

A Framework for Strategic Management of Medicinal Plants

Manoj Kumar Sarcar

There is nothing in this universe which is non-medicinal, which cannot be made use of for many purposes and by many modes.

Sutra Ch.9 – verse 10, Ashtanga Hridaya

That all plants are potential sources of medicine has been recognised in Indian literature thousands of years ago. It is estimated that 70-80% people worldwide rely chiefly on traditional, largely herbal, medicine to meet their primary health care needs¹. Because of their sustained and strategic utility to a large section of people, medicinal plants (MPs) have become an important national and global resource. Estimates for the numbers of species used medicinally vary from 35,000 to 70,000 worldwide².

The three leading exporting countries of MPs are China (ca. 240,000 tonnes per year over 1991-1997), India (ca. 80,000 tonnes) and Germany³. Europe is the major trading centre for medicinal aromatic plants (MAPs) globally, with imports amounting to 440,000 tonnes in 1996⁴. The total number of MAPs in international trade has been estimated at around 2500 species⁵, of which 880 species are commonly used in trade and industry in India⁶.

The size of the global market for all herbal products is estimated at around US\$62 billion, with 85% of the total import of MPs being done by the 12 developed countries. In this, India's share is only about US\$153 million, or 0.3%⁷, although it is the second largest exporter of MAPs after China with an average export of 36750 tonnes/year⁸.

With over 50,000 herbal formulations in the codified medical tradition and known to rural communities in India, and 671124 registered medical practitioners practising traditional systems of medicine⁹, India occupies a unique position in MP-related health culture, health security, economic and resource context in the world. The traditional knowledge based herbal sector in India has an industrial turnover of Rs. 4200 crores (Rs. 42 billion) per annum, with a projected annual growth rate of 20-30%. There are around

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Destructive harvesting and over exploitation, anthropogenic pressures like destruction and fragmentation of natural habitat and introduction of exotic species have pushed a large number of medicinal plants to the threshold of survival. A threat assessment exercise carried out for southern and northern India has brought to notice around 200 Red listed MPs.

9000 registered and licensed manufacturing units. Of these, 95% are in the cottage and small-scale sector. China and India are two great producers of MPs having more than 40% of global biodiversity. There is thus enormous scope for India to emerge as a major player in global herbal product based medicines. However, this requires a grand strategic plan, which takes a holistic view of the entire situation to boost export¹⁰ and minimise import.

India is one of twelve countries in the world with mega-biodiversity areas. Of its estimated 45,000 plant species, 8000 are medicinal plants¹¹. However, more than 1000 species of Indian MPs may be under various degrees of threat¹². More than 85% of MPs used by the Indian industry are collected from the wild/forests¹³. Much of this is illegal (the Forest Department does not conduct sales except minor forest produce and non timber forest produce (MFP/NTFP), and more than 70% of the collection involves destructive harvesting from the wild¹⁴. Further, globalisation has brought in an upsurge in production of plant-based medicines and herbal products and accelerated the export of crude medicinal drugs in the international market. Destructive harvesting practices and over exploitation, anthropogenic pressures like destruction of habitat, fragmentation of natural habitat and introduction of exotic species have pushed a large number of medicinal plants to the threshold point of survival. A threat assessment exercise carried out for southern and northern India has brought to notice around 200 Red listed MPs.

Strategic Management of Threatened Medicinal Plants in Tamil Nadu: A Study

India does not have any institutionalised mechanisms for the

study of threatened MP species and their notification, or for the regulation of wild harvest. Little or no literature is available about the threat position of medicinal plants. It is imperative that we evolve methods for field identification and assessment of their threatened status and undertake recovery plans for their rehabilitation to protect the germplasm and prevent total genetic erosion of such species. To this end, we need to have definite institutional mechanisms for conducting training, research and regulation with short and long term goals.

Research Problem and Objectives

About 1000 MP species suffer from various degrees of threats and 206 of these need immediate attention for their protection and conservation. However, there is a lack of specific policy and legal provisions with appropriate management strategy for the conservation of medicinal plants.

