Bhatt said that the culture of oral transmission of our valuable traditional knowledge through the generations is eroding with changes in lifestyle, which has put our vast traditional knowledge base under severe threat. He suggested the formation of societies such as for traditional healers, farmers, etc., through which indigenous knowledge on agro-techniques, harvesting techniques (from the wild as well as from farms), and the indigenous practices of conservation, could be preserved; further these should be propagated amongst the people through workshops and training sessions by the repositories of traditional knowledge. Attempts should also be made to integrate the traditional knowledge with new scientific developments through extensive research & development.

Priorities for the MAP sector

Expressing the need for more R&D in the MAP sector, Mr. Bhatt cautioned that while prioritizing the species for cultivation and identifying research needs, the welfare of farmers should be kept in mind. He stressed on the importance of safeguarding the interests of the farmer by providing market linkages, minimizing legal hurdles, forming farmer friendly government policies, fixing a minimum support price for MAP crops and also, providing an insurance cover against natural disasters and crop failure. He stressed on the formation of uniform policies for medicinal and aromatic plants for the entire nation, with a thrust for conservation and sustainable utilization of the resources.

Mr. Bhatt concluded his speech emphasising on the need for sharing the knowledge on traditional conservation practices and promoting their implementation. He hoped that the workshop would find a way to promote medicinal plant cultivation and conservation and an overall development of the herbal sector.

Guest Lecture

[Mr Bikram S. Sajwan, CEO, National Medicinal Plants Board (NMPB) is an Indian Forest Service Officer and has served in Arunachal Pradesh and the Union Territories of A&N Islands, Dadra & Nagar Haveli & Daman Diu during his career of 30yrs. He has also served in the Union Ministry of Rural Development, worked as Managing Director and Chief Executive of A&N Forest and Plantation Development Corporation and Deputy Director General (Extension), with the Indian Council of Forest Research and Education, Dehradun. As CEO, NMPB, he is also an expert member in a number of committees of the central government.]

Mr. Sajwan explained the basic objectives behind organizing the workshop as bringing the people who work in the field of medicinal and aromatic plants together at one platform, to collaboratively identify the issues that affect the sector today, the gaps in Research & Development, the constraints that affect the policies and programmes, and the constraints

at the field level, and to formulate measures to bridge the existing gaps and constraints. The motive behind organizing this workshop, he said, was to bring out inputs and suggestions considering the existing knowledge, scientific experience and project learnings, in order to incorporate them into the schemes that NMPB has been developing for the 11th Five Year Plan.

Documentation of indigenous knowledge

Mr. Sajwan emphasized on the need of documentation of the traditional knowledge that exists with the rural communities. He supported Shri Bhatt's suggestion of documenting the indigenous knowledge and creating a database of the same, as is already being done for the high altitude Himalayas by *Pragya*. All relevant knowledge on MAPs should be documented and brought into the public domain for this would make people aware of the immense significance of our biodiversity and the need for conserving it. He shared with the audience the plan for a National Portal for Medicinal Plants where everything would be available to the people at the click of a mouse, with some limits in order to safeguard the traditional knowledge and medicinal systems.

Importance of 'in-situ' conservation

Unless the host communities become aware of the biodiversity supported by the wild areas around them, and actively protect the same, and unless regulatory bodies control the market pressures, the biodiversity of our nation would vanish in no time. The bulk of the raw material for the herbal industry as well as for the traditional health care systems, i.e., the plant material of 90% of the total number of plants, and in terms of volume around 70% of the material used in these, comes from the wild, and a very minimal amount comes from cultivated sources. This is a serious cause for concern. Further, what comes from the cultivated regime is limited both in terms of the number of species and the source areas. Hence, the role of the forest department is extremely important, as is the criticality of *in situ* conservation.

Mr. Sajwan lamented the fact that despite this, there is inadequate funding for and stress on the medicinal plants sector in forest management. In Protected Areas, National Parks and Sanctuaries, extraction is completely prohibited, and only documentation and monitoring are possible. But medicinal plants are not confined in terms of their distribution to protected areas alone, and medicinal plant biodiversity can be protected outside PAs through the use of different community-based conservation models.

Challenge for R&D institutions

R&D institutions in the herbal sector have a significant challenge as well, that of developing standard protocols for the propagation and cultivation of medicinal plants, towards eliminating destructive wild harvesting. This is especially relevant in the case of species with a long gestation periods, and should be placed on a priority for action during the 11th plan period. Delegates in this workshop, should identify the species for which suitable methods for sustainable harvesting could be devised in the next 2-3 years' timeframe. R&D institutions also need to work towards identifying the active molecules and revealing the bioactivity in different medicinal plant species.

Role of civil society organizations

Mr. Sajwan pointed out that civil society organizations such as *Pragya* are important stakeholders and have to play a vital role, not only in creating greater awareness of medicinal plants and the need for conserving them, but also in documentation and creating a knowledge base on medicinal plants. Civil society organizations can help in bridging the gap between the government and various players in the herbal sector, viz, growers, traders and

R&D institutions. NMPB aims to involve a greater number of civil society organizations in its programme, recognising this as a route to take the programme to the grassroots.

Developing market linkages

Marketing, according to Mr. Sajwan, is currently a major bottleneck in the cultivation of medicinal plants. Supporting Mr. Bhatt's suggestions for some support price and crop insurance cover for MAP cultivators, he stressed on the need for facilitation of market linkages. Civil society organizations can play a significant role creating such linkages and thus setting in place a viable cultivation programme. It must be acknowledged that the Ayurveda industry cannot depend indefinitely on imports and at the same time, the population of medicinal plants in the wild cannot be allowed to go down because of indiscriminate wild harvesting for trade.

Mr. Sajwan proposed that organizations like *Pragya* that are working in such areas of biowealth, such as the high altitude Himalayas, should identify suitable partners in those areas who can be linked with appropriate agencies on the market side, as well as with NMPB for support. He assured that NMPB would provide full support for the creation of such linkages between the grassroots and the markets.

He concluded his speech with the expectation that the two day workshop would result in concrete recommendations on various developmental aspects of medicinal plants sector - promotion of conservation, research & development, export promotion, market development and all other relevant aspects. He requested the delegates to debate on issues mentioned as well as others, so that action plans for the herbal sector could be collaboratively designed for uptake during the 11th Plan period.

Keynote Address

[Dr. Avinash K. Sharma (Scientist D) is the Head of the NTFP Division of Forest Research Institute, Dehradun, with over 20 years of experience in sustainable management of medicinal plants. He has worked extensively on the conservation of germplasm of medicinal plants and development of cultivation techniques for the MAPs.]

Dr. Sharma delivered the keynote address for the workshop on 'Medicinal and Aromatic Plants and the Conservation Imperative'. He emphasized the urgent need for conservation of medicinal and aromatic plants in the context of the fact that more than 95% of the plant material used in the manufacture of various Ayurvedic and Homeopathic drugs in India is of wild origin.

Lack of scientific information

Wildharvesting occurs not only from forest areas but also from other land areas like fallow lands or wastelands. Lack of scientific knowledge of the mechanisms that prevail in the ecosystems, along with paucity of the information available on association of species in *in-situ* environments, are key issues in *in-situ* conservation. There is no comprehensive inventory of the existing species and their behaviour in the wild. Dr. Sharma highlighted the need to study the inter-relationships between the species in the wild, the ecological and physiological interactions that are taking place between different species. He talked of the importance of maintaining preservation plots for medicinal plant species for the purpose of inventorying and periodic observations for bridging the knowledge gap. There is also a need

for understanding the productivity of each species under *in situ* conditions and developing species-specific safe harvest limits.

Destructive harvesting

Unsustainable harvesting of medicinal plant material from the forests, for trade and for other purposes, has increased over time. Unfortunately, 70% of the medicinal and aromatic plants material so harvested, are collected in a destructive manner. Collection or extraction of the underground parts including roots, rhizomes, and bulbs of any species or of the whole plants, seriously impairs regeneration of the species, and is hence determined to be destructive. Further, the over-extraction of the medicinal plant material, because of the ever-increasing market demand, both at the national and at global levels, also adds tremendous pressure on the natural habitats in terms of meeting the demands.

Adopted measures

Dr. Sharma highlighted interventions in India aimed at conserving the natural resources of the country. A number of Sanctuaries, National Parks, Reserved Forests, have been established as *in situ* conservation measures, and certain programmes are promoting medicinal plants conservation areas and “*Vanaspati Van*” and other methods for conservation of biodiversity. In addition to these, various approaches have been adopted for *ex situ* conservation, for instance herbal gardens and Botanical Gardens in different agro-climatic zones. Despite this, these may not be sufficient or effective enough to control the escalating biodiversity loss. Natural populations are fast declining and the natural regeneration is slowing down. More and more species are coming on to the endangered and threatened list. Site-specific models for conservation of the species are urgently needed.

Sharing responsibility

Conservation of medicinal plants is not the sole responsibility of a single stakeholder, but should be shared by all stakeholders. The Forest department should act as the central custodian. R&D Institutes, farmers, communities, industrialists and traders, should also be involved. Sustainable system of harvesting should be developed based on science and the traditional knowledge of the people as well. Dr. Sharma emphasized the importance of people’s participation as well, along with that of other organizations including the Government, non-governmental organisations, R&D institutes and traders. JFM could be the mechanism of integrating the community with the forest department.

Transit regulations

Dr Sharma also dwelt on problems related to transit permits, required for transportation of plant material from one state to another. Many farmers and traders face tremendous difficulties in sale of their material since different states have different rules for transportation of herbal material.

Policy issues

To develop the medicinal plants sector and simultaneously achieve the conservation objectives with respect to the species, India must have a national policy, which is in consonance with National Forest Policy. Dr. Sharma called for the creation and adoption of a National MAP Conservation, Development and Harvesting Policy.

He concluded by summarizing the steps that are urgently required in order to develop the industry - ensuring people’s participation in all conservation and developmental actions, establishment of permanent preservation cum production plots in all agro-eco-climatic zones of India, bringing together the regional resources for better regulation and

management and adoption of a national MAP conservation, development and harvesting policy.

Working Session 1: *Prioritization of Species*



India is blessed with among the world's richest medicinal plant heritage, not only in terms of the number of endemic species, but also in terms of the traditional knowledge about their uses for humans and for livestock. The immense plant diversity present in this country is due to the topographic variations and related climatic differences. The nature of vegetation varies from moist evergreen forests in the Western Ghats to the cold deserts and alpine grasslands of the Himalayas; from the thorny scrubs of the Thar Desert to the mangroves on the east coast.

The session sought to prioritize the medicinal plants species based on both conservation and commercial considerations and devise action plans for them through zone-specific group discussions. The outputs of the session were:

- Zone specific lists of priority medicinal and aromatic plants for development action based on consideration of a group of key influencing factors, as well as
- A national list of focal medicinal plants species, comprising an equitable representation from all zones and their biodiversity.

The Framework for Prioritization

Although all medicinal plant species possess medicinal properties important for human and/or animal health, and have ecological values as well, attention and resources are but limited, and hence call for a certain degree of selectivity in focussing policies and interventions. The rationale for this selectivity requires a deep and comprehensive understanding of the diverse issues that beset the sector and the extent of their impact on specific species and the resultant opportunities and threats with respect to these species.

Pragya worked on creating a framework for analysis of the medicinal and aromatic plant species in the country, and their prioritisation for development policies and interventions. While designing the framework, the considerations that were kept in mind and the principles that were evolved in order to address these considerations are as follows:

- There are variations in the nature of medicinal and aromatic plant resources in different parts of the country, and this is mediated by the agro-climatic conditions of different regions. A comprehensive and appropriate evaluation of species would require examination of the medicinal plant wealth of various agro-climatic zones, and ensure that no particular agro-climatic zone and its specific medicinal plant wealth is ignored in the efforts towards developing the herbal sector. Hence:

Principle 1: *Species prioritisation should at the first stage, be for each agro-climatic zone, to be subsequently compiled at the national level, ensuring an equitable representation of all agro-climatic zones.*

- The herbal sector constitutes a long chain that stretches from the collector or farmer of the primary produce through the post harvest processing stages and transportation via several middlemen to the wholesalers and final buyers or manufacturers of herbal/medicinal products. This chain may be divided into the supply side, viz, those parts of the chain that endeavour to supply the primary medicinal plant material, and the demand side, viz, those parts of the chain that create and process the demand for medicinal plant material. Each medicinal species is circumstanced differently, which determine the particular prospects and problems with respect to the species. This 'species circumstance'

cannot be understood through a skewed look at only the commercial considerations or at the ecological status. A comprehensive species assessment has to take note of both the supply side and the demand side, and weigh the prospects and problems on both the supply side, as well as the demand side, with respect to each species. Hence:

Principle 2: *Species prioritisation process has to involve assessment on each species on supply side considerations as well as demand side considerations.*

- Each of the supply side and the demand side of the herbal sector is beset with its issues. The key issues at each of these two parts of the herbal sector chain, would however impact different species differently. Selection of species should to an extent be determined by the severity of the key issues with respect to each of the species under assessment. Further, the herbal sector is characterised by two divergent pulls: ecological concerns and commercial concerns, that have led to a polarisation of stakeholders. A true development of the sector would call for examination of sustainability considerations as well as economic and development considerations. Hence:

Principle 3: *Species prioritisation process has to involve an assessment of each species against key issues that beset the sector at both supply and demand ends, ensuring attention to conservation and commercial concerns.*

- Although prioritisation is a process that calls for examination of species, one against another, a purely relative assessment of species is likely to lose validity over time. An assessment framework that enables change of ratings with a change of 'species circumstance' would retain validity over a longer term. Hence:

Principle 4: *The species assessment framework should enable independent evaluation of species as well as a comparative evaluation between species.*

- The development interventions should be attuned to the specific issues affecting a particular species, as well as all parts of the chain. A species assessment procedure that enables an identification as well as measurement of the severity of the issues with respect to each species, will greatly facilitate the determination of interventions. It must be recognised that were any aspect to be neglected while promoting the development of another, a new set of issues would be likely to emerge.

Principle 5: *The species assessment scoring should be a composite that allows tracing to measurement on key issues and thus determination of action requirements for each species.*

The Agro-ecological zones

India is gifted with diverse climatic conditions along with heterogeneous landforms. These varying environmental conditions have resulted in a great variety of soils, habitats and agro-ecological conditions in different parts of the country. Therefore, a systematic appraisal of agro-ecological regions encompassing relatively homogenous regions in terms of soil, climate, physiographic details and moisture availability/ length of growing period is required for a holistic, as well as region specific action plan for the medicinal and aromatic plants.

An ecological region is an area of the earth's surface characterized by distinct ecological responses to macroclimate, as expressed by soils, vegetation, fauna, and aquatic systems (FAO, 1983). The agro-biodiversity in India can be depicted under fifteen broad agro-climatic zones as delineated by the Planning Commission based on physiography, soils, geological formation, climate, cropping patterns, and development of irrigation and mineral resources:

- | | |
|---|---|
| <i>i. Western Himalayan Region</i> | <i>ii. Eastern Himalayan Region</i> |
| <i>iii. Lower Gangetic Plains Region</i> | <i>iv. Middle Gangetic Plains Region</i> |
| <i>v. Upper Gangetic Plains Region</i> | <i>vi. Trans Gangetic Plains Region</i> |
| <i>vii. Eastern Plateau and Hills Region</i> | <i>viii. Central Plateau and Hills Region</i> |
| <i>ix. Western Plateau and Hills Region</i> | <i>x. Southern Plateau and Hills Region</i> |
| <i>xi. East Coast Plains and Hills Region</i> | <i>xii. West Coast Plains and Ghat Region</i> |
| <i>xiii. Gujarat Plains and Hills Region</i> | <i>xiv. Western Dry Region</i> |
| <i>xv. The Islands Region</i> | |

These fifteen agro-ecological regions of India may be clustered into the following six broad agro-ecological zones for ease of assessment of biodiversity:

1. Central Region
2. Western Himalayan Region
3. Northern Plains
4. Western Region
5. Eastern & North-Eastern Region
6. Southern Region

The Consultative Process

The lists of medicinal and aromatic plants species found in each of the six agro-climatic regions were compiled based on available state-wise species inventories. These lists were put forward for discussion in zone-specific working groups. Each group consisted of multiple stakeholders belonging to the particular zones and included the following:

- Foresters and policymakers from the state sector
- Academicians, scientists and researchers in medicinal plants
- Representatives of civil society groups working on medicinal plants
- Traders and industry representatives of the herbal sector
- Large-scale practitioners/producers of traditional medicine
- Individual traditional healers
- Farmers and growers of medicinal plants

This composition pattern enabled a multi-stakeholder analysis of the various issues as well as zone-specific outcomes.

A Whole Chain Assessment

Growing market demand and continual erosion of the MAP resource base, calls for immediate attention for focused action. The diverse agro-ecological conditions support an enormous wealth of medicinal plants in India and also have region specific issues related to management of the herbal wealth. A systematic assessment is therefore essential to device species-specific action plan. Thus, the prioritization framework takes into consideration both the supply side and the demand side issues for a comprehensive assessment of the multiple factors that drive the herbal sector.

Supply side aspects

On the Supply Side, the prioritization process considers the issues in the herbal sector chain that stretches from the first stage of access of plant material, either by collection or through cultivation, and through post harvest processing, to the first buyer in the trade channel. The key issues and associated values that need to be determined for each species under consideration, were determined to be the following:

- *Conservation value.* Most medicinal plant species that are traded are wildharvested and this, along with the other anthropogenic and ecological pressures, including impacts of climate change, have led to high levels of

depletion of the species. The status of a species in the wild and the extent of need for conservation is a factor that has a strong bearing on the supply of the species in trade. The Conservation Value of a particular species would indicate this with high conservation values indicating lesser availability of resources in the wild and greater loss to global biodiversity in case immediate attention is not given the particular species.

- *Cultivation prospect value.* Medicinal plants have been wildharvested since perpetuity, the traditional healers sourcing the little material they needed from the forests, and extraction of such low quantities was well within sustainable limits and could be supported by the natural regeneration rates of the species. This has also meant that most of the species traded have not been domesticated for cultivation. The Cultivation Prospect Value of a species indicates the extent to which the particular species is suitable to the agro-ecological conditions of the given area and the degree to which it has been domesticated, in that it has had a fair degree of success by the existing agro-techniques.

Demand side aspects

On the Demand Side are those issues that characterise the part of the herbal sector chain that stretches from the primary trader to the final customer, i.e., the user of herbal products and medicines. The key issues and associated values that need to be determined for each species under consideration, were determined to be the following:

- *Local use value.* Most medicinal plant species have a multitude of local uses. The incidence of local use and the diversity of use at the local level of a particular species, is a major determinant of the quantities required of the plant material of the species, as well as the strength of the local/regional market and demand for the species. The Local Use Value of a species indicates an assessment of the species on this parameter, the value increasing with increase in estimated local demand volumes.
- *Far/larger market value.* A few medicinal plant species are also in high demand in markets beyond the region in which the species is naturally found, rendering the plant to be harvested at larger scale, as against a plant that is used only locally. Certain species are exported in large quantities to overseas markets as well. Some species while not used locally have a significant value in allopathic medicine. The Far/Larger Market Value of a species is based on its demand in markets beyond the local area, including in overseas markets, a higher value indicating a higher market demand in such markets.

The Numerical Expression

The rating scale developed was a 20-point disaggregated scale, with equal weightage for supply side issues as well as demand side issues, and within each for two key issues. Scores were to be allotted to each species against its Conservation Value and Cultivation Prospects under Supply Side considerations, and against its Value in Local Use and Far/Larger Market Status under Demand Side considerations. Each of the 4 parameters could gain a maximum rating of 5 points, and thus the species could get a maximum score of 20. The higher the rating, the more significant the species for development, and hence a higher priority would be accorded to it against other species with lower ratings. This rating scale would enable assessment of each species on each of the key issues, and also enable re-assessment and change of rating with change in status, if required.

Species were given scores for their *Conservation Values* depending on their availability and size and distribution of their wild resource base (horizontal and vertical), erosion of the resource base, nature and scale of impacts by trade, species status based on red list

categories, their phylogenetic distinctiveness, available legal framework for protection (e.g. CITES, etc), regeneration period etc.

Scores on *Cultivation Prospects* were given based on suitability to the area's agro-ecology and farming systems, availability of cultivation protocol/propagation/tissue culture techniques, species having high market value, species harvestable in short rotation period, social acceptance for promotion in areas under the specific zone.

The *Local Use Values* were determined by the use of species in primary health care, in treating common ailments as well as a range of ailments, acceptance based on traditional knowledge/practices, importance of the species in local ethno-botany, use for multiple purposes- social & cultural, fodder & food.

The scores for *Far/Larger Market Status* were assigned on the basis of demand in local, regional, national and global markets, market price, potential for domestic value addition, annual industrial demand and export potential.

Deriving the National Priority Ratings

Each working group prepared a list of priority species based on total scores derived from these values stated above. Based on these regional lists, a national level list was then compiled. Average scores were determined for the species occurring in two or more regions and National Ratings (NR) were calculated accordingly.

Finally these NRs were used to divide the prioritized species at the regional level into two categories i.e. Priority I and Priority II. *Priority I* included those species that received NR of 15 to 20 and *Priority II* included those, which received NR between 10 to 14. The rest of the species with scores of 9 or <9 were omitted from the priority list. This however does not apply to Eastern and Northeastern region, their number of species being lower than that of other zones.

The process can be summarized through the diagram given below.

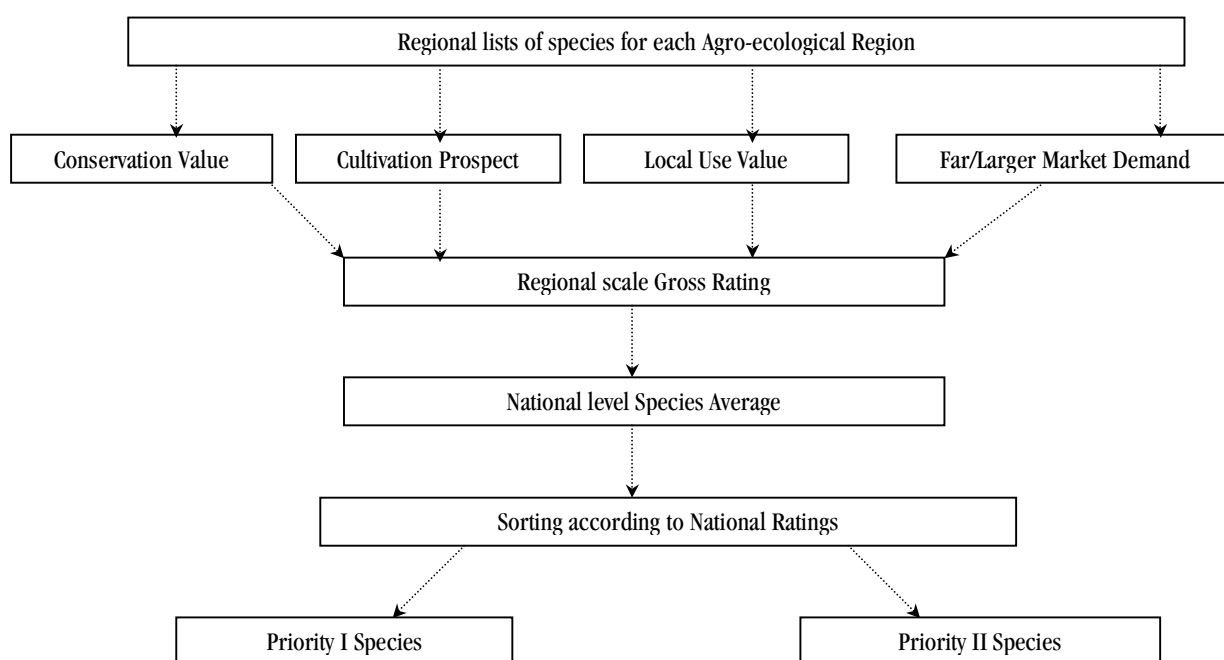


Fig. 1. The Prioritization Process

The National Priority List of Herbal Species

The National list (Annexure I) of prioritized species consists of 56 Priority I species and 63 Priority II species. The list of species is as follows:

Table 1. National list of Prioritized Medicinal Plants Species

Priority I		
1. <i>Aconitum heterophyllum</i>	2. <i>Ammomum subulatum</i>	3. <i>Andrographis paniculata</i>
4. <i>Angelica glauca</i>	5. <i>Aquillaria agallocha</i>	6. <i>Arnebia benthamii</i>
7. <i>Arnebia euchroma</i>	8. <i>Celastrus paniculata</i>	9. <i>Centella asiatica</i>
10. <i>Chlorophytum borivilianum</i>	11. <i>Coleus forskoblii</i>	12. <i>Commiphora wightii</i>
13. <i>Coptis teeta</i>	14. <i>Costus speciosus</i>	15. <i>Curcuma amada</i>
16. <i>Curcuma aromatica</i>	17. <i>Dactylorhiza hatagirea</i>	18. <i>Emblica officinalis</i>
19. <i>Garcinia indica</i>	20. <i>Gloriosa superba</i>	21. <i>Glycyrrhiza glabra</i>
22. <i>Gymnema sylvestre</i>	23. <i>Hardwickia javanica</i>	24. <i>Myrica esculenta</i>
25. <i>Nardostachys grandiflora</i>	26. <i>Ocimum sanctum</i>	27. <i>Panax pseudo ginseng</i>
28. <i>Paris polyphylla</i>	29. <i>Picrorrhiza kurroo</i>	30. <i>Piper betel</i>
31. <i>Piper longum</i>	32. <i>Piper nigrum</i>	33. <i>Plumbago rosea</i>
34. <i>Podophyllum hexandrum</i>	35. <i>Rauwolfia serpentina</i>	36. <i>Rheum australe</i>
37. <i>Rheum moorcroftianum</i>	38. <i>Rheum nobile</i>	39. <i>Santalum album</i>
40. <i>Sapindus mukorossi</i>	41. <i>Saraca asoca</i>	42. <i>Saussurea costus</i>
43. <i>Saussurea obvallata</i>	44. <i>Solanum torvum</i>	45. <i>Sterculia urens</i>
46. <i>Stevia rebaudiana</i>	47. <i>Swertia chirayita</i>	48. <i>Taxus baccata subsp.wallichiana</i>
49. <i>Tecomella undulata</i>	50. <i>Terminalia arjuna</i>	51. <i>Terminalia bellirica</i>
52. <i>Terminalia chebula</i>	53. <i>Tinospora cordifolia</i>	54. <i>Trichodesma zeylanicum</i>
55. <i>Withania somnifera</i>	56. <i>Zanthoxylum armatum</i>	
Priority II		
1. <i>Acacia catechu</i>	2. <i>Acacia nilotica</i>	3. <i>Aconitum ferox</i>
4. <i>Acorus calamus</i>	5. <i>Adhatoda zeylanica</i>	6. <i>Aegle marmelos</i>
7. <i>Allium stracheyi</i>	8. <i>Aloe barbadensis</i>	9. <i>Asparagus racemosus</i>
10. <i>Azadirachta indica</i>	11. <i>Bacopa monnieri</i>	12. <i>Blepharis sindica</i>
13. <i>Boerhaavia diffusa</i>	14. <i>Bunium persicum</i>	15. <i>Bryonopsis lacinosia</i>
16. <i>Calligonum polygonoides</i>	17. <i>Carum carvi</i>	18. <i>Cassia senna</i>
19. <i>Chlorophytum arundinaceum</i>	20. <i>Chlorophytum tuberosum</i>	21. <i>Cissampelos pareira</i>
22. <i>Curculigo orchoides</i>	23. <i>Curcuma angustifolia</i>	24. <i>Cymbopogon citratus</i>
25. <i>Cymbopogon flexuosus</i>	26. <i>Cyperus scariosus</i>	27. <i>Delphinium denudatum</i>
28. <i>Dioscorea bulbifera</i>	29. <i>Dioscorea deltoidea</i>	30. <i>Eclipta prostrata</i>
31. <i>Gaultheria fragrantissima</i>	32. <i>Gentiana kurroo</i>	33. <i>Gymnocardia odorata</i>
34. <i>Gymnocladus assamicus</i>	35. <i>Hemidesmus indicus</i>	36. <i>Hibiscus micranthus</i>
37. <i>Hippophae rhamnoides</i>	38. <i>Holarrhena antidysenterica</i>	39. <i>Leptadenia reticulata</i>
40. <i>Madhuca indica</i>	41. <i>Meconopsis nepaulensis</i>	42. <i>Mesua ferrea</i>
43. <i>Moringa oleifera</i>	44. <i>Mucuna pruriens</i>	45. <i>Oroxylum indicum</i>

46. <i>Phyllanthus amarus</i>	47. <i>Pistacia kbinjuk</i>	48. <i>Plantago ovata</i>
49. <i>Polygonatum cirrbifolium</i>	50. <i>Polygonatum multiflorum</i>	51. <i>Polygonatum verticillatum</i>
52. <i>Punica granatum</i>	53. <i>Plumbago zeylanica</i>	54. <i>Potentilla fulgens</i>
55. <i>Pterocarpus marsupium</i>	56. <i>Pterocarpus santalinus</i>	57. <i>Rheum webbianum</i>
58. <i>Sapindus emarginatus</i>	59. <i>Solanum nigrum</i>	60. <i>Thalictrum foliolosum</i>
61. <i>Valeriana jatamansi</i>	62. <i>Withania coagulans</i>	63. <i>Wrightia tinctoria</i>

The Regional Priority Lists of Herbal Species

The six working groups came up with the prioritized species list for each of the agro-ecological region based on the species list provided to them, also adding several species from their experience. The scoring pattern based on the parameters mentioned earlier, also helped in devising specific action strategies for each region.

1. The Central Region

This working group was chaired by Dr. A.K. Singh (Scientist, CIMAP), co-chaired by Mr. Ajai Shankar (General Manager, MP State MFP Fed Ltd.). The other members of the group included Dr. Lalita Goyal (Scientist, CSIR), Dr. V.K. Singh (Assistant Director, CCRUM), Mr. Narottam Das Vashisht (Tapovan Ayurved Sadan), Mrs. Madhubala Sugandhi (Sanjeevani Mahila Sangh), Mrs. J. Raj (Research Officer, CCRH), Mr. Kapil Garg (HEPAI), Mr. Rajesh Patil (Asst. Manager, DTIC, M.P.) and Mr. Sunil Kumar (Sumangal Industries).

The Working Group prioritized a list of 23 species out of a total of 37 species. Of these, Priority I included 11 species (Annexure II). The list of Priority species is given in Table 2.

Table 2. Prioritized Medicinal Plants Species - Central Region

Priority I		
<i>Saraca asoca</i>	<i>Terminalia arjuna</i>	<i>Andrographis paniculata</i>
<i>Rauwolfia serpentina</i>	<i>Terminalia bellirica</i>	<i>Withania somnifera</i>
<i>Centella asiatica</i>	<i>Piper nigrum</i>	<i>Terminalia chebula</i>
<i>Gloriosa superba</i>	<i>Gymnema sylvestre</i>	
Priority II		
<i>Asparagus racemosus</i>	<i>Cyperus scariosus</i>	<i>Plumbago zeylanica</i>
<i>Mucuna pruriens</i>	<i>Acorus calamus</i>	<i>Hemidesmus indicus</i>
<i>Adhatoda zeylanica</i>	<i>Curcuma angustifolia</i>	<i>Bryonopsis laciniosa</i>
<i>Curculigo orchioides</i>	<i>Solanum nigrum</i>	<i>Moringa oleifera</i>

2. The Western Himalayan Region

The Working group for Western Himalayan region was chaired by Dr. O.P. Chaurasia (Senior Scientist, FRL Leh) and co-chaired by Dr. V.P. Bhatt (Scientist, HRDI). The other members of the group included Dr. C.P. Kala (Consultant, NMPB), Dr. Brij Lal (Senior Scientist, IHBT), Dr. A.K. Badoni (CEO, SHER), Mr. R.S. Chauhan (M.D., SAHARA) and Dr. Bhanu Neopaney (Principal Scientific Officer, IIHS).

The Working Group came up with a priority list of 35 species out of total 69 in the list provided, of which Priority I included 17 (Annexure III) and Priority II 18 species.

Table 3. Prioritized Medicinal Plants Species - Western Himalayan Region

Priority I		
<i>Swertia chirayita</i>	<i>Aconitum heterophyllum</i>	<i>Taxus baccata</i> subsp. <i>wallichiana</i>
<i>Podophyllum hexandrum</i>	<i>Paris polyphylla</i>	<i>Gloriosa superba</i>
<i>Angelica glauca</i>	<i>Dactylorhiza hatagirea</i>	<i>Myrica esculenta</i>
<i>Nardostachys grandiflora</i>	<i>Picrorhiza kurroa</i>	<i>Sapindus mukorossi</i>
<i>Saussurea costus</i>	<i>Arnebia benthamii</i>	<i>Arnebia eubroma</i>
<i>Rheum australe</i>	<i>Rheum moorcroftianum</i>	
Priority II		
<i>Aconitum ferox</i>	<i>Allium stracheyi</i>	<i>Bunium persicum</i>
<i>Delphinium denudatum</i>	<i>Hippophae rhamnoides</i>	<i>Pistacia khinjuk</i>
<i>Rheum webbianum</i>	<i>Valeriana jatamansi</i>	<i>Carum carvi</i>
<i>Oroxylum indicum</i>	<i>Polygonatum cirrbifolium</i>	<i>Polygonatum multiflorum</i>
<i>Polygonatum verticillatum</i>	<i>Acorus calamus</i>	<i>Dioscorea deltoidea</i>
<i>Gentiana kurroo</i>	<i>Thalictrum foliolosum</i>	<i>Saussurea obvallata</i>

3. The Northern Plains

The Northern plains group was chaired by Dr. A.K. Sharma, Sr. Scientist (FRI) and co-chaired by Prof. GL Bansal (CSKHPU). The other members of the group were Mr. K.L. Manhas (CCF and member SMPB, Haryana), Dr. V.K. Saini, Director (Agricare Organic Farming), Dr. Tenzin Deche Kartsang, CMO (TMAI), Dr. Mayaram Unniyal, Ex Director (CIA), Dr. M.L. Dewan (HIMCON), Mr. Piyush Arora (Padmawati Herbs, Bareilly) and Mr. Afaq Ahmad (RA, Jamia Hamdard).

Total 28 species were prioritized by this group from a total of 73, of which 11 fall in Priority I category (Annexure IV). The species are mentioned in Table 4.

Table 4. Prioritized Medicinal Plants Species - Northern Plains Region

Priority I		
<i>Rauwolfia serpentina</i>	<i>Emblica officinalis</i>	<i>Tinospora cordifolia</i>
<i>Withania somnifera</i>	<i>Glycyrrhiza glabra</i>	<i>Centella asiatica</i>
<i>Terminalia chebula</i>	<i>Gloriosa superba</i>	<i>Ocimum sanctum</i>
<i>Gymnema sylvestre</i>	<i>Coleus forskohlii</i>	
Priority II		
<i>Phyllanthus amarus</i>	<i>Aegle marmelos</i>	<i>Asparagus racemosus</i>
<i>Azadirachta indica</i>	<i>Plumbago zeylanica</i>	<i>Bacopa monnieri</i>
<i>Cissampelos pareira</i>	<i>Plantago ovata</i>	<i>Acorus calamus</i>
<i>Acacia catechu</i>	<i>Aloe barbadensis</i>	<i>Boerhaavia diffusa</i>
<i>Chlorophytum tuberosum</i>	<i>Acacia nilotica</i>	<i>Cymbopogon citratus</i>
<i>Hibiscus micranthus</i>	<i>Solanum nigrum</i>	

4. The Western Region

The working group for Western Region was chaired by Mr. Alinda Chandra (CCF, Nagpur) and co-chaired by Dr. Javed Ahmad (Head, Department of Botany, Jamia Hamdard). Other members of the group were Dr. Pawan Kaseera (Associate Professor, JNVU), Mr. Haridas Agarwal (Jairam Das Khushi Ram, Mumbai), Ms Rajeshwari Bhattacharya (RA, IIFM), Dr.

Rajesh Sharma (CEO, Sanjeevani House) and Dr. G.P. Singh Jhala (Programme Director, JJVS, Udaipur).

29 species have been prioritized for this zone from a list of 70 MAPs. Of these, Priority I include 17 species and Priority II 12 (Annexure V). The list of the prioritized species is given in Table 5.

Table 5. Prioritized Medicinal Plants Species - Western Region

Priority I		
<i>Chlorophytum borivilianum</i>	<i>Piper betel</i>	<i>Andrographis paniculata</i>
<i>Rauwolfia serpentina</i>	<i>Santalum album</i>	<i>Garcinia indica</i>
<i>Piper longum</i>	<i>Commiphora wightii</i>	<i>Stevia rebaudiana</i>
<i>Withania somnifera</i>	<i>Glycyrrhiza glabra</i>	<i>Terminalia cbebula</i>
<i>Gloriosa superba</i>	<i>Tecomella undulata</i>	<i>Gymnema sylvestre</i>
<i>Celastrus paniculata</i>	<i>Sterculia urens</i>	
Priority II		
<i>Pterocarpus marsupium</i>	<i>Calligonum polygonoides</i>	<i>Oroxylum indicum</i>
<i>Sapindus emarginatus</i>	<i>Hemidesmus indicus</i>	<i>Blepharis sindica</i>
<i>Dioscorea bulbifera</i>	<i>Eclipta prostrata</i>	<i>Holarrhena antidysenterica</i>
<i>Mesua ferrea</i>	<i>Withania coagulans</i>	<i>Leptadenia reticulata</i>

5. The Eastern & North Eastern Region

This group was chaired by Dr. P. Kausal (Dean Forestry BIU). The other members of the group were Mr. D. Gogoi (DFO, Tawang), Mr. Sudipto Chatterjee (Coordinator, WINROCK India), Dr. J.P. Chaurasia (Senior Scientist, CSIR), Dr. P. Gajurel (Lecturer, NERIST), Dr. A.M. Sunar (Secretary, HHPAEF), Mr. Pradeep (Programme Manager Pragati) and Mr. K.M.G. Bhandari (Mani Himalayan Academy).

The working group came up with two separate lists for 'Eastern' and 'North Eastern' region as the group felt that these regions were distinct from each other and should have separate prioritized lists. The list for North-Eastern Zone includes 19 species of which 13 are in Priority I (Annexure VI.a). Again, 13 species have been prioritized for the Eastern zone of which nine fall in the category of Priority I (Annexure VI.b).

Table 6. Prioritized Medicinal Plants Species - North Eastern Region

Priority I		
<i>Coptis teeta</i>	<i>Panax pseudo ginseng</i>	<i>Aquillaria agallocha</i>
<i>Swertia chirayita</i>	<i>Taxus baccata</i> subsp. <i>wallichiana</i>	<i>Terminalia bellirica</i>
<i>Podophyllum hexandrum</i>	<i>Zanthoxylum armatum</i>	<i>Ammomum subulatum</i>
<i>Hardwickia javanica</i>	<i>Picrorrhiza kurroa</i>	<i>Rheum nobile</i>
<i>Costus speciosus</i>		
Priority II		
<i>Gymnocardia odorata</i>	<i>Gymnocladus assamicus</i>	<i>Gaultheria fragrantissima</i>
<i>Potentilla fulgens</i>	<i>Saussurea obvallata</i>	<i>Meconopsis nepaulensis</i>

Table 7. Prioritized Medicinal Plants Species - Eastern Region

Priority I		
<i>Andrographis paniculata</i>	<i>Rauwolfia serpentina</i>	<i>Terminalia bellirica</i>

<i>Emblica officinalis</i>	<i>Piper longum</i>	<i>Tinospora cordifolia</i>
<i>Glycyrrhiza glabra</i>	<i>Terminalia chebula</i>	<i>Celastrus paniculata</i>
Priority II		
<i>Phyllanthus amarus</i>	<i>Asparagus racemosus</i>	<i>Cyperus scariosus</i>
<i>Plumbago zeylanica</i>	<i>Chlorophytum arundinaceum</i>	<i>Mucuna pruriens</i>
<i>Acorus calamus</i>	<i>Hemidesmus indicus</i>	<i>Eclipta prostrata</i>
<i>Curcuma angustifolia</i>		

6. The Southern Region

The working group for southern zone was chaired by Dr. S. Ganeshan, Director (TBGRI), and co-chaired by Dr. (Mrs.) Veena Gupta, Senior Scientist (NBPGR). The other members of the team were Dr. H.C. Gupta (CCRH), Dr. S. Swain, (MSSRF), Dr. T. Manoharan, Sr. Coordinator (WWF India), Ms. Grace Lhouvum, Associate Fellow (TERI), Dr. Gaurav Vats, (ISAP), Prof. M.Z. Abdin (Jamia Hamdard), Ms Usha Kiran (Jamia Hamdard) and Mr. K. A. Md. Naushad (CF, Kerala Forest Department).

The group came up with a list of 42 priority species out of the initial 57, of which 13 species have been put into Priority I and 15 in Priority II groups (Annexure VII).

Table 8. Prioritized Medicinal Plants Species - Southern Region

Priority I		
<i>Trichodesma zeylanicum</i>	<i>Rauvolfia serpentina</i>	<i>Santalum album</i>
<i>Garcinia indica</i>	<i>Piper longum</i>	<i>Solanum torvum</i>
<i>Piper nigrum</i>	<i>Gloriosa superba</i>	<i>Curcuma amada</i>
<i>Curcuma aromatica</i>	<i>Gymnema sylvestre</i>	<i>Costus speciosus</i>
<i>Plumbago rosea</i>		
Priority II		
<i>Asparagus racemosus</i>	<i>Plumbago zeylanica</i>	<i>Punica granatum</i>
<i>Chlorophytum arundinaceum</i>	<i>Bacopa monnieri</i>	<i>Mucuna pruriens</i>
<i>Oroxylum indicum</i>	<i>Pterocarpus santalinus</i>	<i>Acorus calamus</i>
<i>Hemidesmus indicus</i>	<i>Chlorophytum tuberosum</i>	<i>Madhuca indica</i>
<i>Wrightia tinctoria</i>	<i>Cymbopogon flexuosus</i>	<i>Cassia senna</i>

Working Session 2: Guiding Strategy for Supply side Issues

Medicinal plants and their collection are estimated to create 35 million person-days of employment. 90% of the medicinal plant material used is still collected from the wild, and 70% of this is destructively harvested, rendering the wildharvested species, threatened. The cultivation of medicinal herbs under natural conditions poses several problems at the beginning. There are few high value, native medicinal species with reliable and mainstreamed agro-techniques, and most plant material traded is of non-uniform quality. Non-availability of planting materials, lack of appropriate cultivation practices, uncertainty in trade and lack of sufficient land under cultivation are major concerns. The legal requirements also confuse the growers. Furthermore, Indian farmers cannot afford to cultivate species with long rotation period without any returns. MAPs need observation starting from their habitat, distribution, and adaptability to different micro-climatic conditions and morphological variability, before cultivation, and information on these aspects is still incomplete.