The objectives of the present study were:

1. To propose a policy framework with strategies for conservation and sustainable utilisation of medicinal plants
2. To propose enlarging the existing legal provisions of conservation to include threatened medicinal plants
3. To provide a conservation development model for prioritising the management prescriptions of MPs
4. To provide species specific recommendations and an Action Plan for select MP species of the study area in Tamil Nadu.

Three research propositions were generated:

- 1) MPs are being depleted in their wild habitats
- 2) MPs do not get the attention they deserve from the custodians due to lack of appreciation of their value, utility and survival status
- 3) The Forest Department continues its priority for
 - protection and conservation of wild fauna rather than wild flora
 - excellence in technicalities with less emphasis on policy, vision, skills and competence.

Methodology

To prove the above propositions, the methodology was as follows: First field data was collected from two selected areas to identify the various stakeholders of MPs and map their shares. This data, along with that yielded by a literature survey,

was subjected to a detailed analysis to draw the findings of this study. Finally, specific recommendations for policy formulations, extensions of legal provisions for conservation and sustainable utilisation of MPs were developed based on the findings of this study. A conservation development model to prioritise stress level is proposed and an action plan suggested. Although the study was based on the Kalakad Mundanthurai Tiger Reserve (KMTR) and the state of Tamil Nadu, the proposed model of conservation would hold good for the entire country, and would be of help in framing government policies and implementation for conserving MPs. Such policies will afford the country great economic and other benefits.

Selection of Cases

The objective being conservation of Threatened Medicinal Plant (TMPs), the variation in performance of protection measures and conservation strategies adopted by different agencies for wild fauna and flora has been the main criteria for selection of the cases. Two areas were selected: the Kalakad Mundanthurai Tiger Reserve (KMTR) for detailed study and the forests of Tamil Nadu as a general study. For an additional perspective on the problem, the US Endangered Species Act (ESA) 1973 was also studied.

KMTR

The twin sanctuaries of Kalakad and Mundanthurai in Tirunelveli and Kanyakumari districts in Tamil Nadu form the southernmost of the country's seventeen tiger reserves. Declared a tiger reserve in 1988, KMTR forms a compact and contiguous unit of about 895 sq. km. With about 1156 vascular plants of which 95 are endemic to the region, and 462 of medicinal value of which 53 are listed as TMPs, KMTR can be considered a true representative area of the problems faced by MPs in India. It is controlled and managed by a single agency, the Tamil Nadu Forest Department, and is one of the Global Biodiversity Hot Spots (No. 25). It is the cultural home and birthplace of the Siddha system of medicine and is a well defined, well protected, well studied area, and a flagship for global conservation and protection work¹⁵.

Forests in Tamil Nadu

The forest area in Tamil Nadu is about 22,865 sq. km, about 17.55% of the total geographical area of the state¹⁶. There are five National Parks, 8 Wildlife Sanctuaries, 12 Bird Sanctuaries and two important Biosphere Reserves. KMTR is one such protected area. The Tamil Nadu Forest Department is managed by 9012 personnel, including planners and decision

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makers, executives and protection staff in the field.

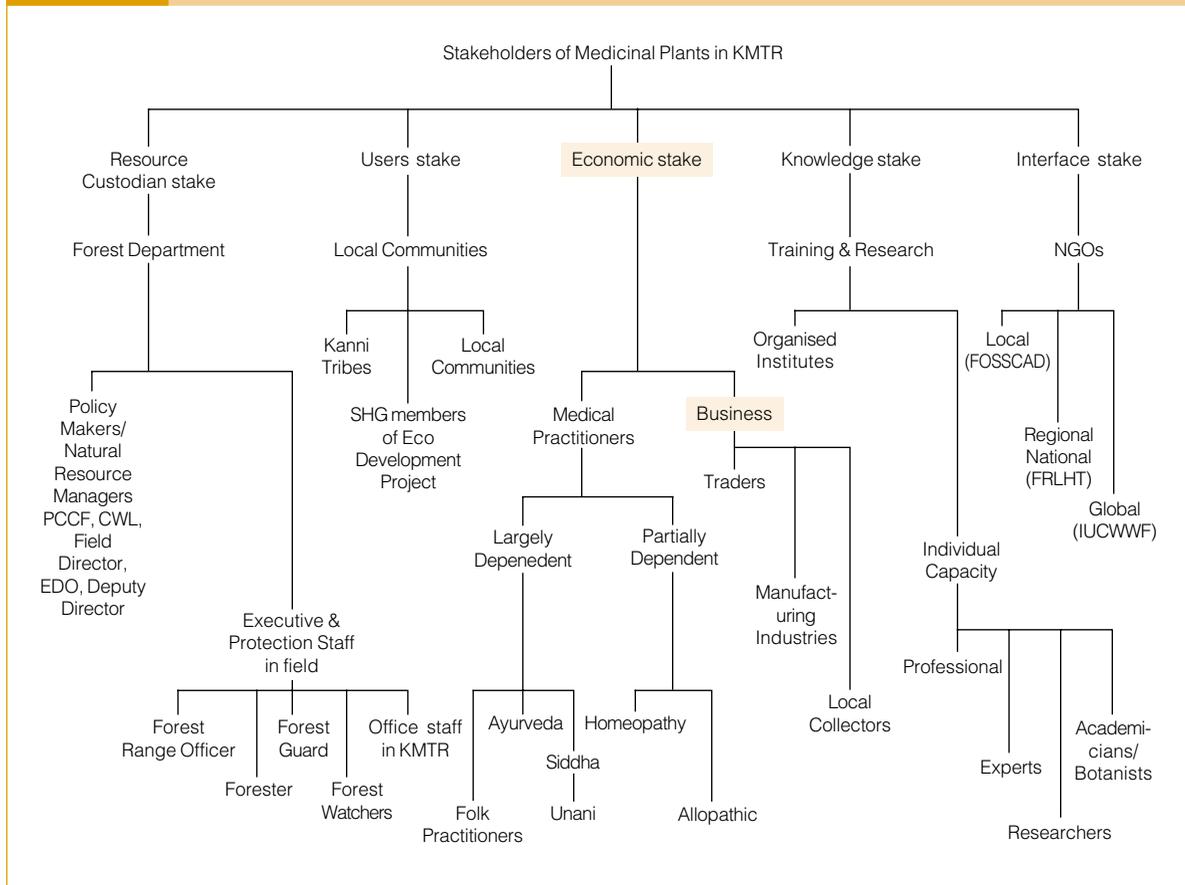
Identification of Stakeholders

The stakeholders of MPs can be grouped into five major groups, based on their stakes:

1. Resource custodian stake (State Forest Department)
2. Users stake (local communities like Kanni tribes, self-help groups under EDP)
3. Economic stake (medical practitioners under Indian systems of medicine (ISMs), business/commercial users like traders and manufacturers, and plant collectors)
4. Knowledge stake (training and research institutes and professional experts)
5. Interface stake (NGOs and voluntary agencies)

Questionnaire surveys and/or in-depth interviews with these stakeholders were employed to collect data. Exhibit 1 provides an overview of the stakeholders of MPs in KMTR.

The stakeholder tree of MPs as mapped for KMTR holds good for the country too as the Forest Department is the main resource custodian of MPs in each state/Union Territory. Their stake is to protect the natural resources and also to work as the bureaucratic policy elite in the mechanism of policy formulation/ reformation through the legislative policy elites of the country. Under the User stake, use of MPs by the local community varies from 60% to 92% in KMTR and may be similar in other parts of the country. However, the basic principle in the use of MPs is, the more remote the locality and habitat of the MPs, the greater the use of indigenous systems of medicine by local users. Under the Economic



stake, the most important subgroups of users are plant collectors, traders and manufacturing industries, whose effect on the growth of MPs in their natural habitat is non-transparent and destructive because of the use of parts like roots, bark, wood, stem and the whole plant. The use of MPs by medical practitioners is marginal. Subgroups under the Knowledge stake – research institutes, professional and experts – still work in an unorganised way and, except for a few centres, are at a rudimentary stage. The Interface stake is however growing fast with inspiring results.