The Supply Side of the Herbal Sector in India was examined in this session, through zone-specific group discussions. The outputs of the session were:

- Identification of the key constraints, bottlenecks, and obstacles, that affect the supply side of the herbal sector
- Crystallization of the potential interventions and policy actions for streamlining and improving the supply side.

The Framework for Discussions

The second working session of the consultative workshop was focused on examining the supply side issues and needs and deliberating on appropriate policy options for the same. Retaining the standard format for the consultative workshop, six parallel working groups, representing the six broad agro-climatic zones of the country, worked on the theme.

Major Bottlenecks on Supply Side: The first focal theme for the working session was the identification of the key issues and bottlenecks on the supply side in the herbal sector in the country. Both conservation and commercial considerations were examined.

Action Strategies for Supply Side: This was followed by a detailed deliberation on action requirements for addressing the issues and bottlenecks identified through the above discussions. The specific action types deliberated on included:

- Regulatory actions with respect to collection, harvesting, fair trade, and other aspects concerning supply of medicinal plant material for industry.
- Extension and grassroots work for widening the stakeholder and benefits base from the herbal sector.
- Education and promotional activities required for sustainable management of biodiversity as well as responsible trade.
- Research and technology development needed for addressing conservation aims and improving quality of plant material.
- Financial and infrastructural support required for developing the supply side of the herbal sector and ensuring sustainable use of biodiversity.

This led to the crystallization of policy recommendations for addressing the supply side issues with respect to medicinal plants species of the six different agro-ecological regions. The following outcomes were thus elicited:

- Action Strategies for Conservation
- Action Strategies for Cultivation

Supply Side Scenario: the Bottlenecks

The working groups pointed out the main constraints faced by the herbal sector on the supply side in that particular region. These have been compiled and summarized as follows:

Major Constraints

Conservation-related

- *Lack of information on species populations and harvesting limits*
- *Absence of appropriate regulatory mechanisms*

Cultivation-related

- *Lack of information on demand and supply of MAPs*
- *Lack of farmer driven agro-technologies*
- *Shortage of quality planting material*
- *Quality issues with respect to plant material*
- *Lack of control of toxicities*
- *Lack of post harvest treatment and high wastage*
- *Fluctuations in the MAP market*
- *Unfair transactions and lack of financial support*

Conservation-related

Lack of information on species populations and harvesting limits

Although sustainable harvesting is much talked of as a mode of conservation of the herbal resources in the wild, there are no clear harvesting limits prescribed for various MAPs, and neither are there any procedures laid down for ensuring an adherence to sustainable harvesting limits. Hence, the wildharvesting carried out continues to be destructive in nature, leading to an erosion of wild resources to levels beyond what is sustainable. There is also a lack of awareness regarding ecology and population dynamics of the MAPs and Good Collection Practices, resulting in habitat loss and disturbance of habitats due to unsustainable harvesting and other anthropogenic disturbances.

Absence of appropriate regulatory mechanisms

There is no proper regulatory mechanism or identified agencies at the state level for ensuring legalities in trade. The roles of SMPBs, forest departments and other authorities are vaguely defined. At the same time, the laws and regulations are confusing and the procedural aspects are often long and cumbersome for small farmers and traders. The sector is still by and large unorganized and no uniform policy exists for it. Further, the certification process, rules regarding transit permits, etc., vary from state to state. Existing legal guidelines are however, adhered to only rarely.

Cultivation-related

Lack of information on demand and supply of MAPs

Lack of information is a constraint for all participants in the herbal trade channel. Farmers lack information on demand for different species, and quality and time considerations. They do not possess or have access to even tentative estimates of the quantity to be produced

from an area over a specific period of time, and this deters them from taking up commercial cultivation of medicinal and aromatic plants. In the trade, there is a lack of information on the quantity available and the sources or points of origin. This is exacerbated by the lack of proper linkages between the growers/collectors and the buyers/end users in the medicinal plant sector. The locations of regional or national markets for different plant materials are often not known to the farmers.

Lack of farmer-driven agro-technologies

Not many farmers are involved in medicinal plants cultivation in India. Unfortunately, since medicinal plants have been wildharvested since perpetuity, there has been neither any grassroots farmer-based agr-technique development, nor any concerted efforts by the scientific community to develop cultivation protocols for MAP species. Today, standard cultivation technologies are available only for a few medicinal plant species, and these are also by and large academic in nature, in that they have not been adapted/localised to the regional varieties and agro-climatic conditions. There is a huge gap in the lab-to-land process and a dearth of compilation of the effective research outcomes. Existing protocols for these species, if any, are also not known to most farmers.

Shortage of quality planting material

There is an enormous shortage of certified quality planting material for large-scale cultivation of medicinal herbs that would help supply the escalating demand while also reducing dependence on the wild populations. Even where farmers are desirous of undertaking cultivation of medicinal species, they do not have access to nursery-raised saplings of good health and uniform quality. Illegal collection, destructive harvesting and habitat degradation are likely to continue till this shortage is overcome.

Quality issues with respect to plant material

The farmers do not follow the standard cultivation methods prescribed for medicinal plants. They are unaware of the WHO prescribed Good Agricultural Practices, which are not available in published form in local languages. This results in varying quality of the produce and hence the differences in the price obtained, which in turn de-motivates the farmers. The quality of the produce also varies due to flaws in post-harvest storage and handling. Further, there are no standards available at present for authentication of plant material, distinguishing it from adulterants, and no standard procedure is followed for anatomical or histo-chemical examination in order to identify genuine plant materials from adulterants.

Lack of control of toxicities

Controlling microbial and heavy metal content in the raw material is another issue in MAP cultivation. Given cultivation methods in use, in which the same farm plot is used for multiple plots and different crops are cultivated on small, adjoining plots, there are chances of heavy metals and fertilizer residues being absorbed by the medicinal plant under cultivation. The presence of these substances in the plant material renders it unsuitable for use in drug preparation.

Lack of post-harvest treatment and high wastage

The post-harvest management standards for medicinal plants are not defined and shelf life of medicinal plants is not given due attention. The poor handling of plant material, lack of local storage facilities and insufficient capacity and provisions for preliminary processing, result in loss and degradation of harvested plant materials. At the time of harvesting and during post harvest handling, packaging and transportation, much deterioration in quality takes place in the raw material and this brings down the price of the produce.

Fluctuations in the MAP market

The demand and supply trends for MAP species display enormous fluctuations across seasons and over years, as do the prices of the raw plant material. The farmers often produce material that they are either unable to sell or have to suffer unexpectedly low returns on. On the other hand, this also leads to unfair trade practices, such as of hoarding of produce. The uncertainty of market price and demand, along with the lack of storage facilities, hoarding practices, and un-organized markets and channels, has a negative effect on the herbal sector.

Unfair transactions and lack of financial support

The farmer undertaking to cultivate medicinal plants has to do this at considerable risk, of cultivating a species with not quite established agro-techniques, and with uncertain demand and price pattern, and unorganized and unregulated markets. Further, most medicinal plant species have a very long gestation period, delivering harvests often only after three years. Yet, there are very few incentives to take this risk of cultivating medicinal plants, with very little available and accessible financial support and credit facilities. The generated revenues from the sale of medicinal plants material is also not distributed fairly along the trade channel, and very little of the benefit reach the farmers, much of it being absorbed higher up the chain.

Action Options for Conservation

Following the above identification of key issues and bottlenecks that the supply side of the herbal sector is beset by, the working groups deliberated on and formulated the following action options for addressing the conservation-related issues:

Guidelines for Conservation

Policies & guidelines and focussed research

- *Frame a National Policy for conservation of MAPs*
- *Inventory MAPs and determine species-specific strategies*
- *Research on ecology and conservation*

In-situ conservation

- *Promote community protection of species and habitats*
- *Create network of protected sites of MAP concentration*
- *Institute sustainable harvesting and GCP (Good Collection Practices)*

Ex-situ conservation

- *Conserve and manage MAP germplasm*
- *Establish a network of herbal gardens*

Policies & Guidelines and Focussed Research

Frame a national policy for conservation of MAPs

While conservation of flora and fauna in general do have conservation policies, there is no specific policy directed at medicinal and aromatic plants. Given the higher levels of threat because of their trade value and the nature of their distribution and growth in the wild, there

is an urgent and critical need for framing a national level policy for the conservation of medicinal and aromatic plants.

Protection and limits for medicinal plants: The policy should delineate and protect areas of medicinal plants concentration in the wild, and lay down limits for wild extraction for endangered species and procedures for determining and managing these.

Management and regulatory structure: The policy should also bring in a well-coordinated management structure for transparency and smooth functioning of the sector. Distinguished grassroots agencies, and/or village level authorities i.e., local *Panchayats*, should be responsible for issuing permits with respect to cultivation and collection, and the regulatory controls must lie in the hand of the Medicinal Plant Board. Forest management units should be created and certified for sustainable forest management.

Determine species-specific strategies

Population and distribution assessment of species: Conservation needs to begin with comprehensive quantitative inventorying and mapping of the distribution of species, especially those in high demand. Red list species should be given priority along with other considerations. Research institutes should take up this mission with assistance from the local communities.

Collection/wildharvesting limits: Collection/wildharvesting limits should be determined based on such population and distribution assessment. Until a detailed quantitative inventory is prepared and a sustainable harvesting limit is prescribed, over utilization and illegal trade would continue. A regular (e.g. every 5 year) update or review of the population and distribution of red listed species will ensure that collection and trade strategies are attuned to species availability assessment, since the threat status would keep changing with time.

Species-specific conservation: At the same time time, such an assessment has to be the framework for designing species-specific conservation methods. These strategies must ensure adequate consideration of parameters such as species usage, habitat, associated species, phonological characteristics, agro-climatic suitability, eco-floristic region, ethno-botanic importance of the species, etc.

Research on ecology and conservation

Research institutions need to be encouraged for furthering the cause of conservation of endangered species of medicinal plants. Ecosystem specific species interaction and phyto-sociological association studies are to be taken up for essential wider scientific understanding. Habitat protection approaches should be examined for in-group conservation of species existing in association. The central and state government institutions along with the NGOs can play a very important role in research and conservation.

In-situ conservation

Promote community protection of species and habitats

'Sacred Groves' and other good conservation practices arising out of religious beliefs and traditions are common all over the country. When aware of the importance of the species and habitats, and imbuing them with special significance, the community plays an effective stewardship role and is successful in conserving them by imposing some kind of social barrier/sanctions and protecting the sites.

Community awareness: Hence, efforts should be made to educate the local communities in areas of MAP concentration, raise awareness about these species, their usage, risk status and

conservation requirements among the local inhabitants, and generate their involvement towards conservation of the targeted MAP species.

Community protection: Extension work with communities can focus on reviving their sense of stewardship over their resources and setting and monitoring extraction and usage, based on changes in availability/regeneration of species.

Create network of protected sites of MAP concentration

Conserving the plants *in situ* is a major concern, as the plants conserved thereby will retain their genetic characteristics and evolutionary pattern.

Medicinal plants conservation areas: *In situ* conservation would require identifying 'medicinal plants hotspots'. Since medicinal plants tend to occur in small, concentrated patches, they are often overlooked in broader conservation/protection strategies. Hence, areas of concentration of medicinal plants which also have maximum diversity of MAPs should be identified in all agro-climatic zones of the country, and taken up for protection as “*Aushadhiya Van*”, or as PSRAs (Permanent Seed Resource Areas). A network of many such areas of concentration/conservation will ensure genetic protection.

Community management of in-situ sites: Efficient management and regular monitoring of these selected conservation sites should be ensured with community support.

Institute sustainable harvesting and Good Collection Practices

Development, extension and capacity building for sustainable and non-destructive collection practices are necessary. Extensive training and literature development in local languages would be helpful in this regard. Authentic Collection Centers with basic infrastructure, like the ‘*Mandi*’ system in Uttarakhand, should be established to set up a formal, certified collection channel. Developing safe harvesting regimes along with permanent protection cum productivity plots in in-situ conditions could be a key to solving the problem.

Ex-situ conservation

Conserve and manage MAP germplasm

Ex situ conservation methods for conserving medicinal and aromatic plants would include a variety of techniques to ensure the conservation and management of the germplasm of MAP species, at field level and in research laboratories.

Field gene banks: The state should promote the establishment of field gene banks by rural communities and/or NGOs for growing medicinal plants in areas that are best suited for them from the point of ensuring the in-field preservation of the species. Developing seed gene banks at community levels would also further this aim.

Cryo-preservation: Select research laboratories need to be supported to maintain dedicated cryo-preservation units for various strains of medicinal plant species, with a special thrust on endangered species.

Establish a network of herbal gardens

Regional herbal gardens: There should be a network of herbal gardens set up covering all agro-climatic zones. These regional herbal gardens would ensure in-field preservation of all

medicinal species that are native to the particular zone. Research institutions and NGOs could be facilitated to establish and maintain them.

School herbal plots: Establishing School Herbal Gardens or “*Vidyarthi Vatika*”, would help in spreading awareness among the students from an early age, along with serving the purpose of ex-situ conservation of the species.

Action Options for Cultivation

The working groups also discussed action strategies for cultivation to address the major bottlenecks. These suggestions again, can be applicable to the country as a whole. The suggested action options for cultivation are as follows:

Strategies for Promoting Cultivation:

- Policies & guidelines and focussed research*
 - *Frame National Policy on MAP development*
 - *Research for agro-technique development*
 - *Create information database and systems*
- Cultivation support*
 - *Create channels for quality planting material*
 - *Promote Good Agricultural Practices*
 - *Finance the farmers for cultivation uptake*
- Fair trade*
 - *Establish forward and backward linkages for MAP trade*
 - *Develop growers' combines*
 - *Institute Buy-back Guarantee Assurance*

Policies & guidelines and focussed research

Frame National Policy on MAP development

The lack of a clear and specific national level policy for Cultivation of Medicinal and aromatic plants (MAPs) needs to be corrected in order to give the sector a boost.

Support for cultivation: A package of support needs to be developed for various levels and stakeholder groups of the herbal sector, based on the needs at each stage. At the growers' end, the farmers involved in medicinal plants cultivation should be registered through State Medicinal Plants Boards (and such boards should be established in states where they are not present), and these growers provided with technical and financial support for cultivation.

Species prioritisation: In order to streamline the production of medicinal plant material with the demand quantities, it is necessary to prioritise medicinal plant species by agro-climatic zones, and determine target volumes for each.

Regulation and development: Uniform regulations and specific designated agencies should be established, that facilitate the growers' interests as well as those of the sector as a whole. Policy directives should also be developed for market development actions, including formalisation the currently unorganised internal markets, and developing the supply base to meet the emerging regulatory regime of export markets.

Research for agro-technique development

Support for agro-technique development and germplasm management: Agricultural Universities and environment-focussed NGOs should be provided adequate financial support for research into cultivation of medicinal plants and extension of the technical know-how available/created. Quality research labs and germplasm banks have to be in place in each state in which there are prospect for medicinal plants cultivation.

Adaptive and participatory research approaches: It is essential to identify knowledge gaps and conduct adaptive research based on field experiences. Farmer expert groups may be created and leveraged for developing suitable propagation methods for medicinal plants through seeds and vegetative parts, pest management packages, and area-specific best practices for cultivation of MAPs.

Agro-technique dissemination: There has to be a thrust on ensuring that research outputs are transferred from lab to land. Technical know-how should be made available to farmers at the site. Detailed technical information should be published in simple booklet form for the farmers to understand.

Create information database and systems

Lack of information regarding market prices and market avenues, is a serious constraint for the farmers in taking up the commercial cultivation of medicinal and aromatic plants. Hence, the market price of different MAPs at regional and national markets should be highlighted in daily or weekly local newspapers or periodicals to reach the local farmers along with the developed cultivation protocols.

Cultivation support

Create channels for quality planting material

Paucity of quality planting material hampers the large-scale cultivation of medicinal and aromatic plants and is also a barrier to producing quality raw material for the herbal sector.

Nurseries and herbal gardens: A large network of nurseries and herbal gardens is needed to produce and supply large numbers of quality and disease-free saplings of particular MAP species, determined by specific species demand levels.

Field seed banks: Farmer combines can also be facilitated to manage field programmes for germplasm management along with maintenance of seed banks and MAP propagation. Field seed banks can be set up and exchange programmes can also be facilitated within farmer combines to ensure self-help among MAP growers at the local level.

Promote cultivation of MAPs

Cultivation training and technical support: Potential growers in rural areas must be provided training and information on the prospects and methods of cultivating medicinal plants. Quality NGOs could provide training to farmers in an area to help them take up cultivation of the area-specific, commercially viable MAP species based on their utility and market value, habitat and agro-climatic conditions. Herbal gardens set up by NGOs and research institutions could serve demonstration and educative purposes as well.

MAP Clinics: Continuing technical support also should be provided in plantation planning, ensuring adequate incomes each year, and plantation management from seed sowing to harvesting. MAP Clinics could be set up at a block/district level in order to provide sound

advice/suggestion to the farmers with regard to MAP cultivation, including inputs on organic cultivation, integrated pest management, etc.

Plantations, small and big: Various sizes and scales of plantations may be supported amongst potential growers. These could include large-scale plantations of several hectares, mixed farming with other food/cash crops, and 'home herbal gardens' or 'kitchen gardens', the last being especially suitable for medicinal plants that have smaller and primarily local markets and domestic use prospects. Government lands could be provided on lease to farmers for cultivating the priority species.

Promote Good Agricultural Practices

GAP dissemination: MAP farmers should be trained on the WHO guidelines for Good Agricultural Practices and the Standard Operating Procedures (SOPs) for the herbal sector. Quality standards and quality control parameters should be publicised through simple publications in local languages, broadcasts through radio or other media and websites as well as on-field training to the farmers.

Organic farming: There is also a need for the farmers to understand the norms and benefits of organic farming and its importance in relation to the quality needs of the industry, especially the international markets. Training and education of farmers should be provided alongside financial benefits for the practice of organic farming.

Toxicity testing: The permissible limits of various toxic elements in the soil should also be clearly defined and disseminated to farmers. Additionally, on-site quick tests for detecting levels of heavy metal, and other toxicities, should be promoted. The MAP Clinics could also provide this service to MAP growers.

Finance the farmers for cultivation uptake

The price fluctuations, long gestation period for MAP crops, unorganized markets, and the normal vagaries of climate, affect the growers of medicinal plants in India. A farmer will therefore require certain incentives and support to be motivated to undertake cultivation of MAPs.

Assistance and credit facility: Farmers who are determined to be technically sound/trained can be identified for financial assistance. While the first-time growers should be supported through financial assistance to the extent of 50% subsidy, those who wish to expand their MAP farms should be enabled through the provision of credit facilities.

Crop insurance: Since medicinal plants have a long gestation period, the risks for a farmer are higher than for other shorter-duration crops. Hence, the introduction of crop insurance, along with market intelligence support, would be beneficial for growers.

Fair trade

Establish forward and backward linkages for MAP trade

Farmers are often not aware of existing market links in the herbal trade sector, and this deters them from taking up MAP cultivation. One of the major tasks in the appropriate development of the herbal sector therefore, is that of developing forward and backward linkages and facilitating the channel from farmer to end-users in the herbal industry. This would ensure reduced control of middlemen, favourable income to the farmers, and requisite regular flow of quality produce to the industry.

Develop growers' combines

Cluster farming: Most large buyers that can provide an assurance of regular purchase are interested to procure quality raw material in bulk. For farmers with small and marginal landholdings however, it is difficult to produce raw material in such large quantities. Such farmers then would be deprived of the opportunity of benefitting from the burgeoning herbal sector. Cluster farming should be promoted for such farmers, while also providing the clusters with direct linkages to potential buyers.

Herb growers' cooperatives and women's SHGs: The formation of growers' cooperatives can serve to address the above issue of bulk sales by collecting members' produce and undertaking the sale for them; cooperatives would also provide strength to the farmers and thus ensure them a fair share in the revenues from medicinal plant trade. Hence, cooperatives must be promoted in all districts in which the number of growers crosses a certain minimum number.

Apart from providing greater economic strength and higher bargaining power, cooperatives could also undertake post-harvest activities and thus gain more economic benefits. Finally, cooperatives would also help in taking advantage of existing government schemes. Women's Self Help Groups may also be promoted for MAP cultivation, and aromatics processing.

Institute Buy-back Guarantee Assurance

Farmer hesitation to take up commercial cultivation of medicinal plants is due to the lack of well established market linkages and the long gestation period. At this nascent stage of the sector and especially to facilitate the switch from wild collection to cultivation, an assurance of sale of produce would greatly promote cultivation. Farmer combines should be supported with the provision of Buy-back Guarantees for cultivating the priority species of medicinal and aromatic plants.

Other suggested action options included provision of quality testing labs at district level, proper training of the traders, proper labeling and packaging etc.

SESSIONS SUMMARY: DAY 2



Medicinal plants have traditionally occupied an important position in the socio-cultural, spiritual and medicinal arena of rural and tribal lives of India. Not only do they provide access to affordable medicine to the rural poor and those deprived of formal channels of healthcare, they also generate income and employment through the herbal trade and industry, from collection to processing of the medicinal plant material. In recent years, trade in herbal products has taken a quantum leap, with the volume of plant material traded within and outside the country multiplying each year. The second day focussed on the Demand Side Issues in the herbal sector in India, as well as the R&D and facilitation needs. The day also included a semi-structured interactive session between all the different stakeholders in the herbal sector towards generating a better understanding within the sector.

Working Session 3: Guiding Strategy for Demand side Issues

Demand for herbal medicines has led to significant changes in traditional patterns of medicinal plants trade. The demand for medicinal plant material is increasing in both developing and developed countries, and the bulk of the material traded is still from wild harvested sources and only a very small number of species are cultivated. 500 of the 15,000 medicinal plants found in India are used heavily in the preparation of drugs. Much of the plant material however goes through very basic quality checks, if any, and standards either do not exist, or are not in use. Post harvesting, the plant material is stored poorly and 40% of the material is wasted due to spoilage during storage and transportation. Adulteration is a growing problem and is threatening to cloud the image of the traditional medicine sector, while also potentially affecting the future and the international market prospects.

The Demand Side of the Herbal Sector in India was examined in this session and the outputs of the session were:

- *identification of the key issues and blocks that distress the demand side of the herbal sector*
- *formulation of the potential interventions and policy actions for streamlining and improving the demand side.*

The Framework for Discussions

In the first working session on the second day of the workshop, the working groups deliberated on the multiple demand side issues that constrain the herbal sector and worked on determining actions and policy options to overcome these. The mode of the sessions was the same as that of earlier sessions that had focused on the supply side issues.

Major Bottlenecks on Demand Side: The working groups began with the identification of the key issues and blocks on the demand side in the herbal sector in the country.

Action Strategies for Demand Side: Following that above, a detailed deliberation was carried out on the action requirements for addressing the identified demand side issues. The specific action types deliberated on included:

- Regulatory aspects with respect to quality of plant material, transportation and fair trade.
- Technology and other services to address the storage, quality and processing needs of the sector.
- Linkages between channel partners and stakeholders for optimal and shared benefits and promotion of particular species.
- Research and technology development for improving quality, processing, and efficiencies of use of plant material.
- Financial and infrastructural support required for the demand side of the sector that could facilitate its effectiveness.

This led to the crystallization of policy recommendations for addressing the supply side issues with respect to medicinal plants species of the six different agro-ecological regions. The following outcomes were thus elicited:

- Action Strategies for Post-Harvest and QA Processes
- Action Strategies for Information & Regulation
- Action Strategies for Channel Development
- Action Strategies for Marketing & Promotion

Demand side Scenario - the Stumbling Blocks

The working expert groups identified the regional issues plaguing the demand side operations in the herbal sector. The issues can be summarized as follows:

Major Constraints:

- *Lack of demand and channel information*
- *Inadequate post harvest facilities*
- *Adulteration*
- *Lacunae in packaging & labeling*
- *Absence of quality standards and facilities*
- *Lack of administrative support*

Lack of demand and channel information

There is a high degree of ambiguity regarding the overall market demand for various species. Demand for MAPs is often erratic and quantity required of a species by industry varies rather widely as does the price. But there is no demand forecast at local/ regional or even at a larger level and no reliable methodologies exist for demand projections. The channel partners are similarly shrouded in ambiguity. There is no authentic directory of buyers and users with adequate contact details.

Inadequate post harvest facilities

The sector suffers from faulty processing and value addition as the farmers are not aware of the correct methods and nor do they have access to proper drying and storage facilities. Improper post-harvest processes and storage leads to excessive damage to and depreciation of the plant material, and high levels of wastage and resultant losses as well. At the same time, the plant material that enters the production process often has lower potency as a result of this poor post-harvest management which thus affects the efficacy of the final product that reaches the consumer.

Adulteration

Adulteration has been impacting the traditional medicine sector of late. Collection is today done by hired labour that is mostly untrained and hence unable to recognise the species to be harvested, and this is compounded by the reducing plant material available in the wild. Adulterants at their least damaging end, are resulting in reducing potency of medicines, but at their worst, they are also resulting in health damages.

Lacunae in packaging & labeling

Apart from improper post-harvest operations and storage, improper packaging is another cause of frequent damage and depreciation of the raw medicinal plant material. Further, the herbal trade sector currently follows the practice of grading of plant material based on its geographical origin. However, there is no proper system of labeling that would allow one to determine place of origin, and other required information such as species authentication, grade/quality specifications, etc. While this does create some issues in the domestic markets, in terms of improper assessment of plant material, it is likely to result in a serious drop in competitiveness in the international market in the future when traceability becomes an imperative.

Absence of quality standards and facilities

There is no standardized method for checking the quality of the herbal produce available to the stakeholders along the trade channel. There are no prescribed pharmacological and pharmacokinetics parameters and no norms for quality assessment which is currently primarily based on observation of the physical appearance of the raw material. There are also no testing laboratories available for the farmers to check the quality of their product before entering it in the supply chain. Lack of toxicological data and shelf life studies on different plant medicines add to the quality issues in this sector. The lacunae in quality processes is also likely to reduce the competitiveness of the sector in the international market, especially as a more stringent regulatory regime is set in place.

Lack of administrative support

The players in the sector are harassed by the complexity, lack of clarity and multiplicity of the regulatory and permit system, including the existing trade permit and transit permit system across state borders. Although the system of certification and registration of growers and traders does exist, the process is beset with administrative and procedural hurdles. There is little or no coordination between different government departments, and little administrative support to the stakeholders.

Action Options for Demand Management

The working groups devised specific action strategies for addressing the major issues in demand side, which are as follows:

Action Plan for Demand Side Issues:

Post-harvest and QA processes

- *Establish post harvest processing & storage facilities*
- *Provide quality testing facilities*
- *Promote Good Manufacturing Practices*

Information and regulation

- *Develop a herbal info channel*
- *Institute regulatory actions*
- *Institute quality certification*

Channel development

- *Establish market linkages*

Marketing and promotion

- *Develop markets and MAP products*

Post-harvest and QA processes

Establish post harvest processing & storage facilities

Integrated post-harvest techniques: Local knowledge and procedures prescribed in traditional medicine texts should be integrated with findings of scientific research for creating standardized post harvest techniques. These should be documented and promoted amongst growers and dealers of medicinal plants.

Training on post-harvest processes: Farmers should be trained on proper post harvest techniques

e.g. drying, storage conditions such as temperature & humidity, shelf-life, grading of the produce according to quality, pest control, value addition, proper packaging, etc., so that they are capable of maintaining/enhancing the quality of their produce. The growers should be provided inputs on appropriate methods of cultivation through harvesting and post-harvest technologies, so that the raw drug may possess optimum levels of active constituents.

Local processing and storage facilities: Primary processing units (for drying, storage, packaging) are required at the local level in order to minimize losses through wastage and damage, and to part-process in order to reduce the bulk of the raw material and thereby the transportation cost. Appropriate, low cost storage facilities should be created at *Panchayat*, Block or District level in order to ensure higher shelf-life and avoid distress sale.

Provide quality testing facilities

Advanced QA standards and techniques: Standard Quality assessment parameters and norms should be developed incorporating authentic Ayurveda texts as well as global scientific standards. Latest techniques like Molecular Marker technology, phyto-chemical analysis and DNA fingerprinting can be employed for quality assessment of the products.

Quality testing centres: Quality testing facilities should be set up at all medicinal plants procurement/collection centers, such as herbal '*Mandi*'s. District level testing laboratories should be set up and promoted among players in the herbal sector, viz, farmers and traders in the district.

Promote Good Manufacturing Practices

Dissemination of GMPs: As in the case of GAPs on the supply side, there is a need for a thrust on and promotion of Good Manufacturing Practices on the demand side of the herbal sector in India. Simple publications should be developed and distributed to all kinds and sizes of processors. A series of awareness sessions should also be conducted in different cities for a more active promotion of GMPs.

Facilitation for GMP: Beyond the above, consulting firms may be harnessed for facilitating the adoption of GMP (in the nature of ISO) among manufacturers.

Information and regulation

Develop a Herbal Info Channel

Information on demand and supply: A Herbal Info Channel should be created for different regions in regional languages and it should be accessible to all. It should include a national level database on demand and supply status of different species, and could be maintained by NMPB. A survey of demand and supply figures should be carried out at regular intervals and used to update the database. Additionally, rate lists of medicinal plants should be published in simple local languages and circulated on a regular basis.

Directory of channel partners: An authentic directory of buyers and sellers of medicinal plant material with contact details should be compiled for each region and at national level and widely circulated.

Institute regulatory actions

Role of MPB and other regulatory agencies: The NMPB needs to play a significant role with respect to streamlining procedural requirements and ensuring appropriate regulatory action

in the herbal sector. The SMPBs should take the initiative at the state level, the district union at the district level and the primary MFP society in coordination with the *Gram Sabha* at village level.

Transport permits and procedures: The issues regarding procedural requirements and transport permits across state borders, should be resolved and effective implementation should be ensured.

Regulations against illegal and irregular actions: Regulatory actions should be focused to wipe out unauthorized dealers. Misleading websites/literature should be strictly dealt with to avoid misguidance. Regulations should also be introduced that make it imperative for firms to follow GMPs.

Institute quality certification

Single-window certification: The certification procedure should be simplified and there should be a single certification agency at the regional level duly authorized by the SMPBs.

Comprehensive certification: Certification of both organic (in case of cultivated material) and sustainable extraction (in case of wild harvested material) should be made essential. The certification process should also comprise authentication of species in order to avoid adulterants.

Quality labelling and traceability: A system of quality labeling should also be developed, comprising grade (after quality testing), harvesting time, geographical origin and molecular testing report, and made compulsory. Traceability during transit should also be ensured in order to prevent adulteration during transit.

Channel development

Establish market linkages

Buyer-seller interactions: Improved market linkages and increased interactions and transparent transactions would increase efficiency in the entire chain. Regular buyers-sellers' meets should be carried out which would increase stakeholder understanding of demand and supply status of different herbs. Information dissemination through different media would also be useful for information sharing with the various stakeholders.

Herbal mandis: Every state should establish 'Herbal Mandis' in the pattern of commodity markets for easy trade of herbs and to ensure fair price and quality of produce.

Marketing and promotion

Develop markets and MAP products

Market awareness building: The benefits of the various medicinal herbs of India should be highlighted through the electronic and print media, both national and international. The state should facilitate participation in international events such as relevant fairs and exhibitions and work to promote an enhanced awareness and acceptance of Indian herbs and herbal products.

New sector development: Diversified use of MAPs should be promoted and linkages with allied sectors like cosmetics, food and beverages and the semi-processed products should be formed. Industry meets need to be held and information about the potential use of specific species in these industries should be disseminated.

Indian herbal brand: An Indian brand of herbal products may be launched by NMPB as an umbrella brand to sell the material of various Indian cooperatives/manufacturers. This could also include its franchisee sales outlets in select cities with the help of civil society organizations. Additionally, the brand could certify the produce/products and enable an entry to international markets.

International certification facilitation: Sale in international markets needs to be negotiated by NMPB, especially given the stringent regulatory regime that is emerging. Additionally, the certification fees charged by international bodies like (SGS, Eco Cert, SKALL, Indo Cert) being very high should be borne/subsidised by appropriate govt. agencies.

Working Session 4: Guiding Strategy for R&D Requirements



Drug discovery and ethnobotany have long been fundamental to medicinal plant research. With new advancements, concern over bio-piracy and the need for conservation of both species and habitat have been growing increasingly. Development of medicinal plant sector in the country is suffering from inadequate research on various critical aspects. The research outcomes need to be consolidated, the gaps are to be identified and new initiatives to be taken to address the research requirements.

The R&D Requirements of the Herbal Sector in India was examined in this session and the outputs of the session were:

- *Identification of the key needs on both the supply and the demand side of the herbal sector that call for R&D interventions.*

The Framework for Discussions

In the second working session on the second day of the workshop, the working groups deliberated on the issues that call for R&D interventions and the nature of interventions required.

Major R&D Intervention Needs: The working groups began with the identification of the key issues on the supply and demand side in the herbal sector in the country that call for R&D interventions. The specific aspects deliberated on included:

- Agrotechniques and micropropagation, especially for addressing RET species, and developing cultivation as a viable alternative to wildharvesting.
- Post-harvest processes and technologies for ensuring efficiency of use of plant material and improved quality of products.
- Value addition and packaging towards appropriate benefit-sharing, and improved quality and storage.
- Quality standards and processes for as standard operating procedures in the herbal sector.
- Market information for formalising the sector operations and enabling faster, equitable and sustainable growth.

This led to the crystallization of the major R&D needs. The following outcomes were thus elicited:

- R&D Requirements for the Supply Side, from conservation to cultivation of plant material.
- R&D Requirements for the Demand Side, from post-harvest processing and storage to value addition and production of the final products.

Action Options for R&D Requirements

The session sought to derive action options for R&D requirements through focussed discussions in multiple working groups. The recommendations can be summarized as follows:

R&D Requirements for Supply side

Financial support and distributed research: Financial support should be given to promote Research and Development on MAPs. R&D institutions and NGOs with a research agenda should be selected and the research requirements allocated to them with the financial support required for the same.

Biodiversity management: A National Commission for MAPs should be set up with links to National Biodiversity Authority such that wildharvesting and MAP development have a close and continual linkage. Proper documentation and inventorization of MAP resource base should be carried out. Available studies should be collated and the gaps should be filled through commissioned studies by various appropriate institutions; the database thus created needs to be periodically updated for documenting changes. Sustainable Harvesting Regimes have to be established on the basis of this for naturally growing MAPs.

Active ingredient research: Use of transgenic technology should be encouraged for increasing adaptability and active ingredients of MAPs. Research on alternative species/species having similar active principles should be carried out to reduce pressure on rare, endangered and threatened species.

Propagation research: Research needs to be carried out by suitable laboratories in conjunction with farmer expert groups on cost effective propagation methods for medicinal plants. Micro-propagation protocols should be developed for rare and endangered species for which conventional methods are not effective.

Germplasm management: Permanent Protection cum Production Plots (P4) need to be established according to the agro-climatic conditions for conservation and species-specific research. Community level seed banks should be established to ensure that the local germplasm remains protected. Seed Production Areas should be developed at appropriate places.

Agro-technique development: R&D institution and NGO combines should be given the task of establishing agro-techniques for various species for uptake by farmers. they should also be charged with the task of documentation, sharing and dissemination of these agro-techniques. Agro-technique development needs to include the development of proven and effective bio-pesticides and bio-fertilizers as well, given the critical need for organic farming methods in MAP cultivation. Mixed cropping combinations for medicinal plants with agricultural crops should be worked out to reduce associated economic risk.

R&D Requirements for Demand side

Market-driven research: Emphasis should be given on Research and Development in keeping with the requirements of industry and in order to help it meet market needs and international regulations.

Quality processes: Quality parameters need to be identified for thorough testing and norms and processes developed for certification of plant material as well as finished herbal products. For this purpose, a proper assessment process at morphological as well as molecular level needs to be developed. Possible on-field testing of plant material and self-certification needs to be explored. Infrastructure needs to be developed at the *Panchayat* or Block level for post harvest processing and soil testing facilities.

Low cost processing: Low cost equipment for post harvest processing and feasible technology for value addition need to be developed. This will enable timely processing, lower wastage, and increased returns.

Potency enhancement: Biological screening for optimization of active principles should be carried out and its findings brought into practice. Standardization of post harvest storage conditions for minimizing the loss of active ingredients is also required.

Good practices: Good Practices should be developed and standardized regarding quality of planting material, sowing/planting date, use of bio-pesticides and bio-fertilizers, harvesting time, as well as post-harvest processing, manufacturing, etc.

The Central Himalayan Working Group even prioritized some of the species particularly for R&D requirements. These are *Achyranthes aspera* (Apamarg), *Vernonia cinerea* (Sahdevi), *Curculigo orchioides* (Kalimusli), *Hemidesmus indicus* (Anantamool) and *Solanum nigrum* (Maco).

Working Session 5: Perspectives~ from the grassroots and from policy-shapers

This session provided an opportunity for interaction with the grassroots and among policy-shapers. The scientists, industrialists, decision makers and development organizations working in the herbal sector shared a common platform with the medicinal plant cultivators, grassroots traditional healers and members of growers' cooperatives from remote villages, for examining the issues at grassroots level, finding solutions and understanding the sector from a different point of view.

Interaction with Himalayan community

This session provided an open platform for the community members from remote villages of high altitude Himalayas to share their experiences, difficulties and needs with stakeholders of the whole sector from various parts of the country. Pragma provided an opportunity for the people related to medicinal and aromatic plants cultivation, marketing and traditional healing from all across the Himalayas to be a part of the policy recommendation initiative with their valuable inputs.

Thrust on Cultivation for Conservation and Livelihood Strategy

The Himalayas has been recognized as one of 32 “biodiversity hotspots” of the world. Its medicinal plants are an integral part of its celebrated biodiversity, much of it endemic in nature and unfortunately endangered. Several of the Himalayan medicinal plants have a high value and a high demand in the herbal trade sector; whatever part of this demand is met, is unfortunately sourced through large-scale removal of the plants from the wild, leading to critical levels of depletion of the species and resulting endangerment.

Large-scale cultivation of Himalayan medicinal plants is the strategy that would help meet the industry demand while offering an alternative to wild collection and thus conservation of the species in the wild. The endemic nature of several Himalayan medicinal species implies a competitive advantage for Himalayan farmers and indicates the potential for economic development of the region. There is a strong need for a concerted effort by governmental and non-governmental agencies to catalyse cultivation of the particularly at-risk medicinal species by Himalayan farmers. A complete package of support needs to be proffered by these agencies to enable and facilitate the Himalayan farmers for medplants cultivation.

Enhance Awareness of prospects of MAP Cultivation

The enormous prospects of medicinal plants cultivation, and the competitive advantage that Himalayan farmers, needs to be widely disseminated in the Himalayan region. Unless the volume of material being cultivated and traded is significant, this avenue cannot be maximized on for the Himalayan people.

As a strategy for creating awareness on the production potential of medicinal plants, local authorities especially at the Block HQ level, could be tapped for disseminating information. Even local events like fairs and festivals that draw significant amount of crowd could be tapped for information dissemination. Such initiatives would help spread the message to a larger audience. Care should be taken to ensure that such materials for dissemination are developed in the local language for effective communication, which is the *Bhoti* script in most of the places along with Hindi.

Enhance Awareness of & Access to NMPB and SMPB Support

Since Himalayan farmers are typically small farmers, they are often hesitant in taking to new cash crops. Most of the high-value medicinal species have a long gestation period of upto three years. At least for the first-time therefore Himalayan farmers require financial support as a risk cover and also to compensate them for the opportunity cost of blocking their land for the long gestation period required by medicinal plants.

The financial support provided by NMPB and SMPB would be invaluable in this regard, and facilitate the Himalayan farmers to undertake cultivation and sustain the gestation period. However, most of the farmers of the high altitude Himalayan regions are barely aware of the NMPB, the SMPBs in their respective State headquarters and the activities carried out by these agencies. Except for some progressive farmers from Leh and Lahaul farmers, the Himalayan farmers were not aware of the various schemes, nor their eligibility criteria and application procedures. It is essential therefore that an awareness blitzkrieg is carried out to inform the Himalayan people of available schemes of support from the NMPB and SMPBs and modes for accessing these.

Provide Planting Material to Cultivators

Success of farm-based livelihoods is dependent on the timely availability of appropriate and adequate planting material. This, unfortunately however, is the biggest bottleneck with the cultivation of medicinal plants. Nurseries are few and far apart and saplings produced by these are typically highly priced, logistics and transportation, further adding costs. Unable to get planting material, Himalayan farmers lose the motivation to undertake medicinal plants cultivation.

There is an urgent need for support of propagation of medicinal plants. Nurseries are required in every administrative block in the Himalayan region and these should be supported to produce and distribute saplings free of cost to farmers desirous of cultivating medicinal plants. NGOs and farmers or women's groups can be supported to establish and operate nurseries.

Wasteland Development & Cluster Farming

As mentioned earlier, Himalayan farmers typically have very small landholdings from which they eke out their subsistence as well as some cash crops. There is an opportunity available in the large tracts of wastelands available in the hills, which could well be rehabilitated with and for medicinal plants plantations. The additional benefit of this approach is that it would simultaneously address desertification by greening of wastelands.

The native species of medicinal plants are acclimatized to local conditions and hence would be established relatively easily on wastelands. However, some support for wasteland reclamation is required. Most wastelands essentially suffer from a lack of irrigation potential. Higher cost measures, such as lift-irrigation technologies, might be called for, which would however require some degree of support. Since these wastelands are usually at some distance from the villages and more vulnerable to grazing, support for fencing activities is also called for. Further, farmer associations can be supported to carry out cluster farming.

Priority Species, Species-Habitat Match

There is a wide variety of habitats within the Himalayan region, and each medicinal species also has certain most conducive habitats for growth. Certain highly traded species, including many of the Himalayan species, do not currently figure in the list of priority species drawn up by the NMPB.

Some more species of both ecological and economical significance like *Saussurea costus*, *Inula racemosa*, *Dactylorhiza hatagirea*, *Carum carvi* and *Podophyllum hexandrum* to name a few, could be included in the NMPB priority species list, to ensure the crop diversity in the long run. At the same time, it is necessary to determine the species most appropriate for each agro-climatic zone within the Himalayan region, as well, and disseminate this widely. Species-wise targets must be set for cultivation of medicinal plants, ensuring that the targeted acreage under cultivation of a particular species is aligned with the market demand for the species.

Insurance for Himalayan Uncertainties

Uncertainty is the most certain thing in the Himalayan region. Flash floods, landslides, and crop-damage through anthropogenic factors and wild animals can happen anytime during the life-cycle of a plant in a plantation, and the frequency of such damage is on the rise. In the case of the 3-year gestation medicinal plants, the risk of a farmer not being able to earn from his crop because of pre-harvest damage, is far higher, and a deterrant for undertaking cultivation of the species.