Exploratory Study

An exploratory study was done in the Tamil Nadu Forest Department in two phases. The first phase of the study was to understand the working of the forest department, Tamil Nadu, in conservation and management of medicinal plants, with special reference to conservation of TMPs in KMTR. This phase of the study revealed that in KMTR area and in other protected areas and forest divisions, overall emphasis is on the special protection of wild fauna. The Tamil Nadu Forest Department has no special policy, acts or rules like those for Wild Fauna to protect MPs, other than the general

protection of being in reserve forests or protected areas. Nor does it have a strategy for their protection and conservation. The involvement and personal gain of a few stakeholders appears to be highly detrimental to the sustainable utilisation and development of MPs.

In the second phase of the exploratory study, the focus area for the present study was identified. Detailed interviews with the top and middle level management in the Forest Department covered four major areas – government policies and legislation; existing strategies for inventorisation, sustainable harvest, conservation and recovery planning; target-based monitoring of progress; and planning for protection and conservation of MPs available in KMTR. The interviews indicated some important focus areas for the study – policy and strategy formulations for conserving TMPs, sustainable harvesting and utilisation, and processes for reducing unsustainable harvest and illicit collection.

A detailed mapping of the stakeholders was followed by the formation of an inventory and shortlisting of seven TMPs for detailed study¹⁷. This was felt to be necessary in order to arrive at a set of definite recommendations, which could then

be extended to other situations/species. The criteria for selection of species for detailed study were: endemic character, decline in the wild, actively traded, reported rarity of occurrence in the wild, and phylogenetic distinction of the taxon. Care was taken to include all categories of habits, i.e. from herb, shrub, tree, climber and liana proportionately. The stress levels for each species was then plotted to diagnose individual problems, data analysis was carried out to make prescriptions, and a management strategy was evolved.

Results and Discussion

The three research propositions enumerated earlier were tested through analysis of field data, discussions and published data.

Research Proposition 1: MPs are being depleted in their wild habitats.

Many plants mentioned by members of the individual stakeholders groups are considered common. However, a comprehensive list prepared by recording the repeated frequency and sequencing them showed that all the commonly used medicinal plant species have been reported to be declining by field staff of KMTR, Kanni tribes and Nattu vaidyas or ISM doctors. This trend is also validated by the literature survey. Six of the seven MPs selected for detailed study were also perceived by the stakeholders to be declining in the wild.

Research Proposition 2: MPs do not get the attention they deserve from the custodians due to lack of appreciation of their value, utility and survival status.

Analysis of data derived from the field survey, interviews and literature survey reveals the following facts, which support the above proposition:

- No operation procedures exist to empower forest staff to check illegal harvesting of medicinal plants from forest areas
- Steady decline in population of MP species in forest areas
- No inventory of MPs undertaken by the custodian
- No checklist of threatened species exists in KMTR
- No budgetary provisions have been made for conservation or propagation of MPs in KMTR
- India is the world's second largest exporter of medicinal plant material, most of which is harvested from the wild and mainly from the forest. The trade in MPs has increased 100% from 1991-97, i.e. since globalisation. This trade is

Trade in MPs has increased 100% since globalisation. This trade is completely controlled by the informal sector with large traders operating from port towns. The custodian has no material stake in the trade, either in terms of revenue, or even in terms of surveillance of what is exported.

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- This lack of sensitivity to the floral resources by their custodians appears to be a global phenomena, with the US flora sharing a similar plight.
- No direct legal rule is in place to check illegal harvesting of MPs from any of the forest areas¹⁸. The only existing legal provisions in the existing Forests Acts cover six plant species in Schedule VI of the Wildlife Protection Amendment Act, 2002, and a list of 28 plants (including the above mentioned six plants) in which the Ministry of Commerce prohibits trade.
- The number of species is gradually declining in the study area and as many as 53 MPs are under threat.
- The Department is yet to undertake an inventory of the TMPs.
- A species-specific rehabilitation/recovery plan is yet to be undertaken by the custodian.
- Budgetary provision is yet to be made for taking up planting or afforestation work of medicinal plants.

Research Proposition 3: The Forest Department continues its priority for:

- protection and conservation of wild fauna rather than wild flora
- excellence in technicalities with less emphasis on policy, vision, skills and competence.