There is a need to devise strategies to offset such risks for farmers. Crop insurance facilities can be worked out for the farmers in the Himalayan farmers, with the appropriate and relevant agencies. A pilot scheme could be initiated by the government for a few crops in some locations. The scheme could then be finetuned based on the pilot experience and upscale to be applied for all medicinal crops and its geographical spread enhanced.

Facilitation Centres

On an average, it takes 2 days for an interested farmer from the high altitude Himalayas to reach the concerned SMPB office mostly located in the state capital. The commutation time and the cost involved, does not allow interaction between the Himalayan farmers and the SMPBs or the usage of the SMPB services/schemes by the Himalayan farmers.

To address the remote Himalayan villages, the service centres too need to be dispersed and made available at a much lower administrative level. Local facilitation centres should be established at a strategic location in each district or even block for availability of information and easier access to governmental support for medicinal plants. Some of the recommended sites for the proposed NMPB Facilitation Centres are: Keylong in H.P., Leh in J& K, Tawang in A.P., Joshimath in Uttaranchal. Linkages could be established with local government departments to operate these facilitation centres or they could be anchored with reputed NGOs in the area.

Change of acreage norms in government support

The Himalayan region differs from plains areas in India in several ways. Unfortunately however, most government support schemes, have the same set of norms, typically developed with the plains areas in view, for all parts of India. The Himalayan region as a result, is rarely able to benefit from these schemes. NMPB support for instance, is provided to what would be a significantly large plantation in the hills where, given the undulating and rugged terrain, per farmer holdings of arable land is typically very small.

For the Himalayan region, the minimum plantation size stipulated in the NMPB support scheme, should be reduced from 2 ha of land, in order to enable more and more farmers to benefit from the scheme and undertake cultivation of medicinal plants. Though, group farming and collective trade could be a way out for the interested farmers of this region, that tends to place an additional burden of meeting the challenges of functioning as a group on the poor farmers. It is the responsibility of the government to adapt the scheme to the specific conditions of different regions, especially a region such as the Himalayas that can

contribute immensely to the herbal trade sector, and also stands to lose significantly in terms of biodiversity in case it does not take to cultivation of medicinal plants.

Relax procedural criteria for Himalayas

The Himalayan region where the most valuable of medicinal plants may be cultivated is very far from the markets where they are used and where the buyers linger. This is a great disadvantage for the growers of medicinal plants, in connecting with potential buyers, and building the level of trust required for buy-back relationships.

A signed buyer-seller MoU, at the time of filing the application for grant of subsidy, is difficult for Himalayan farmers. At this time, without the crop being visible, buyers are wary and the rates indeterminable. Most of the markets in the northern region are located at the foothills or the plains, and the buyers expect the sellers to bring their produce to the markets. Moreover, the Himalayan region does not have a history of medicinal and aromatic plants cultivation, and hence the buyers are unwilling to rest their trust on verbal assurances. While, in time, this trust might be won and meeting the NMPB requirement might become easier, it must be noted that the assistance is most required at the initial period itself.

Enhance the financial support package

The initial investment for plantation establishment, in terms of land preparation and creation of irrigation infrastructure, is comparatively higher for Himalayan farmers, given the undulating, rugged terrain. The distance from the markets and the lack of information flow to the Himalayan region, add to the barriers. Although a few NGOs like *Pragya* do provide support, creation of economies of scale would call for greater government support.

The subsidy-structure for Himalayan farmers for medicinal plants cultivation could be devised considering the special and higher needs of these regions. The financial support package provided to Himalayan medplants farmers should be a degree higher than that for farmers in the plains; institutional-level support both from public and the private sector is not an uncommon feature for the latter, but in the mountainous region, such support is almost non-existent.

R&D for Cultivation Protocols & Local-level Technical Support

Many of the high-value, high-demand medicinal species are undomesticated and the techniques for cultivation of these species are not known. Even where the cultivation protocols may have been formulated, the species are still affected by problems regarding technologies-in-use, chemical pesticides and fertilizers barred from use in cultivation of because of their special requirements, frequent problems of plant growth and pathology. The Himalayas are distant from R&D centres and technical supports as well.

It is important to include the development and dissemination of cultivation protocols for medicinal plants in the mandate of relevant R&D institutions in the country. The high-value, high-demand species, which are also typically, the threatened species, should be focused on as a priority. At the same time, it is important to provide technical support to farmers in the Himalayan areas. Select NGOs should be facilitated to provide this service in every Himalayan district/block. Agri-clinics could also be supported that supply the technical advice as well as required agricultural inputs to farmers.

Comprehensive training for Farmers

The lack of knowledge among farmers of the various processes specific to this sector, from cultivation to processing, e.g. lack of awareness regarding appropriate time of seed collection, insect and pest management also inhibits the uptake and successful establishment

of cultivation of medicinal plants. Apart from these, they often lose revenues because of improper harvesting or suffer high wastage due to improper storage.

Frequent training of farmers is necessary in cultivation techniques, and in plantation management and yield extraction for enhanced incomes. Farmers should also be provided training in proper harvesting techniques and storage, as well as appropriate packaging, for highest revenues and reduced wastage. Good practices in agriculture, harvesting, storage and processing, should be disseminated and commitment built as well, through these trainings. The SMPBs should provide such training from time to time. NGOs with expertise in the medicinal plants sector and working in the area should also be facilitated to provide continual training and support to farmers in their respective areas.

Farmer Expert Groups for Training & Mentoring

The high altitude Himalayas is characterized by scattered and remote villages, which makes the reach of any service difficult and intermittent; telecommunication is either unavailable or frequently disrupted and hence, not dependable for remote delivery of services. Hence, Himalayan farmers are not able to access advisory services provided by facilitation centres, agri-clinics and/or NGOs, at all times. This leads to crop failures, de-motivation etc.

In order to ensure timely assistance to medicinal plants farmers, Farmer Expert Groups should be set up in each district and these should comprise one/more expert farmers from each cluster of villages in the district. These expert farmers must be developed as grassroots trainers and every farmer expert must be facilitated to provide regular mentoring for medicinal plants cultivation to other farmers in his/her village cluster. The Group would undertake grassroots research and development with respect to medicinal plants. This would help develop capacity within local areas and potential for sustainable management.

Establish Medicinal Plants Growers' Cooperatives

The Himalayan farmers are usually a small farmer trading in small volumes, and distant from the market of which they have little information. This makes it difficult attract the buyers and also makes them vulnerable to unjust trade practices.

Cooperatives are a potential route out of small volume trading and exploitation by middlemen/buyers. Governmental and non-governmental agencies should facilitate the creation of cooperatives for medicinal plants growers that could enable a collective effort by farmers for marketing and logistics. This is a critical necessity to beat the unorganized nature of the sector. A medicinal plants growers' cooperative should be constituted in each Himalayan district and these should also be federated into an apex structure- at the regional or national level – that could facilitate information flow and fair trade.

Produce collection and logistics support

Marketing is a problem that the entire agri-produce sector faces and this applies to medicinal plants as well. For the Himalayan region in particular, the problem is magnified due to its distance from markets and the logistical difficulties and costs involved. The dependence on middlemen is high wastage of produce and related losses are higher. There is a need for back-end assistance to give an impetus to medplants cultivation and facilitate a fair share of revenues as well, for the farmers.

Transportation-related support should be instituted whereby the disadvantages and problems faced by individual farmers can be overcome through collective marketing and trade. For instance, schemes could be devised stipulating that for an area being able to produce “say x” quantity of produce, which is also the optimum truck load limit for one truck, (whichever is the convenient mode of local transport), transportation from one

collection point to the market would be arranged by the concerned SMPB. Such an intervention could be seasonal in nature, and provided during the peak-harvesting season.

Local processing and value addition

The Himalayan region remains at the stage of production and trade of primary produce and this leaves it with a relatively small share of the benefits, with the larger share going to processors up the value chain. Although the medicinal plants are a heritage of the Himalayan region, the region receives very little of the total revenues from the trade.

There is a need to explore the prospect of value addition at the local level, i.e, drying, cutting and packaging. This could improve the quality of material sold, reduce wastage and even logistical costs, and enhance revenues. The low technological capacity within the area and the lack of material testing/authentication and certification facility, are hindrances to such value addition. Creation of storage facilities within the area can also aid in reducing wastage and enable sales at the right time when the best prices may be received from the market.

Specialised commodity markets

Markets for medicinal plants are extremely secretive in nature, a large part of the produce being illegally harvested and traded. Apart from obvious biodiversity impacts, this also encourages unfair trade practices, and is a deterrant for farmers to undertake cultivation. Bringing greater transparency in marketing of medicinal plants would enable the achievement of multiple objectives.

Specialised medicinal plants markets on the commodity markets format could be established at the regional level to facilitate trading in medicinal plants produce of the region. Transparent pricing could be ensured with the global bids and offers, matched electronically. As with commodity markets, both spot trading and forward contracts should be encouraged. Every commodity contract should specify: the quantity and quality of the commodity, the specific price per unit, the date and method of delivery. An additional aspect could be inclusion of source specification, which would reduce illegal harvesting and promote responsible trade behaviour. The creation of regional medicinal plants markets would also contribute to creation of production zones for specific medicinal plants.

Information services for farmers

Although some information services do exist today for the herbal trade sector, the actual growers are still unreached by information, and hence vulnerable to exploitation and unfair practices. The Himalayan farmers are especially distant from real time information on medicinal plants markets. This leaves them to depend on middlemen and hence receive only a lower share of the medicinal plants revenues.

It is essential to ensure reach of information to all corners of the country in which cultivation of medicinal plants is desired. The SMPBs should help set up electronic herbal networks and the earlier suggested facilitation centres should be linked so as to enable real time information and direct buyer-seller contacts. Information bulletins should include prices of different species and their extracts, regional demand and supply levels; information could also be disseminated on industry events taking place in the region.

Documentation support for farmers

The multiple issues that dog the herbal trade sector have necessitated various checks and greatly enhance the need for procedural and documentation formalities for trade of medicinal plant material. Such documentation tend to confuse and deter the average

Himalayan farmer from undertaking medplants cultivation; the lack of knowledge of the documentation requirements at the district level govt. departments compounds the issue.

The proposed facilitation centres should assist the Himalayan farmers undertaking medicinal plants cultivation with the various procedural requirements, and help them get the required clearances for trade. The centres should also help the farmers deal with the documentation requirements for international trade in the medicinal plant material.

Authentication, Testing & Certification of Produce

Authentication and quality assurance is currently based on physical parameters assessed purely through observation. This has always caused variation in drug potency, but has lately begun resulting in adulteration as well, and is likely to affect the product credibility and market size in times to come.

Authentication and quality testing of medicinal plants material is necessary for effective negotiations with buyers. But the cost of testing at both the government managed institutions and those run privately, is prohibitive; very few testing centres are besides available and none in the Himalayan region. Testing fees of medicinal plants should be subsidized so that growers of medicinal plants are able to get proper value on the resources invested, and testing facilities need to be established nearer to production hubs. It would also be wise to invest into the development of an easy field-testing method and self-certification/authentication system for farmers' cooperatives.

Conservation & Responsible Trade

It has been difficult to establish cultivated material in the supply channel because of the availability of cheaper wild-harvested material in the market. No role models exist besides that demonstrates the benefits of purchase of cultivated material.

There should be a thrust on raising conservation awareness among the communities. The uses and status of MAPs should be included in the school syllabus to generate awareness among the children. The scheme of School herbal gardens promoted by NMPB should also be implemented in every school. Additionally, the laws need to be made more stringent. A complete ban needs to be imposed on extraction of MAPs by foreign tourists and authorities enabled for its implementation. At the same time, it is necessary to create support structure for those who do conform. The creation of a Responsible Trade Network can aid in this. Manufacturers and buyers should be encouraged to be a part of the Responsible Trade Network and exhibit their corporate social responsibility (CSR) credentials. The peer group support provided by membership in this group and the clean image promoted in the market, would become incentives for fair trade practices. Certain financial incentives are also recommended by the government for the members of this RTN in the initial period.

A Policy-shaper's Perspective

[Ms. Veena Gupta, National Bureau of Plant Genetic Resources, Delhi]

The National Medicinal Plant Board, along with its units like State Medicinal Plant Boards, should take action to bring the Medicinal Plant sector to the forefront, nationally and in the international market.

Exim info med

Export-import information regarding cultivation (what species are being cultivated, in how much area of land, in what areas it is cultivated, who are the farmers involved in cultivation), status, production, supply, demand etc, should be developed in a form that is accessible to everyone.

Linkage with other departments

Information should be shared amongst all the players- farmers, government departments, institutions, NGOs, industry etc., - for the sector to grow, and the NMPB should facilitate this process. SMPB should look after the needs of the farmers and should act as a link between the different authorities and the farmers for certification and other purposes.

Development of good germplasm

High yielding good quality germplasm naturally found in certain areas should be registered with the SMPB as a quality planting material. Nurseries should be raised by local farmers and this material should be provided to all the other farmers of that area so that farmers have access to quality yield and industries are able to produce quality products. Formal development in laboratories should be carried out through research and experimentation.

Promotion of ExTV, EDV, TRV, Land races

ExTV (extant varieties: those that traditionally exist with farmers), as well as EDV (essentially derived varieties: those that are exotic but doing very well here after being researched upon), TRV (traditional varieties) and Land races particular to an area, need to be promoted. Considerable work is in progress on Intellectual Property Rights and initiatives such as the National Biodiversity Act (NBA) and Protection of Varieties and Farmers Rights (PVFR) exist that are helping in conservation as well as in protecting the indigenous knowledge and traditions. For medicinal plants in particular, these initiatives should be routed through the NMPB. The NMPB and SMPBs should bring together the farmers, NGOs, institutes and different authorities to create a strong network for the progress and posterity of the herbal sector.

CONCLUSIONS

The workshop was an effort to come up with effective measures to protect the herbs found in different parts of the country ranging from the resources of cold deserts of Himalayas, diversity of Western and Eastern Ghats, to the riches of Andaman and Lakshwadeep islands; to conserve and utilize the indigenous traditional knowledge base; to reflect on the immediate plan of action. It generated expert inputs right from the commencement with the chief guest's lecture, through suggestions of the members in the working groups, deliberations and discussions among the participants, interaction with community participants, the Q&A sessions till its winding up with the feedbacks from the honourable guests.

The output of the workshop may be summarised in the form of the recommendations for policy and practice for the herbal sector, and the generation of a spirit of collaboration and urgency among the stakeholders as represented by the participant community.

Recommendations for Policy and Practice

The medicinal plants were assessed based on their conservation value, cultivation prospects, local use value and far/larger market demand of the species. The framework for prioritisation helped in determining the exact nature of support required for each species. The specific interventions for each support need category were drawn from the Supply Side and Demand Side Action Options devised by the workshop participants that have been collated and presented in previous chapters.

Three well-delineated Interventions Strategies have thus been crystallised and the prioritised medicinal plant species listed by the Intervention Strategy most suitable for it. The three intervention strategies and the species prioritized under each are given below.

Intervention Strategy A: R&D First!

Rationale for Strategy A

MAPs in general have a high gestation period and farmers are therefore reluctant to experiment with the cultivation of these species unless they are provided with proven and successful agro-techniques. Species with low scores on cultivation prospects especially, lack developed propagation methods through natural means and/or standardised cultivation packages, and adequate nursery production of saplings for use in cultivation. They also might have specific agroclimatic niche requirements that are not available at a larger scale. Besides, several of these species are not adequately understood in terms of the inter-relationships between the growing conditions and/or post-harvest processing requirements and the active principle content in the plant material. These are bottlenecks that will not allow a sustainable use of these species by the herbal sector, in spite of the high market demand for them.

The Priority Species that were assessed to have a 'Low Cultivation Prospect', whether rated high or low against the other three parameters of conservation value, local use value and far/larger market demand, are placed in this group and prioritized for R&D interventions.

The rationale for the above is that the required research needs to precede any other developmental activity for these particular species, in order to remove/reduce the existing bottlenecks that affect the species.

Elements of Strategy A

The R&D proposed within this strategy include:

- *Developing propagation and cultivation protocols for strengthening the supply base:* Germination protocols need to be developed along with specific agro-techniques for the species. Agro-technique development will call for determining required growing conditions for the species (e.g. soil type, moisture requirement, shade and nutrient requirements, associated species), land preparation methods, effective methods for pest and disease management. Care would need to be taken to identify the cultivation methods and site conditions that would ensure high active ingredients in the medicinal plant material.
- *Micropropagation protocols for recalcitrant species:* Research will be called for for developing tissue culture protocols for especially recalcitrant species that prove not amenable to germination by natural modes.
- *Nursery propagation and productionising support:* Following the establishment of protocols through the above, the species would need to be supported in their productionising phase. This will imply a thrust on nursery production of saplings of the particular species and distribution to potential farmers, along with considerable technical support to facilitate an effective lab to land transfer of the agro-techniques and ensuring their reach to all potential growers of the particular species.
- *Developing suitable post-harvest processing techniques:* Alongside the development of cultivation protocols, the harvesting, drying, storage and packaging requirements for plant material of the particular species, as well as the technologies for processing the material into the final drugs, such as pulverising/extraction, etc., also need to be researched.
- *Establishing quality standards and testing methods:* The methods of authentication, as well as the quality parameters and standards for the various grades of the plant material for the particular species, need to be laid down, along with the equipment and methods for testing at various stages of processing the material.

Intervention Process & Requirements

An effective implementation of the 'R&D First' Intervention Strategy will call for:

A1. Mobilising and coordinating the R&D institutions:

The intervention will require focussed attention to the concerned species by the R&D institutions working to address problems of this sector. This includes agricultural universities, R&D set-ups with a medicinal plant mandate, non-governmental organisations with a research thrust. At the same time, a coordinating body should ensure that the resources and efforts are distributed as per competence and capacity of research institutions, and there is least duplication and optimal efficiency and pace. The coordinating body must identify and if necessary, establish, in each state in which there are prospects for medicinal plants cultivation, some quality research labs to undertake the required research work.

A2. Funding for research and dissemination:

- 2.1 The required funding for the research activities and facilities would need to be made available by governmental agencies such as the NMPB, keeping in mind the above considerations.

- 2.2 Financial support should extend beyond the actual research to facilitation of dissemination of the findings and infusion/absorption of the developed techniques. NGOs can provide adequate extension and can be supported through various governmental schemes for the same.
- 2.3 A programme must be instituted for the publication of agro-techniques, harvesting & storage methods, quality standards & testing techniques, in simple booklet form for distribution to the farmers.

A3. *Participatory research and protocol establishment:*

It is important to recognise the fact that farmers can play a significant role in developing agro-techniques. Schemes that support participatory forms of research involving researchers and farmers in collaborative research efforts, are likely to be more successful by far. This would enable quicker absorption of the developed protocols and least lab-land gaps. Such collaborations will also facilitate area-specific protocol development. The species that allow cultivation in multiple zones would need inter-zone adaptation of the cultivation protocols, and this would be facilitated by the involvement of farmers of each such zone in the development process. Farmer Expert Groups (FEG) must be created in local area with prospects for medicinal plant cultivation, and these must be developed and facilitated by NGOs of repute in the area.

A4. *Productionising support for grassroots NGO/FEG nurseries:*

In each area with prospects for medicinal plants cultivation, NGOs and FEGs must be encouraged to establish nurseries for localising the developed agro-techniques for the priority medicinal plant species, and bringing the species into production.

A5. *Two-stage species development process:*

It must be noted that Intervention A cannot be an end in itself, but is only a precursor to either Intervention B or C. Once the research needs have been met for a particular species that is prioritised for the 'R&D First' Intervention, it should immediately be placed among the species group under Intervention B or C, as determined by their ratings on the remaining three parameters.

Species to be Addressed

The species recommended for *Strategy A* from each zone are given below.