In KMTR, census of the wild fauna has been conducted many

Exhibit 2 Role of Existing Legal Provisions and Policies for Protection of MPs	
Legal Provisions	Role
Tamil Nadu Forest Act (1882)	Passive role
Indian Forest Act (1927)	Passive role
National Forest Policy (1952)	Passive role
Tamil Nadu Hill Areas (Preservation of Trees) Act (1955)	Passive role
Tamil Nadu Timber Transit Rules (1968)	Passive role
The Wildlife (Protection) Act (1972) — 6 MPs	Can play active role in species protection but it covers only 6 plants. Felling of trees in tiger reserves and other protected areas prohibited
Forest Conservation Act (1980)	Active role in habitat protection
National Forest Policy (1988)	Passive role
Directions of the Supreme court in W.P (Civil) No.202/1995 with W.P. (Civil) No.171/1996	Country-wide ban on indiscriminate felling of trees, irrespective of status of land
Export & Import Policy (1997-2002) – 28 MPs	Active role /no proper implementing mechanism.
Export & Import Policy (2002-2007) –Mainly Sandal and Red Sanders.	With gaps in enforcement.
Wildlife Protection Amendment Act (2002)	No addition over WLA 1972.
Biological Diversity Act (2002) Sec. 38	Only empowers Central Government to notify threatened species.

times. But the inventory of floral species, the checklist of MPs and number of threatened plants are yet to be prepared. Since the inception of the tiger project in KMTR, no resources have been allocated or spent on the rehabilitation of imperilled MPs. Under the Wildlife Protection Act 1972 and even in the Wildlife Protection Amendment Act 2002, only six plants received special protection (under Section VI), while many species of Wild Fauna including insects and beetles are listed as protected species (Schedules I-V). In the Biological Diversity Act 2002, only one section talks about empowerment of the central government to notify any species as threatened and make regulation on the same. Exhibit 2 shows the role of different existing legal provisions and policies to protect TMPs.

A historical perspective of the Policies and Acts formulated over the last 120 years in the forestry sector shows that more than 16 Acts and Policies have been made for the protection and conservation of fauna, and none for floral species. However, there has been a shift in the management policy of these natural resources over the years. During the colonial period, exploitation of the valuable timber from the natural forests, the revenue generation by commercial cash plantations and extraction of forest products were the main

concerns. In the post-independence early plan periods, agriculture and industry were the top priority sectors for the policy makers. Forest land was diverted for non-forestry purposes, and forests and the forestry sector were regarded as a source of livelihood and of raw material for commercial and industrial activities. In the 70s and 80s, with the commissioning of the Wildlife (Protection) Act, 1972 and the Forest Conservation Act (1980), wildlife and forest protection were given special importance. In 1990, the Government of India also circulated the Joint Forest Management resolution to all state governments, recommending the involvement of the local people in all forest management processes – planning, execution and benefit sharing. Social forestry thus became the mainstay.

In this context, it is interesting to compare the Indian policies with those of a developed nation like the US. The United States federal government has enacted an array of environmentally focused forestry legislation, for wilderness protection legislation since 1872. Among these, the *Endangered Species Act, 1973* is the most powerful act in species-specific protection and conservation strategies. However, the expenditure on rehabilitation and recovery

planning of floral species is minimal – less than 2% of the total expenditure. The rest is devoted to the protection and rehabilitation of fauna species. Thus apathy to species-specific protection and rehabilitation of plant species can be seen even in a highly developed country like the US¹⁹.

The concepts of biodiversity and management of natural resources of forests became a global concern during the 80s and 90s, and globalisation has triggered an upsurge in the production of plant-based medicines and herbal products. The resulting indiscriminate harvesting and export have put a large number of India's MPs under threat of extinction. Analysis of the working plan operations since 1900 shows that tree species of commercial value and fuel wood received far more importance than other habits like shrubs, herbs, climbers and grasses, which account for 66% of forests and include many species of great medicinal and commercial value. It is a matter of concern that when more than 1000 MPs suffer from various degrees of threat in the country, there is still no policy formulation/reformation in this sector of the forestry operations. In the absence of such species specific legal acts or policies for flora, illegally collected MPs from the tiger reserves or reserve forests could neither be identified (physically or by bio-chemical tests in forensic lab: due to lack of skill, expertise and policies), nor booked outside the forest boundary under any offence as it is not legally supported by the court of law.