Central Zone		
<i>Cyperus scariosus</i>	<i>Mucuna pruriens</i>	<i>Azadirachta indica</i>
<i>Curcuma angustifolia</i>	<i>Bryonopsis laciniata</i>	<i>Curculigo orchioides</i>
<i>Solanum nigrum</i>		
Western Himalayas		
<i>Aconitum heterophyllum</i>	<i>Taxus baccata</i> subsp. <i>wallichiana</i>	<i>Podophyllum hexandrum</i>
<i>Paris polyphylla</i>	<i>Gloriosa superba</i>	<i>Angelica glauca</i>
<i>Dactylorhiza hatagirea</i>	<i>Myrica esculenta</i>	<i>Nardostachys grandiflora</i>
<i>Picrorhiza kurroo</i>	<i>Saussurea costus</i>	<i>Arnebia benthamii</i>
<i>Arnebia euchroma</i>	<i>Rheum australe</i>	<i>Rheum moorcroftianum</i>
<i>Aconitum ferox</i>	<i>Bunium persicum</i>	<i>Delphinium denudatum</i>
<i>Hippophae rhamnoides</i>	<i>Rheum webbianum</i>	<i>Valeriana jatamansi</i>
<i>Carum carvi</i>	<i>Oroxylum indicum</i>	<i>Polygonatum cirrhifolium</i>
<i>Polygonatum multiflorum</i>	<i>Polygonatum verticillatum</i>	<i>Acorus calamus</i>
<i>Dioscorea deltoidea</i>	<i>Gentiana kurroo</i>	<i>Thalictrum foliolosum</i>
<i>Saussurea obvallata</i>		
Northern Plains		

<i>Terminalia chebula</i>	<i>Gloriosa superba</i>	<i>Aegle marmelos</i>
<i>Asparagus racemosus</i>	<i>Azadirachta indica</i>	<i>Plumbago zeylanica</i>
<i>Cissampelos pareira</i>	<i>Plantago ovata</i>	<i>Acorus calamus</i>
<i>Acacia catechu</i>	<i>Aloe barbadensis</i>	<i>Boerhaavia diffusa</i>
<i>Chlorophytum tuberosum</i>	<i>Acacia nilotica</i>	<i>Hibiscus micranthus</i>
<i>Solanum nigrum</i>		
Western Zone		
<i>Garcinia indica</i>	<i>Commiphora wightii</i>	<i>Glycyrrhiza glabra</i>
<i>Terminalia chebula</i>	<i>Gloriosa superba</i>	<i>Tecomella undulata</i>
<i>Gymnema sylvestre</i>	<i>Celastrus paniculata</i>	<i>Sterculia urens</i>
<i>Pterocarpus marsupium</i>	<i>Calligonum polygonoides</i>	<i>Oroxylum indicum</i>
<i>Sapindus emarginatus</i>	<i>Hemidesmus indicus</i>	<i>Blepharis sindica</i>
<i>Dioscorea bulbifera</i>	<i>Eclipta prostrata</i>	<i>Holarrhena antidysenterica</i>
<i>Mesua ferrea</i>	<i>Leptadenia reticulata</i>	
North Eastern Zone		
<i>Terminalia bellirica</i>	<i>Podophyllum hexandrum</i>	<i>Zanthoxylum armatum</i>
<i>Ammomum subulatum</i>	<i>Gymnocardia odorata</i>	<i>Gymnocladus assamicus</i>
<i>Gaultheria fragrantissima</i>	<i>Potentilla fulgens</i>	<i>Saussurea obvallata</i>
<i>Meconopsis nepaulensis</i>		
Eastern Zone		
<i>Tinospora cordifolia</i>	<i>Phyllanthus amarus</i>	<i>Cyperus scariosus</i>
<i>Mucuna pruriens</i>	<i>Acorus calamus</i>	<i>Hemidesmus indicus</i>
<i>Eclipta prostrata</i>	<i>Curcuma angustifolia</i>	
Southern Zone		
<i>Santalum album</i>	<i>Gymnema sylvestre</i>	<i>Plumbago rosea</i>
<i>Asparagus racemosus</i>	<i>Plumbago zeylanica</i>	<i>Punica granatum</i>
<i>Chlorophytum arundinaceum</i>	<i>Oroxylum indicum</i>	<i>Pterocarpus santalinus</i>
<i>Chlorophytum tuberosum</i>	<i>Madhuca indica</i>	<i>Wrightia tinctoria</i>
<i>Cymbopogon flexuosus</i>	<i>Cassia senna</i>	

Intervention Strategy B: Conserve, Cultivate, Channel

Rationale for Strategy B

Prioritised MAP species with high scores on conservation value indicate a restricted resource base for the species. Harvesting and usage of the species without adequate conservation action would lead to serious biodiversity impacts. Several such species are also rated to possess high cultivation prospects, indicating an availability of well developed and tested cultivation techniques and hence good chances of lucrative returns to farmers. However, this potential will not be realised unless the grassroots is made aware of available technologies and galvanised for production.

Several of the prioritised species are also assessed to have a high local use, indicating existing demand in local markets and hence the need for local level sources of supply. A high rating on the status in far/larger markets on the other hand indicates assured returns to the farmers and with it, the need to work on market channel development as well as provision of structural and promotional facilities.

The Priority Species that were assessed to have a 'High Conservation Value' as well as a 'High Cultivation Prospect', and along with these, an established market, with a 'High Value in Local Use' and/or 'High Value in Far/Larger Markets', are placed in this group and prioritized for Conservation cum Cultivation cum Channelising interventions.

Species that are characterised by a high market demand, and while possessing cultivation technologies, are also threatened in the wild, need to be addressed through an integrated strategy that combines conservation interventions with those that promote supply from cultivated sources, and those that facilitate linkages between channel partners.

Elements of Strategy B

The strategy '*Conserve, Cultivate, Channel*' could comprise the following elements:

- *Managing sustainable harvesting of species:* Harvesting limits should be determined and institutionalised for each species. These limits must be based on scientific quantitative inventorying of the particular medicinal species with high market demand, and must be adjusted periodically to changing biodiversity status. These must be ensured through adequate regulations and checks and allowed only in specific extraction plots.
- *Protection of medicinal plant rich areas:* Areas of concentration of medicinal plants in particular, within and/or outside existing Protected Areas, must be identified and protected & actively conserved. This should include barring human and animal intervention in the particular sites, as well as measures for induced regeneration and habitat conservation.
- *Targeted species & habitat conservation measures:* Species and habitat specific conservation measures need to be designed, based on the nature and extent of threat to the particular species and habitat, and implemented. These should be a judicious mix of in-situ and ex-situ measures for species, and habitat protection and conservation actions, as determined through an understanding of precise ecological processes in the specific habitats and species behaviour.
- *Programme of ex-situ conservation for species:* There should be a range of ex-situ conservation measures for genetic preservation of the specific species, both at the local level, as well as at a zonal/national level. This could include field gene banks, cryopreservation at laboratories, herbal gardens, small and big, among others.
- *Promoting cultivation for local consumption:* The species that have a high value in local use need to be promoted for cultivation in kitchen gardens and small plots. This would help generate adequate plant material for local consumption from sustainable, cultivated sources. Input and technical support for undertaking cultivation should be provided especially to women towards this.
- *Promoting cultivation for supplying to far/larger markets:* The species that have a high value in far/larger markets must be actively promoted as cash crops in areas that have suitable agro-climatic conditions. Farmers in these areas may undertake cultivation of these species. Use of Good Agricultural Practices, including organic methods of cultivation, should be ensured. Input support should include distribution of quality seeds and/or saplings, financial support, as well as organic fertilisers and pesticides. Technical support should include guidance on suitable agro-techniques, pest management, and right harvesting & storage.
- *Regulating supplies for sustainability, optimal quality and fair benefits:* The production volumes of medicinal plant material through cultivation should be aligned to market demand levels for different species, such that farmers' revenues do not fall below certain minimum

limits. At the same time, it should be ensured that all supply of plant material is as per required quality levels and there is adherence to sustainability requirements.

- *Improving post-harvest processes and quality adherence.* Standardized post harvest techniques should be created. These should include measures for drying, storage conditions such as temperature & humidity, shelf-life, grading of the produce according to quality, pest control, value addition, proper packaging, etc. Stakeholders of the herbal sector should be developed for adherence to international quality requirements.

Intervention Process & Requirements

The above would be enabled through the following:

B1. Support for periodic ecological and biodiversity research:

- 1.1 In order to bridge the information gap that might help determine sustainable harvesting limits and conservation strategies for the species with high market demand, support may be provided to conservation agencies to conduct distribution and population assessment of species, with a priority on red list species. A process of 3-5 year re-assessments should be set in place. NGOs must be supported to facilitate communities in medicinal plant rich areas to monitor biodiversity status and inform changes in availability/regeneration of species.
- 1.2 Research institutions and NGOs must also be encouraged to conduct species and habitat conservation studies, and disseminate their findings.

B2. Network of medicinal plants conservation & research areas:

- 2.1 In each agro-climatic zone of the country, areas of concentration of medicinal plants should be identified, and established as “*Aushadhiya Van*”. A network of many such areas of concentration/conservation should be created and provided State protection.
- 2.2 Host communities in medicinal plant rich areas must be facilitated to carry out efficient management and regular monitoring of these selected conservation sites.
- 2.3 Permanent Protection cum Production Plots must be identified and continual research by select agencies carried out on these P4s to understand the ecology and species behaviour for determining conservation measures.

B3. Annual harvesting limits, Panchayat control, and certified & appropriate collection:

- 3.1 Sustainable harvesting limits must be prescribed for various species, along with well-delineated extraction plots; the extraction limits must be reviewed every 3-5 years and attuned to current biodiversity status as revealed by recent surveys.
- 3.2 *Panchayats* should manage the issuing of permits and management of extraction limits with regulatory control by the Medicinal Plant Board.
- 3.3 Certified Collection Centers should be established at all major and minor collection points.
- 3.4 Non-destructive collection practices must be made mandatory. NGOs may be supported to carry out extensive training and publish instructional pamphlets in local languages specifying the harvesting limits and Good Collection Practices.

B4. Programmes for community awareness and extension:

- 4.1 NGOs must be charged with the responsibility and provided support for educating local communities in areas of medicinal plant richness, revive their sense of stewardship for these resources and generate their involvement in conservation.
- 4.2 All schools may be encouraged to maintain “*Vidyarthi Vatika*” along with other eco-awareness generating programmes for students.

B5. Local area ex-situ programme:

- 5.1 Every community in a medicinal plant rich area and especially those using these for local consumption and/or trade should be assisted to maintain a local seed bank for

the specific medicinal plants that would help it to preserve the local genetic varieties and also use it for induced regeneration in the local area.

- 5.2 NGOs and agricultural universities must be assisted to set up and maintain a network of herbal gardens covering all agro-climatic zones.

B6. Ex-situ programme for research institutes:

Select institutes, governmental and non-governmental, should be supported to manage an ex-situ programme for the priority medicinal plants species. The programme should comprise dedicated cryo-preservation units as well as botanic gardens for various strains of medicinal plant species, with a special thrust on endangered species.

B7. Demand monitoring and information services:

- 7.1 Select agri-marketing agencies, governmental and/or non-governmental, should be harnessed to conduct annual surveys of market demand quantities for various species, along with their prices, and the supply statistics as well.
- 7.2 A Herbal Info Channel must be developed and maintained by the said agencies and made available to all stakeholders, through the internet, through dailies & periodicals, broadcasts through radio or other media.
- 7.3 Publications and broadcasts should also be used for the purpose of disseminating information on quality standards, organic cultivation norms, certification system, etc.

B8. NGO-based cultivation support and extension:

Select NGOs in each block/district with prospects for medicinal plants cultivation must be supported for setting up MAP Clinics for the purpose of providing technical support and inputs to potential growers. These should be charged with the responsibility of training and guiding farmers on MAP cultivation, including on the WHO guidelines for Good Agricultural Practices, organic farming, and post-harvest technologies, quality systems and standards. The MAP Clinics should also provide services for soil testing and harvested plant material to MAP growers.

B9. Network of rural nurseries/seed banks:

- 9.1 A programme needs to be launched for the rapid creation of a network of centres for the production and distribution of quality seeds/saplings for enhancing cultivation of medicinal plants. This should include nurseries as well as field seed banks by NGOs and farmer combines.
- 9.2 Seed exchange programmes must be set up within farmer combines to ensure maintenance of MAP germplasm.

B10. Financial support for farmers:

- 10.1 Medicinal plants growers should be provided financial support for undertaking cultivation of medicinal plants. A dual route should be followed for this- direct from the NMPB/SMPB and through mother NGOs selected by the NMPB/SMPB for this purpose. A multi-category and differentiated financial support scheme should be launched. This should comprise support for first-time growers as well as for the well-established growers desirous of enhancing the scale of their plantations.
- 10.2 Further, a crop insurance should also be set in place for all certified growers such that failures may not impact heavily on the poor.

B11. Targeted increase of scale of MAP plantations:

- 11.1 Small and medium farmers should be assisted with leased government lands for MAP cultivation and for cluster farming.
- 11.2 Wasteland development should be integrated with MAP cultivation. A special wasteland support programme should include irrigation and soil interventions, and MAP saplings.

B12. Creation of cooperatives and SHGs:

- 12.1 In every district with the potential for significant production of medicinal plants crops, NGOs should be encouraged to help constitute growers' cooperatives. These cooperatives should be strengthened to undertake marketing and sale of medicinal plant produce.
- 12.2 There should be a specific thrust on women's groups for cultivation of medicinal and aromatic plants. Women's groups should also be facilitated to undertake processing and/or packaging and sale of the produce, especially aromatics and spices.
- 12.3 These cooperatives and women's groups must be enabled with support for purchase of equipment and infrastructure for appropriate post-harvest and storage.

B13. Multiple linkage facilitation actions:

- 13.1 Agri-marketing agencies must be charged with the task of developing and formalising the marketing channels for the herbal sector, and provided support for this. Forward and backward linkages must be developed and periodic interfaces such as buyer-seller meets must be conducted. Buy-back Guarantees must be worked out wherever possible, between cooperatives and end-users.
- 13.2 A directory of buyers and sellers of medicinal plant material with contact details should be compiled, widely circulated and regularly updated.
- 13.3 Collection routes must be established and 'Herbal Mandi's must be set up at convenient points on each route to facilitate the farmers to bring their produce to the market and the traders to procure their required materials and reduce the strong hold of middlemen in the sector.

B14. Providing post harvest processing, testing and packaging facilities:

- 14.1 Primary processing units should be set up at the local level, to reduce degradation of quality of the produce and wastage till the materials reach the markets. Appropriate, low cost storage facilities should be created at *Panchayat*, Block or District level and managed by the cooperatives, or even anchored with the MAP Clinics.
- 14.2 Facilities for testing and grading of the harvested plant material, should also be set up at all medicinal plants procurement/collection centers, such as herbal '*Mandi's*. District level testing laboratories should be set up equipped with advanced equipment. The SMPBs or mother NGOs or available research institutes could manage these facilities.

B15. Developing quality system and instituting certification:

- 15.1 A QA Working Group comprising select R&D institutions and members of various stakeholder groups should be created for the purpose of researching into and creating a QA system that serves the needs of the herbal sector. The system should incorporate parameters and standards drawn from traditional texts and modern scientific knowledge.
- 15.2 A certification system incorporating authentication, source certification, organic certification, should also be developed. A system of quality labeling should also be developed that should indicate grade of the material, harvesting time, geographical origin and molecular testing report. A multi-stakeholder working group should be commissioned for the purpose, and the system should be designed keeping in mind emerging international requirements in the sector.
- 15.3 The certification and quality labeling system should be instituted with extensive training amongst growers and dealers of medicinal plants; a print and web publication should also be brought out on the quality standards and certification system.
- 15.4 A single certification agency should be identified and developed at the regional level duly authorized by the SMPBs.

B16. Programme for promotion of good industrial practices:

- 16.1 Good manufacturing practices and principles of fair trade should be developed and published in the form of simple booklets and distributed to all industry stakeholders.
- 16.2 Consulting firms must be commissioned to conduct awareness sessions in all cities with a healthy herbal industry for a more active promotion of GMPs. They must also

be given the responsibility for facilitating the adoption of GMP (in the nature of ISO) among manufacturers.

B17. Promoting responsible stakeholder ship:

17.1 An educational programme must be designed and carried out targeting all stakeholders of the herbal sector, aiming to develop in them a greater understanding of the need for conservation, generation/use of quality material, following of fair trade principles and good practices. The programme should use a variety of media, including print publications, radio and TV, and even training and awareness sessions, and should also communicate the regulations regarding the above.

17.2 The NMPB and SMPBs should periodically assess suppliers and producers in the herbal sector for the appropriateness of their practices. When required, warning letters should be sent to erring stakeholders; the NMPB/SMPB should also periodically, bring out 'black lists' of the chronically erring stakeholders.

B18. Demand and new sector development:

18.1 A consultancy study should be commissioned for determining the potential use of the priority species in allied sectors like cosmetics, food and beverages, etc.

18.2 Industry meets should be conducted by NMPB with associations of these particular industries and information about the potential use of specific species in these industries should be disseminated.

B19. Launching an internationally recognised Indian herbal brand:

19.1 An Indian brand of herbal products may be created by NMPB. This should act as an umbrella brand under which material of various Indian cooperatives/manufacturers may be sold. A multi-stakeholder group should be set up for designing the brand along with a reputed marketing agency. The modalities of supplying under the brand should be worked out well.

19.2 The brand should be promoted nationally and in the international market, ensuring a perception of quality among potential customers. This would involve representation at exhibitions, as well as running a strong marketing campaign.

19.3 Sale of products under this brand could be through franchisee sales outlets in select cities in the country, as well as internationally. Private sector and NGO partnerships could be worked for this purpose.

B20. International facilitation:

20.1 NMPB should play a direct and active role in negotiating with international bodies for promoting sale of Indian medicinal plant products in international markets.

20.2 NMPB should facilitate stakeholders to access international markets, providing export subsidies, and facilitation for the procedural and regulatory requirements. Certification fees charged by international bodies may also be subsidised, at least initially.

20.3 Producers should be assisted to display their products in relevant international events, through travel and participation grants.

Species to be Addressed

The species recommended for *Strategy B* from each zone are as follows.

Central Zone		
<i>Saraca asoca</i>	<i>Terminalia arjuna</i>	<i>Andrographis paniculata</i>
<i>Rauvolfia serpentina</i>	<i>Terminalia bellirica</i>	<i>Withania somnifera</i>
<i>Centella asiatica</i>	<i>Piper nigrum</i>	<i>Terminalia chebula</i>
<i>Gloriosa superba</i>	<i>Gymnema sylvestre</i>	<i>Asparagus racemosus</i>
<i>Cyperus scariosus</i>	<i>Acorus calamus</i>	<i>Hemidesmus indicus</i>

<i>Curculigo orchioides</i>	<i>Moringa oleifera</i>	
Western Himalayas		
<i>Swertia chirayita</i>	<i>Aconitum heterophyllum</i>	<i>Taxus baccata</i> subsp. <i>wallichiana</i>
<i>Podophyllum hexandrum</i>	<i>Paris polyphylla</i>	<i>Gloriosa superba</i>
<i>Angelica glauca</i>	<i>Dactylorhiza hatagirea</i>	<i>Myrica esculenta</i>
<i>Nardostachys grandiflora</i>	<i>Picrorhiza kurrooa</i>	<i>Sapindus mukorossi</i>
<i>Saussurea costus</i>	<i>Arnebia benthamii</i>	<i>Arnebia euchroma</i>
<i>Rheum australe</i>	<i>Rheum moorcroftianum</i>	<i>Aconitum ferox</i>
<i>Delphinium denudatum</i>	<i>Hippophae rhamnoides</i>	<i>Valeriana jatamansi</i>
<i>Polygonatum cirrbifolium</i>	<i>Polygonatum multiflorum</i>	<i>Polygonatum verticillatum</i>
<i>Acorus calamus</i>	<i>Dioscorea deltoidea</i>	<i>Gentiana kurroo</i>
<i>Saussurea obvallata</i>		
Northern Plains		
<i>Rauwolfia serpentina</i>	<i>Tinospora cordifolia</i>	<i>Centella asiatica</i>
<i>Gloriosa superba</i>	<i>Gymnema sylvestre</i>	<i>Coleus forskohlii</i>
<i>Aegle marmelos</i>	<i>Bacopa monnieri</i>	<i>Cissampelos pareira</i>
<i>Acorus calamus</i>	<i>Acacia catechu</i>	<i>Aloe barbadensis</i>
Western Zone		
<i>Chlorophytum borivilianum</i>	<i>Piper betel</i>	<i>Andrographis paniculata</i>
<i>Rauwolfia serpentina</i>	<i>Santalum album</i>	<i>Garcinia indica</i>
<i>Piper longum</i>	<i>Commiphora wightii</i>	<i>Glycyrrhiza glabra</i>
<i>Gloriosa superba</i>	<i>Tecomella undulata</i>	<i>Gymnema sylvestre</i>
<i>Celastrus paniculata</i>	<i>Sterculia urens</i>	<i>Pterocarpus marsupium</i>
<i>Calligonum polygonoides</i>	<i>Oroxylum indicum</i>	<i>Blepharis indica</i>
<i>Dioscorea bulbifera</i>	<i>Withania coagulans</i>	
North Eastern Zone		
<i>Coptis teeta</i>	<i>Panax pseudo ginseng</i>	<i>Aquillaria agallocha</i>
<i>Swertia chirayita</i>	<i>Taxus baccata</i> subsp. <i>wallichiana</i>	<i>Podophyllum hexandrum</i>
<i>Zanthoxylum armatum</i>	<i>Hardwickia javanica</i>	<i>Picrorrhiza kurrooa</i>
<i>Rheum nobile</i>	<i>Costus speciosus</i>	<i>Gymnocladus assamica</i>
<i>Gaultheria fragrantissima</i>	<i>Potentilla fulgens</i>	<i>Saussurea obvallata</i>
<i>Meconopsis nepaulensis</i>		
Eastern Zone		
<i>Andrographis paniculata</i>	<i>Rauwolfia serpentina</i>	<i>Terminalia bellirica</i>
<i>Emblica officinalis</i>	<i>Piper longum</i>	<i>Terminalia chebula</i>
<i>Celastrus paniculata</i>	<i>Phyllanthus amarus</i>	<i>Cyperus scariosus</i>
<i>Plumbago zeylanica</i>	<i>Eclipta prostrata</i>	<i>Curcuma angustifolia</i>
Southern Zone		
<i>Trichodesma zeylanicum</i>	<i>Rauwolfia serpentina</i>	<i>Santalum album</i>
<i>Garcinia indica</i>	<i>Solanum torvum</i>	<i>Gloriosa superba</i>
<i>Curcuma amada</i>	<i>Curcuma aromatica</i>	<i>Plumbago rosea</i>
<i>Plumbago zeylanica</i>	<i>Bacopa monnieri</i>	<i>Mucuna pruriens</i>
<i>Oroxylum indicum</i>	<i>Pterocarpus santalinus</i>	<i>Hemidesmus indicus</i>
<i>Chlorophytum tuberosum</i>	<i>Cymbopogon flexuosus</i>	<i>Cassia senna</i>

Strategy C: A Market Boost!