SWOT Analysis

Based on the summary discussion and details collected from literature survey, a SWOT analysis for the existing management system of MPs was made (Exhibit 3).

Based on these findings, as well as the lessons from the case study of species preservation in the US particularly the strength of ESA 1973, an attempt is made to develop some policy recommendations. Further, a specific action plan for the seven select TMPs is made for the managers of KMTR, Tamil Nadu Forest Department.

Policy Recommendation and Action Plan

Based on the results and discussion above, some policy recommendations and action plans are developed for the strategic management, conservation and sustainable utilisation of MPs²⁰. Exhibit 4 depicts a policy recommendation tree for conservation and sustainable use of MPs.

State Medicinal Plant Policy – A Proposal

As forests are on the concurrent list in the Indian Constitution,

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the Government of India needs to issue some policy guidelines, under which each state can formulate its own medicinal plant policy. A draft policy guideline is suggested in Exhibit 5.

Floral Resource Survey and Inventorisation

Resource survey and inventorisation of MP species should be given top priority, for which training and skill development of staff, including field managers, is a vital step. A systematic study should be conducted in each unit (division level of the forest department) to list all species growing naturally in the area, including naturalised ones. A comprehensive plant resources inventory encompassing herbs, shrubs, climbers, lianas and trees will be useful to build a database, out of which species distribution and frequency, association, regeneration status, species interaction, availability of NTFP particularly medicinal plants etc. can be studied. Cost effective but reliable methods need to be evolved to carry out comprehensive plant resources inventory over extensive forests. Two methods that have been found to be suitable for ground enumeration after field-testing are the ordinate method and the line plot method²¹. These methods lend themselves to speed of execution and are also economical in terms of financial and manpower resources.

Strategic Issues

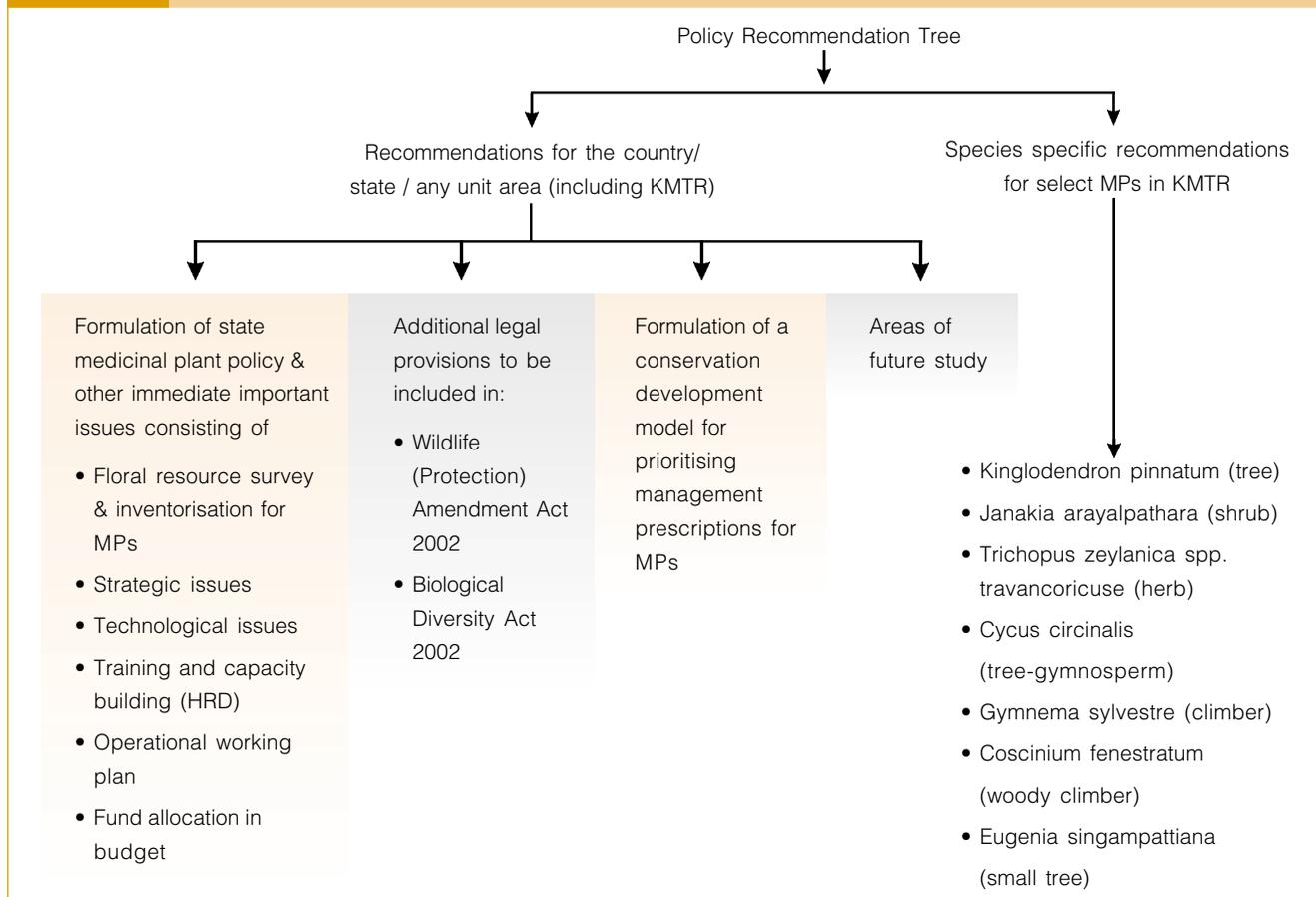
Habitat protection ensures species protection in general. But specific species with narrow spatial distribution zones i.e., endemic in nature for a particular area, whose population has gone down to a critical level, need special attention to be preserved in their natural habitat. Management intervention should include developing a systematic protocol – identification of plants that are in stress, preparation of