Rationale for Strategy C

Certain medicinal species, although they might have established pharmaceutical actions and/or potential for use in wellness or cosmetic products, do not have a well-established market demand. Research may have indicated that these species have high potential in the market and in certain cases, local use value may be high but far/larger markets do not recognise these values. Unless the markets are made aware of the potential of these species, this potential is unlikely to be realised.

The Priority Species that were assessed to have a 'Low Value in Markets', whether in Local and/or Far/Larger Markets, and whether rated high or low against the other two parameters of conservation value, cultivation prospects, are placed in this group and prioritized for Market Development interventions.

The rationale for the above is that market development has to be essentially carried out in order to ensure the realisation of its potential.

Elements of Strategy C

The strategy '*A Market Boost*' could comprise the following elements:

- *Focussed attention on product development:* The species being addressed by this strategy would require developing products based on research on its local use values and available active ingredients. Apart from prescription medicinal products, there should be a thrust on OTC drugs, wellness products, food supplements, cosmetics, etc.
- *Analyzing potential markets and product positioning:* In-depth studies need to be carried out on the prospective market potential for the particular species. Domestic and international markets need to be analysed for the potential use of the herbal products or botanicals obtained from the species. Products made using the particular species must be positioned based on the findings of these surveys.
- *Promotion and demand creation:* Major promotional activities would need to be carried out for improving the market status of these species. This should include awareness building among the farmers and traders, as well as among manufacturers, national and international; final customers, i.e., users of the products, should also be educated on the products such that a demand is created for the same.

Intervention Process & Requirements

C1. R&D for potential products:

A Task Force should be set up comprising R&D institutions and major industrial houses with R&D capacity. Members of this Task Force should be encouraged to undertake research on the species to be covered under this strategy, with the aim of developing products, medicinal or non-medicinal, with market potential.

C2. Market studies and development strategy:

- 2.1 Agri-marketing agencies should be commissioned to conduct studies to assess the market potential of the select species in various herbal and allied sectors.
- 2.2 The study findings should be used for demand assessment and determining the strategic positioning of each of the target species.

C3. Market awareness building:

- 3.1 Marketing firms should be hired by NMPB for projecting the benefits of the select herbs, nationally and internationally, through electronic and print media.

3.2 Presentations should be made at various producers' meets by the Task Force for R&D on the particular species.

C4. Two-stage development process:

Once Strategy C has borne success, the species being covered by this strategy need to be addressed by Strategy B.

Species to be Addressed

The species recommended for Strategy C from each zone are given below.

Central Zone		
<i>Cyperus scariosus</i>	<i>Plumbago zeylanica</i>	<i>Mucuna pruriens</i>
<i>Acorus calamus</i>	<i>Hemidesmus indicus</i>	<i>Adbatoda zeylanica</i>
<i>Curcuma angustifolia</i>	<i>Bryonopsis laciniosa</i>	<i>Curculigo orchioides</i>
<i>Moringa oleifera</i>		
Western Himalayas		
<i>Allium stracheyi</i>	<i>Bunium persicum</i>	<i>Hippophae rhamnoides</i>
<i>Carum carvi</i>	<i>Oroxylum indicum</i>	<i>Dioscorea deltoidea</i>
<i>Saussurea obvallata</i>		
Northern Plains		
<i>Bacopa monnieri</i>	<i>Aloe barbadensis</i>	
Western Zone		
<i>Celastrus paniculata</i>	<i>Calligonum polygonoides</i>	<i>Blepharis sindica</i>
<i>Dioscorea bulbifera</i>	<i>Withania coagulans</i>	<i>Leptadenia reticulata</i>
North Eastern Zone		
<i>Rheum nobile</i>	<i>Gymnocardia odorata</i>	<i>Gymnocladus assamicus</i>
<i>Potentilla fulgens</i>	<i>Saussurea obvallata</i>	<i>Meconopsis nepaulensis</i>
Eastern Zone		
<i>Glycyrrhiza glabra</i>	<i>Phyllanthus amarus</i>	<i>Mucuna pruriens</i>
<i>Acorus calamus</i>	<i>Hemidesmus indicus</i>	<i>Eclipta prostrata</i>
<i>Curcuma angustifolia</i>		
Southern Zone		
<i>Costus speciosus</i>	<i>Oroxylum indicum</i>	<i>Pterocarpus santalinus</i>
<i>Madhuca indica</i>	<i>Wrightia tinctoria</i>	

The species wise action requirements for each zone are given in Annexure VIII.

Post-Workshop Actions

Post workshop processing of the prioritization exercise was found to be necessary. In order to ensure a validated outcome of the endeavour, the prioritized lists were sent back to the participants for a back-home examination. By and large, the assessments arrived at during the workshop were upheld. Changes that were suggested by individual participants were re-circulated. Unless confirmed by a minimum number of participants, these were noted and presented in the report, but not used to modify the workshop generated ratings. Furthermore, the final lists of species were compiled with local/regional names of the

species after discussing with regional experts in this field. Species that are important for more than one reason or in more than one region were identified for formulating strategies at a national level or for multi-regional clusters. The prioritization was done from the point of view of management interventions, and should be carried out at regular intervals as the threats, market trends and priorities change over time.

ANNEXURES

Annexure I. National List of Priority Species

Priority I			
<i>Aconitum heterophyllum</i>	Atish, Patish	<i>Ammomum subulatum</i>	Bara Elachi, Ela
<i>Andrographis paniculata</i>	Kalmegh	<i>Angelica glauca</i>	Chaura, Gandrayan, Mandrani, Yorek
<i>Aquillaria agallocha</i>	Agus	<i>Arnebia benthamii</i>	Ratanjot
<i>Arnebia euchroma</i>	Laljari, Ratanjot	<i>Celastrus paniculata</i>	Jyotishmati, Bhalkangati
<i>Centella asiatica</i>	Mandukparni	<i>Chlorophytum borivilianum</i>	Musli
<i>Coleus forskohlii</i>	Paichur	<i>Commiphora wightii</i>	Gugul, Googan
<i>Coptis teeta</i>	Mamira	<i>Costus speciosus</i>	Kemuka, Keu
<i>Curcuma amada</i>	Amahaldi, Amaharida	<i>Curcuma aromatica</i>	Van haridra, Jangli haldi
<i>Dactyloctenium aegyptium</i>	Salam panja	<i>Emblia officinalis</i>	Amla, Amlaki
<i>Garcinia indica</i>	Vrikashamla	<i>Gloriosa superba</i>	Kalihari, Langali
<i>Glycyrrhiza glabra</i>	Mulethi, Madhuphali	<i>Gymnema sylvestre</i>	Gurmaar
<i>Hardwickia javanica</i>		<i>Myrica esculenta</i>	Kaphal, Karpal
<i>Nardostachys grandiflora</i>	Jatamansi	<i>Ocimum sanctum</i>	Tulsi
<i>Panax pseudo ginseng</i>	Gunseng, Lakshmana	<i>Paris polyphylla</i>	Hemvati, Khetvacha
<i>Picrorrhiza kurrooa</i>	Kutki	<i>Piper betel</i>	Paan
<i>Piper longum</i>	Pipli, Pipli choti	<i>Piper nigrum</i>	Kali mirch, Krishna Mirch
<i>Plumbago rosea</i>	Chitraka, Rakta chitrak, Lal chitrak	<i>Podophyllum hexandrum</i>	Bankakri
<i>Rauvolfia serpentina</i>	Sarpagandha	<i>Rheum australe</i>	Dolu
<i>Rheum moorcroftianum</i>	Dolu	<i>Rheum nobile</i>	Archa
<i>Santalum album</i>	Shwet Chandan	<i>Sapindus mukorossi</i>	Reetha, Arishthak
<i>Saraca asoca</i>	Ashok	<i>Saussurea costus</i>	Kuth
<i>Saussurea obvallata</i>	Brahmkamal	<i>Solanum torum</i>	Brehti Bhed
<i>Sterculia urens</i>	Katira	<i>Stevia rebaudiana</i>	Madhukari
<i>Swertia chirayita</i>	Chiryata, Latzeera	<i>Taxus baccata subsp. wallichiana</i>	Thuner, Talisbhed
<i>Tecomella undulata</i>	Rohi, Roira, Rohera	<i>Terminalia arjuna</i>	Arjun
<i>Terminalia bellirica</i>	Bahera	<i>Terminalia chebula</i>	Harar, Haritaki
<i>Tinospora cordifolia</i>	Guduchi, Giloi, Gurch	<i>Trichodesma zeylanicum</i>	Jhingi, Hetenuria
<i>Withania somnifera</i>	Ashwagandha	<i>Zanthoxylum armatum</i>	Timur, Tumru, Gaira

Priority II			
<i>Acacia catechu</i>	Khair, Kachu	<i>Acacia nilotica</i>	Babul, Kikar
<i>Aconitum ferox</i>	Vatsnabha, Meetha zahar, Bish	<i>Acorus calamus</i>	Vacha, Bach
<i>Adhatoda zeylanica</i>	Arusha, Vasaka	<i>Aegle marmelos</i>	Bel, Bil, Maredu, Vilvam
<i>Allium stracheyi</i>	Jammu fern	<i>Aloe barbadensis</i>	Ghee-kunvar, Ghritkumari
<i>Asparagus racemosus</i>	Shatavari, Shatmuli	<i>Azadirachta indica</i>	Neem
<i>Bacopa monnieri</i>	Nira-Brahmi, Jalneem	<i>Blepharis indica</i>	
<i>Boerhaavia diffusa</i>	Punrnarva, Vishakpara	<i>Bunium persicum</i>	Siah-zirah, Kala zira
<i>Bryonopsis laciniosa</i>	Shivalingi	<i>Calligonum polygonoides</i>	Phog, Phogalli, Phok, Tirni
<i>Carum carvi</i>	Krishan jirak, Shia zirah, Kala zira	<i>Cassia senna</i>	Swarnpatti Bhade
<i>Chlorophytum arundinaceum</i>	Safed musli	<i>Chlorophytum tuberosum</i>	Safed musli
<i>Cissampelos pareira</i>	Patha	<i>Curculigo orchioides</i>	Kali mushli, Mushali
<i>Curcuma angustifolia</i>	Tavakshira, Tikhur, Tirvur	<i>Cymbopogon citratus</i>	
<i>Cymbopogon flexuosus</i>	Kodi Pullu, Gandharan	<i>Cyperus scariosus</i>	
<i>Delphinium denudatum</i>	Jadwar, Nirbisi	<i>Dioscorea bulbifera</i>	Ratalu, Barahi Kand
<i>Dioscorea deltoidea</i>	Kiriss, Genthi	<i>Eclipta prostrata</i>	Bhrinraj, Bhangra
<i>Gaultheria fragrantissima</i>		<i>Gentiana kurroo</i>	Tikta
<i>Gymnocardia odorata</i>		<i>Gymnocladus assamicus</i>	
<i>Hemidesmus indicus</i>	Anantmula	<i>Hibiscus micranthus</i>	
<i>Hippophae rhamnoides</i>	Seabuckthorn, Lehberry, Amlvaelus, Aameel	<i>Holarrhena antidysenterica</i>	Karchi
<i>Leptadenia reticulata</i>	Jeevani	<i>Madhuca indica</i>	Mahua, Madhuk
<i>Meconopsis nepaulensis</i>		<i>Mesua ferrea</i>	Naagkesar
<i>Moringa oleifera</i>	Sahjan	<i>Mucuna pruriens</i>	
<i>Oroxylum indicum</i>	Shyonaka, Ullu, Arlu	<i>Phyllanthus amarus</i>	Bhoomi Amla, Bhumyamalki
<i>Pistacia khinjuk</i>	-	<i>Plantago ovata</i>	Isabgol
<i>Polygonatum cirrhifolium</i>	Maeda	<i>Polygonatum multiflorum</i>	Mahamaeda
<i>Polygonatum verticillatum</i>	Mahamaeda	<i>Punica granatum</i>	Dadima, Anar, Daniamma
<i>Plumbago zeylanica</i>	Chittrak, Chita	<i>Potentilla fulgens</i>	Vajradanti
<i>Pterocarpus marsupium</i>	Patala, Pathal	<i>Pterocarpus santalinus</i>	Lal Chandan, Rakt Chandana
<i>Rheum webbianum</i>	Archu, Lachu	<i>Sapindus emarginatus</i>	
<i>Solanum nigrum</i>	Kakmachi, Macoy	<i>Thalictrum foliolosum</i>	Peetmula, Mameeri
<i>Valeriana jatamansi</i>	Muskbala, Tagar, Samyo	<i>Withania coagulans</i>	Akri, Punir, Paneerdodi
<i>Wrightia tinctoria</i>	Indrajau, Meetha-indrajau		

Annexure II. List of Priority Species for Central Region

Species name	Rating: Supply-side considerations		Rating: Demand side considerations		Gross rating (Regional scale)	Average ratings (National scale)
	Conservation value CV	Cultivation prospects CP	Value in local use VLU	Value in far/larger markets VFM		
Priority I						
<i>Saraca asoca</i>	5	5	5	5	20	20.0
<i>Terminalia arjuna</i>	5	5	5	5	20	20.0
<i>Andrographis paniculata</i>	5	4	5	5	19	19.3
<i>Rauwolfia serpentina</i>	5	5	5	5	20	19.2
<i>Terminalia bellirica</i>	5	5	5	5	20	17.7
<i>Withania somnifera</i>	3	5	5	5	18	17.0
<i>Centella asiatica</i>	4	4	4	4	16	16.5
<i>Piper nigrum</i>	5	4	4	4	17	16.5
<i>Terminalia chebula</i>	5	5	5	5	20	16.5
<i>Gloriosa superba</i>	4	5	5	5	19	16.2
<i>Gymnema sylvestre</i>	4	4	5	4	17	15.8
Priority II						
<i>Asparagus racemosus</i>	4	4	4	4	16	14.0
<i>Cyperus scariosus</i>	4	3	3	3	13	14.0
<i>Plumbago zeylanica</i>	2	4	4	3	13	14.0
<i>Mucuna pruriens</i>	3	3	4	2	12	13.0
<i>Acorus calamus</i>	4	4	3	3	14	12.8
<i>Hemidesmus indicus</i>	4	5	3	2	14	12.8
<i>Adhatoda zeylanica</i>	3	3	3	3	12	12.0
<i>Curcuma angustifolia</i>	3	3	2	2	10	11.5
<i>Bryonopsis laciniosa</i>	3	2	3	3	11	11.0
<i>Curculigo orchioides</i>	4	2	3	2	11	11.0
<i>Solanum nigrum</i>	2	3	2	4	11	10.5
<i>Moringa oleifera</i>	2	4	2	2	10	10.0

**Chlorophytum spp.*, *Pterocarpus marsupium*, *Sterculia urens*, *Boswellia serrata*, *Butea monosperma* are recommended for inclusion in the list of prioritized species for Central zone. (Dr. A.K. Singh, Scientist & Head, Technology & Business Development, CIMAP, Lucknow).

***Piper betel* is also recommended to be included in the list of Central zone. (Dr. J.P. Chourasia, Senior Scientist, CSIR, New Delhi).

Annexure III. List of Priority Species for Western Himalayan Region

Species name	Rating: Supply-side considerations		Rating: Demand side considerations		Gross rating (Regional scale)	Average ratings (National scale)
	Conservation value CV	Cultivation prospects CP	Value in local use VLU	Value in far/ larger markets VFM		
Priority I						
<i>Swertia chirayita</i>	5	5	3	5	18	18.5
<i>Aconitum heterophyllum</i>	5	3	5	5	18	18.0
<i>Taxus baccata</i> subsp. <i>wallichiana</i>	5	1	5	5	16	18.0
<i>Podophyllum hexandrum</i>	5	2	5	5	17	17.5
<i>Paris polyphylla</i>	5	2	5	5	17	17.0
<i>Gloriosa superba</i>	5	2	4	4	15	16.2
<i>Angelica glauca</i>	5	1	5	5	16	16.0
<i>Dactylorhiza hatagirea</i>	5	1	5	5	16	16.0
<i>Myrica esculenta</i>	4	2	5	5	16	16.0
<i>Nardostachys grandiflora</i>	5	1	5	5	16	16.0
<i>Picrorhiza kurroo</i>	5	1	1	5	12	16.0
<i>Sapindus mukorossi</i>	1	5	5	5	16	16.0
<i>Saussurea costus</i>	5	1	5	5	16	16.0
<i>Arnebia benthamii</i>	5	1	5	4	15	15.0
<i>Arnebia euchroma</i>	5	1	5	4	15	15.0
<i>Rheum australe</i>	5	1	4	5	15	15.0
<i>Rheum moorcroftianum</i>	5	1	4	5	15	15.0
Priority II						
<i>Aconitum ferox</i>	5	3	2	4	14	14.0
<i>Allium stracheyi</i>	3	4	5	2	14	14.0
<i>Bunium persicum</i>	3	3	5	3	14	14.0
<i>Delphinium denudatum</i>	5	1	3	5	14	14.0
<i>Hippophae rhamnoides</i>	5	1	5	3	14	14.0
<i>Pistacia kbinjuk</i>	2	5	2	5	14	14.0
<i>Rheum webbianum</i>	3	1	5	5	14	14.0
<i>Valeriana jatamansi</i>	5	1	3	5	14	14.0
<i>Carum carvi</i>	2	3	5	3	13	13.0
<i>Oroxylum indicum</i>	3	1	5	3	12	13.0
<i>Polygonatum cirrbifolium</i>	5	1	2	5	13	13.0
<i>Polygonatum multiflorum</i>	5	1	2	5	13	13.0
<i>Polygonatum verticillatum</i>	5	1	2	5	13	13.0
<i>Acorus calamus</i>	4	1	3	5	13	12.8
<i>Dioscorea deltoidea</i>	5	1	3	3	12	12.0
<i>Gentiana kurroo</i>	4	2	1	5	12	12.0
<i>Thalictrum foliolosum</i>	2	1	3	5	11	11.0
<i>Saussurea obvallata</i>	5	1	5	1	12	10.0

Annexure IV. List of Priority Species for Northern Plains

Species name	Rating: Supply-side considerations		Rating: Demand side considerations		Gross rating (Regional scale)	Average ratings (National scale)
	Conservation value CV	Cultivation prospects CP	Value in local use VLU	Value in far/larger markets VFM		
Priority I						
<i>Rauwolfia serpentina</i>	5	5	5	5	20	19.2
<i>Emblica officinalis</i>	2	5	5	5	17	17.5
<i>Tinospora cordifolia</i>	5	5	5	5	20	17.0
<i>Withania somnifera</i>	1	5	5	5	16	17.0
<i>Glycyrrhiza glabra</i>	3	5	5	5	18	16.7
<i>Centella asiatica</i>	5	4	3	5	17	16.5
<i>Terminalia chebula</i>	3	3	5	5	16	16.5
<i>Gloriosa superba</i>	5	3	1	5	14	16.2
<i>Ocimum sanctum</i>	3	4	5	4	16	16.0
<i>Gymnema sylvestre</i>	4	5	3	5	17	15.8
<i>Coleus forskohlii</i>	5	4	2	4	15	15.0
Priority II						
<i>Phyllanthus amarus</i>	3	4	4	5	16	14.5
<i>Aegle marmelos</i>	4	2	4	4	14	14.0
<i>Asparagus racemosus</i>	2	3	3	4	12	14.0
<i>Azadirachta indica</i>	3	1	5	5	14	14.0
<i>Plumbago zeylanica</i>	3	3	1	4	11	14.0
<i>Bacopa monnieri</i>	4	4	2	3	13	13.0
<i>Cissampelos pareira</i>	5	1	3	4	13	13.0
<i>Plantago ovata</i>	1	3	4	5	13	13.0
<i>Acorus calamus</i>	4	2	2	4	12	12.8
<i>Acacia catechu</i>	4	1	2	5	12	12.0
<i>Aloe barbadensis</i>	4	2	3	3	12	12.0
<i>Boerhaavia diffusa</i>	2	1	5	4	12	12.0
<i>Chlorophytum tuberosum</i>	2	1	5	4	12	12.0
<i>Acacia nilotica</i>	3	1	3	4	11	11.0
<i>Cymbopogon citratus</i>	1	4	1	5	11	11.0
<i>Hibiscus micranthus</i>	3	2	2	4	11	11.0
<i>Solanum nigrum</i>	2	2	3	3	10	10.5

Annexure V. List of Priority Species for Western Zone

Species name	Rating: Supply-side considerations		Rating: Demand side considerations		Gross rating (Regional scale)	Average ratings (National scale)
	Conservation value CV	Cultivation prospects CP	Value in local use VLU	Value in far/larger markets VFM		
Priority I						
<i>Chlorophytum borivillianum</i>	5	5	5	5	20	20.0
<i>Piper betel</i>	5	5	5	5	20	20.0
<i>Andrographis paniculata</i>	5	5	5	5	20	19.3
<i>Rauwolfia serpentina</i>	5	5	5	5	20	19.2
<i>Santalum album</i>	5	5	5	5	20	18.5
<i>Garcinia indica</i>	5	3	5	5	18	17.5
<i>Piper longum</i>	5	5	5	5	20	17.3
<i>Commiphora wightii</i>	5	2	5	5	17	17.0
<i>Stevia rebaudiana</i>	2	5	5	5	17	17.0
<i>Withania somnifera</i>	3	4	5	5	17	17.0
<i>Glycyrrhiza glabra</i>	5	3	5	5	18	16.7
<i>Terminalia chebula</i>	2	1	4	5	12	16.5
<i>Gloriosa superba</i>	4	2	3	4	13	16.2
<i>Tecomella undulata</i>	5	3	4	4	16	16.0
<i>Gymnema sylvestre</i>	5	1	5	5	16	15.8
<i>Celastrus paniculata</i>	4	2	5	3	14	15.5
<i>Sterculia urens</i>	5	1	4	5	15	15.0
Priority II						
<i>Pterocarpus marsupium</i>	5	1	4	4	14	14.0
<i>Calligonum polygonoides</i>	5	1	4	3	13	13.0
<i>Oroxylum indicum</i>	5	2	3	5	15	13.0
<i>Sapindus emarginatus</i>	2	2	5	4	13	13.0
<i>Hemidesmus indicus</i>	3	1	3	4	11	12.8
<i>Blepharis indica</i>	4	3	3	2	12	12.0
<i>Dioscorea bulbifera</i>	4	2	3	3	12	12.0
<i>Eclipta prostrata</i>	2	2	4	4	12	12.0
<i>Holarrhena antidysenterica</i>	2	1	5	4	12	12.0
<i>Mesua ferrea</i>	3	2	2	5	12	12.0
<i>Withania coagulans</i>	4	4	2	2	12	12.0
<i>Leptadenia reticulata</i>	3	2	3	3	11	11.0

* *Mollna spicata*, *Diosoxylon malabaricum*, *Myristica dactyloides* and *Piper trichocarpa* are suggested for prioritization in the list of western region (Dr. Veena Gupta, Principal Scientist, NBPGR, Delhi).

Annexure VI(a). List of Priority Species for North Eastern Region

Species name	Rating: Supply-side considerations		Rating: Demand side considerations		Gross rating (Regional scale)	Average ratings (National scale)
	Conservation value CV	Cultivation prospects CP	Value in local use VLU	Value in far/larger markets VFM		
Priority I						
<i>Coptis teeta</i>	5	5	5	5	20	20.0
<i>Panax pseudo ginseng</i>	5	5	5	5	20	20.0
<i>Aquillaria agallocha</i>	5	4	5	5	19	19.0
<i>Swertia chirayita</i>	5	4	5	5	19	18.5
<i>Taxus baccata</i> subsp. <i>wallichiana</i>	5	5	5	5	20	18.0
<i>Terminalia bellirica</i>	3	2	5	5	15	17.7
<i>Podophyllum hexandrum</i>	5	3	5	5	18	17.5
<i>Zantboxylum armatum</i>	5	2	5	5	17	17.0
<i>Ammomum subulatum</i>	3	3	5	5	16	16.0
<i>Hardwickia javanica</i>	4	4	4	4	16	16.0
<i>Picrorrhiza kurrooa</i>	5	5	5	5	20	16.0
<i>Rheum nobile</i>	5	4	5	2	16	16.0
<i>Costus speciosus</i>	4	5	5	4	18	15.5
Priority II						
<i>Gymnocardia odorata</i>	3	3	5	2	13	13.0
<i>Gymnocladus assamicus</i>	5	2	5	1	13	13.0
<i>Gaultheria fragrantissima</i>	4	1	3	4	12	12.0
<i>Potentilla fulgens</i>	4	2	3	2	11	11.0
<i>Saussurea obvallata</i>	5	1	1	1	8	10.0
<i>Meconopsis nepaulensis</i>	5	1	1	0	7	7.0

* Additional species suggested for inclusion are *Garcinia kurzii*, *Entada phaseoloides*, *Sapindus mukorsii*, *Oroxylum indica*, *Withania somnifera*, *Valeriana hardwickii*, *Tinospora cordifolia*, *Nardostachys grandiflora*, *Illicium griffithii*, *Orchis latifolia*, *Dioscorea deltoidea*, *Aconitum ferox*, *Piper mullesua*, *Gymnadaenia orchidis*, *Acorus calamus*, *Amentotaxus assamicus*, *Trichosenthes cucumerina*, *Ephedra gerardiana* var. *sikkimensis*, *Rheum emodi*, *Cpdiopsis sinensis* (Dr. P.R. Gajurel, Lecturer NERIST)

Annexure VI(b). List of Priority Species for Eastern Region

Species name	Rating: Supply-side considerations		Rating: Demand side considerations		Gross rating (Regional scale)	Average ratings (National scale)
	Conservation value CV	Cultivation prospects CP	Value in local use VLU	Value in far/larger markets VFM		
Priority I						
<i>Andrographis paniculata</i>	5	5	4	5	19	19.3
<i>Rauvolfia serpentina</i>	5	4	4	5	18	19.2
<i>Terminalia bellirica</i>	4	5	5	4	18	17.7
<i>Emblica officinalis</i>	4	5	5	4	18	17.5
<i>Piper longum</i>	5	4	3	4	16	17.3
<i>Tinospora cordifolia</i>	3	2	4	5	14	17.0
<i>Glycyrrhiza glabra</i>	2	5	4	3	14	16.7
<i>Terminalia chebula</i>	5	4	4	5	18	16.5
<i>Celastrus paniculata</i>	4	4	5	4	17	15.5
Priority II						
<i>Phyllanthus amarus</i>	4	2	4	3	13	14.5
<i>Asparagus racemosus</i>	2	5	2	4	13	14.0
<i>Cyperus scariosus</i>	5	3	3	4	15	14.0
<i>Plumbago zeylanica</i>	4	4	5	4	17	14.0
<i>Chlorophytum arundinaceum</i>	3	5	3	4	15	13.5
<i>Mucuna pruriens</i>	3	3	4	3	13	13.0
<i>Acorus calamus</i>	3	2	3	3	11	12.8
<i>Hemidesmus indicus</i>	3	2	3	2	10	12.8
<i>Eclipta prostrata</i>	4	3	2	3	12	12.0
<i>Curcuma angustifolia</i>	4	2	4	3	13	11.5

Annexure VII. List of Priority Species for Southern Zone

Species name	Rating: Supply-side considerations		Rating: Demand side considerations		Gross rating (Regional scale)	Average ratings (National scale)
	Conservation value CV	Cultivation prospects CP	Value in local use VLU	Value in far/larger markets VFM		
Priority I						
<i>Trichodesma zeylanicum</i>	5	5	5	5	20	20.0
<i>Rauwolfia serpentina</i>	5	4	4	5	18	19.2
<i>Santalum album</i>	5	3	4	5	17	18.5
<i>Garcinia indica</i>	4	4	4	5	17	17.5
<i>Piper longum</i>	3	4	4	5	16	17.3
<i>Solanum torvum</i>	5	4	4	4	17	17.0
<i>Piper nigrum</i>	3	4	4	5	16	16.5
<i>Gloriosa superba</i>	5	5	5	5	20	16.2
<i>Curcuma amada</i>	4	4	4	4	16	16.0
<i>Curcuma aromatica</i>	4	4	4	4	16	16.0
<i>Gynemna sylvestre</i>	3	3	3	4	13	15.8
<i>Costus speciosus</i>	3	4	4	2	13	15.5
<i>Plumbago rosea</i>	4	2	4	5	15	15.0
Priority II						
<i>Asparagus racemosus</i>	3	3	4	5	15	14.0
<i>Plumbago zeylanica</i>	4	2	4	5	15	14.0
<i>Punica granatum</i>	2	4	4	4	14	14.0
<i>Chlorophytum arundinaceum</i>	3	3	2	4	12	13.5
<i>Bacopa monnieri</i>	1	4	4	4	13	13.0
<i>Mucuna pruriens</i>	3	4	2	5	14	13.0
<i>Oroxylum indicum</i>	4	3	3	2	12	13.0
<i>Pterocarpus santalinus</i>	4	3	4	2	13	13.0
<i>Acorus calamus</i>	1	4	4	5	14	12.8
<i>Hemidesmus indicus</i>	4	4	4	4	16	12.8
<i>Chlorophytum tuberosum</i>	3	3	2	4	12	12.0
<i>Madhuca indica</i>	3	3	3	3	12	12.0
<i>Wrightia tinctoria</i>	3	3	4	2	12	12.0
<i>Cymbopogon flexuosus</i>	1	4	1	5	11	11.0
<i>Cassia senna</i>	1	3	2	4	10	10.0

Annexure VIII. Regional Species Lists for Action Recommendations

A. Central Zone						
Species	Strategy A	Strategy B				Strategy C
	R&D for Cultivation	Conservation Strategy Development	Providing Support for Cultivation	Cultivation for local consumption	Market Linkages & Post Harvest Facilities	Market Promotion
<i>Saraca asoca</i>		✓	✓	✓	✓	
<i>Terminalia arjuna</i>		✓	✓	✓	✓	
<i>Andrographis paniculata</i>		✓	✓	✓	✓	
<i>Rauwolfia serpentina</i>		✓	✓	✓	✓	
<i>Terminalia bellirica</i>		✓	✓	✓	✓	
<i>Withania somnifera</i>			✓	✓	✓	
<i>Centella asiatica</i>		✓	✓	✓	✓	
<i>Piper nigrum</i>		✓	✓	✓	✓	
<i>Terminalia chebula</i>		✓	✓	✓	✓	
<i>Gloriosa superba</i>		✓	✓	✓	✓	
<i>Gymnema sylvestre</i>		✓	✓	✓	✓	
<i>Asparagus racemosus</i>		✓	✓	✓	✓	
<i>Cyperus scariosus</i>	✓	✓				✓
<i>Plumbago zeylanica</i>			✓	✓		✓
<i>Mucuna pruriens</i>	✓			✓		✓
<i>Acorus calamus</i>		✓	✓			✓
<i>Hemidesmus indicus</i>		✓	✓			✓
<i>Adhatoda zeylanica</i>	✓					✓
<i>Curcuma angustifolia</i>	✓					✓
<i>Bryonopsis laciniosa</i>	✓					✓
<i>Curculigo orchbioides</i>	✓	✓				✓
<i>Solanum nigrum</i>	✓				✓	
<i>Moringa oleifera</i>			✓			✓

B. Western Himalayas						
Species	Strategy A	Strategy B			Strategy C	
	R&D for Cultivation	Conservation Strategy Development	Providing Support for Cultivation	Cultivation for local consumption	Market Linkages & Post Harvest Facilities	Market Promotion
<i>Swertia chirayita</i>		✓	✓		✓	
<i>Aconitum heterophyllum</i>	✓	✓		✓	✓	
<i>Taxus baccata</i> subsp. <i>wallichiana</i>	✓	✓		✓	✓	
<i>Podophyllum hexandrum</i>	✓	✓		✓	✓	
<i>Paris polyphylla</i>	✓	✓		✓	✓	
<i>Gloriosa superba</i>	✓	✓		✓	✓	
<i>Angelica glauca</i>	✓	✓		✓	✓	
<i>Dactylorhiza hatagirea</i>	✓	✓		✓	✓	
<i>Myrica esculenta</i>	✓	✓		✓	✓	
<i>Nardostachys grandiflora</i>	✓	✓		✓	✓	
<i>Picrorhiza kurroo</i>	✓	✓		✓	✓	
<i>Sapindus mukorossi</i>	✓	✓	✓	✓	✓	
<i>Saussurea costus</i>	✓	✓		✓	✓	
<i>Arnebia benthamii</i>	✓	✓		✓	✓	
<i>Arnebia euchroma</i>	✓	✓		✓	✓	
<i>Rheum australe</i>	✓	✓		✓	✓	
<i>Rheum moorcroftianum</i>	✓	✓		✓	✓	
<i>Aconitum ferox</i>	✓	✓			✓	
<i>Allium stracheyi</i>	✓		✓	✓		✓
<i>Bunium persicum</i>	✓			✓		✓
<i>Delphinium denudatum</i>	✓	✓			✓	
<i>Hippophae rhamnoides</i>	✓	✓		✓		✓
<i>Pistacia kbinjuk</i>			✓		✓	
<i>Rheum webbianum</i>	✓			✓	✓	
<i>Valeriana jatamansi</i>	✓	✓			✓	
<i>Carum carvi</i>	✓			✓		✓
<i>Oroxylum indicum</i>	✓			✓		✓
<i>Polygonatum cirrhifolium</i>	✓	✓			✓	
<i>Polygonatum multiflorum</i>	✓	✓			✓	
<i>Polygonatum verticillatum</i>	✓	✓			✓	
<i>Acorus calamus</i>	✓	✓			✓	
<i>Dioscorea deltoidea</i>	✓	✓				✓
<i>Gentiana kurroo</i>	✓	✓			✓	
<i>Thalictrum foliolosum</i>	✓				✓	
<i>Saussurea obvallata</i>	✓	✓		✓		✓

C. Northern Plains						
Species	Strategy A	Strategy B			Strategy C	
	R&D for Cultivation	Conservation Strategy Development	Providing Support for Cultivation	Cultivation for local consumption	Market Linkages & Post Harvest Facilities	Market Promotion
<i>Rauwolfia serpentina</i>		✓	✓	✓	✓	
<i>Embllica officinalis</i>			✓	✓	✓	
<i>Tinospora cordifolia</i>		✓	✓	✓	✓	
<i>Withania somnifera</i>			✓	✓	✓	
<i>Glycyrrhiza glabra</i>			✓	✓	✓	
<i>Centella asiatica</i>		✓	✓		✓	
<i>Terminalia chebula</i>	✓			✓	✓	
<i>Gloriosa superba</i>	✓	✓			✓	
<i>Ocimum sanctum</i>			✓	✓	✓	
<i>Gymnema sylvestre</i>		✓	✓		✓	
<i>Coleus forskohlii</i>		✓	✓		✓	
<i>Phyllanthus amarus</i>			✓	✓	✓	
<i>Aegle marmelos</i>	✓	✓		✓	✓	
<i>Asparagus racemosus</i>	✓				✓	
<i>Azadirachta indica</i>	✓			✓	✓	
<i>Plumbago zeylanica</i>	✓				✓	
<i>Bacopa monnieri</i>		✓	✓			✓
<i>Cissampelos pareira</i>	✓	✓			✓	
<i>Plantago ovata</i>	✓			✓	✓	
<i>Acorus calamus</i>	✓	✓			✓	
<i>Acacia catechu</i>	✓	✓			✓	
<i>Aloe barbadensis</i>	✓	✓				✓
<i>Boerhaavia diffusa</i>	✓			✓	✓	
<i>Chlorophytum tuberosum</i>	✓			✓	✓	
<i>Acacia nilotica</i>	✓				✓	
<i>Cymbopogon citratus</i>			✓		✓	
<i>Hibiscus micranthus</i>	✓				✓	
<i>Solanum nigrum</i>	✓				✓	

D. Western Zone						
Species	Strategy A	Strategy B				Strategy C
	R&D for Cultivation	Conservation Strategy Development	Providing Support for Cultivation	Cultivation for local consumption	Market Linkages & Post Harvest Facilities	Market Promotion
<i>Chlorophytum borivillianum</i>		✓	✓	✓	✓	
<i>Piper betel</i>		✓	✓	✓	✓	
<i>Andrographis paniculata</i>		✓	✓	✓	✓	
<i>Rauvolfia serpentina</i>		✓	✓	✓	✓	
<i>Santalum album</i>		✓	✓	✓	✓	
<i>Garcinia indica</i>	✓	✓		✓	✓	
<i>Piper longum</i>		✓	✓	✓	✓	
<i>Commiphora wightii</i>	✓	✓		✓	✓	
<i>Stevia rebaudiana</i>			✓	✓	✓	
<i>Withania somnifera</i>			✓	✓	✓	
<i>Glycyrrhiza glabra</i>	✓	✓		✓	✓	
<i>Terminalia chebula</i>	✓			✓	✓	
<i>Gloriosa superba</i>	✓	✓			✓	
<i>Tecomella undulata</i>	✓	✓		✓	✓	
<i>Gymnema sylvestre</i>	✓	✓		✓	✓	
<i>Celastrus paniculata</i>	✓	✓		✓		✓
<i>Sterculia urens</i>	✓	✓		✓	✓	
<i>Pterocarpus marsupium</i>	✓	✓		✓	✓	
<i>Calligonum polygonoides</i>	✓	✓		✓		✓
<i>Oroxylum indicum</i>	✓	✓			✓	
<i>Sapindus emarginatus</i>	✓			✓	✓	
<i>Hemidesmus indicus</i>	✓				✓	
<i>Blepharis sindica</i>	✓	✓				✓
<i>Dioscorea bulbifera</i>	✓	✓				✓
<i>Eclipta prostrata</i>	✓			✓	✓	
<i>Holarrhena antidysenterica</i>	✓			✓	✓	
<i>Mesua ferrea</i>	✓				✓	
<i>Withania coagulans</i>		✓	✓			✓
<i>Leptadenia reticulata</i>	✓					✓

E. North Eastern Zone						
Species	Strategy A	Strategy B				Strategy C
	R&D for Cultivation	Conservation Strategy Development	Providing Support for Cultivation	Cultivation for local consumption	Market Linkages & Post Harvest Facilities	Market Promotion
<i>Coptis teeta</i>		✓	✓	✓	✓	
<i>Panax pseudo ginseng</i>		✓	✓	✓	✓	
<i>Aquillaria agallocha</i>		✓	✓	✓	✓	
<i>Swertia chirayita</i>		✓	✓	✓	✓	
<i>Taxus baccata</i> subsp. <i>wallichiana</i>		✓	✓	✓	✓	
<i>Terminalia bellirica</i>	✓			✓	✓	
<i>Podophyllum hexandrum</i>	✓	✓		✓	✓	
<i>Zanthoxylum armatum</i>	✓	✓		✓	✓	
<i>Ammomum subulatum</i>	✓			✓	✓	
<i>Hardwickia javanica</i>		✓	✓	✓	✓	
<i>Picrorrhiza kurrooa</i>		✓	✓	✓	✓	
<i>Rheum nobile</i>		✓	✓	✓		✓
<i>Costus speciosus</i>		✓	✓	✓	✓	
<i>Gymnocardia odorata</i>	✓			✓		✓
<i>Gymnocladus assamicus</i>	✓	✓		✓		✓
<i>Gaultheria fragrantissima</i>	✓	✓			✓	
<i>Potentilla fulgens</i>	✓	✓				✓
<i>Saussurea obvallata</i>	✓	✓				✓
<i>Meconopsis nepaulensis</i>	✓	✓				✓

Eastern Zone						
Species	Strategy A	Strategy B				Strategy C
	R&D for Cultivation	Conservation Strategy Development	Providing Support for Cultivation	Cultivation for local consumption	Market Linkages & Post Harvest Facilities	Market Promotion
<i>Andrographis paniculata</i>		✓	✓	✓	✓	
<i>Rauwolfia serpentina</i>		✓	✓	✓	✓	
<i>Terminalia bellirica</i>		✓	✓	✓	✓	
<i>Emblia officinalis</i>		✓	✓	✓	✓	
<i>Piper longum</i>		✓	✓		✓	
<i>Tinospora cordifolia</i>	✓			✓	✓	
<i>Glycyrrhiza glabra</i>			✓	✓		✓
<i>Terminalia chebula</i>		✓	✓	✓	✓	
<i>Celastrus paniculata</i>		✓	✓	✓	✓	
<i>Phyllanthus amarus</i>	✓	✓		✓		✓
<i>Asparagus racemosus</i>			✓		✓	
<i>Cyperus scariosus</i>	✓	✓			✓	
<i>Plumbago zeylanica</i>		✓	✓	✓	✓	
<i>Chlorophytum arundinaceum</i>			✓		✓	
<i>Mucuna pruriens</i>	✓			✓		✓
<i>Acorus calamus</i>	✓					✓
<i>Hemidesmus indicus</i>	✓					✓
<i>Eclipta prostrata</i>	✓	✓				✓
<i>Curcuma angustifolia</i>	✓	✓		✓		✓

F. Southern Zone						
Species	Strategy A	Strategy B				Strategy C
	R&D for Cultivation	Conservation Strategy	Cultivation Support	Cultivation for local consumption	Mkt Linkages & Post Harvest Facilities	Mkt Promotion
<i>Trichodesma zeylanicum</i>		✓	✓	✓	✓	
<i>Rauwolfia serpentina</i>		✓	✓	✓	✓	
<i>Santalum album</i>	✓	✓		✓	✓	
<i>Garcinia indica</i>		✓	✓	✓	✓	
<i>Piper longum</i>			✓	✓	✓	
<i>Solanum torvum</i>		✓	✓	✓	✓	
<i>Piper nigrum</i>			✓	✓	✓	
<i>Gloriosa superba</i>		✓	✓	✓	✓	
<i>Curcuma amada</i>		✓	✓	✓	✓	
<i>Curcuma aromatica</i>		✓	✓	✓	✓	
<i>Gymnema sylvestre</i>	✓				✓	
<i>Costus speciosus</i>			✓	✓		✓
<i>Plumbago rosea</i>	✓	✓		✓	✓	
<i>Asparagus racemosus</i>	✓			✓	✓	
<i>Plumbago zeylanica</i>	✓	✓		✓	✓	
<i>Punica granatum</i>	✓		✓	✓	✓	
<i>Chlorophytum arundinaceum</i>	✓				✓	
<i>Bacopa monnieri</i>			✓	✓	✓	
<i>Mucuna pruriens</i>			✓		✓	
<i>Oroxylum indicum</i>	✓	✓				✓
<i>Pterocarpus santalinus</i>	✓	✓		✓		✓
<i>Acorus calamus</i>			✓	✓	✓	
<i>Hemidesmus indicus</i>		✓	✓	✓	✓	
<i>Chlorophytum tuberosum</i>	✓				✓	
<i>Madhuca indica</i>	✓					✓
<i>Wrightia tinctoria</i>	✓			✓		✓
<i>Cymbopogon flexuosus</i>	✓		✓		✓	
<i>Cassia senna</i>	✓				✓	

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