negative lists²² of plants, threat assessment and development of a recovery plan including regulated harvesting and

cultivation. Conservation could focus on valuable species, for instance those that provide life saving drugs.

Exhibit 3 SWOT Analysis	
Strengths	Weaknesses
<ul style="list-style-type: none"> • KMTR gets umbrella protection as Tiger Reserve. • Ca 1200 plant species of which Ca 462 are MPs available in compact area of KMTR. • Single Agency – TNFD works as custodian of these resources • Strong institutional framework of TNFD available for conservation and protection. • Various legislative Acts and Rules provided for habitat Conservation Action e.g. FCA, 1980; Wildlife (Protection) Amendment Act. 2002; BDA, 2002 • Very good protection work by field staff • Cooperation from 120 Village Forest Councils under EDP along buffer zone and reduction of biotic pressure of forest • Siddha system of medicine originated here; about 80% of population rely on traditional medicine system • Local people are well aware about MPs and their uses through the kitchen herbal garden • Setting up of National Medicinal Plants Board (NMPB) by GOI encouraging in-situ conservation of MPs may reduce the pressure on forest • Global acceptance of Ayurveda system of medicine • Traditional Knowledge Digital Library at the Central Institute for Medicinal and Threatened Plants, Lucknow. • Scientific institutions and human resources available. 	<ul style="list-style-type: none"> • No inventory of floral resource, comprehensive list of MPs, check list of TMPs, or any recovery plan of such TMPs has been made so far in the study area • Policy framework (e.g. Wildlife Protection Act) is biased towards fauna, does not provide for specific floral conservation • Although 85% of MPs used by Indian industry comes from wild/ forest, conservation and management of MPs is not seen as the mandate of FD • No specific legal support to deal with offences related to MPs • Awareness about the Indian medicinal heritage is weak • No technological know how to identify species other than gross plant/ Lack of coordination and concerted action among stakeholders • Lack of provision of financial support for conservation and protection of MPs • Weak in research and training • Despite large demand, India's contribution to the global market is <1%. Trade is unorganised, secretive, non transparent and opportunistic • Excessive regulatory regimes and lack of transparency in collection and trade • Lack of linkage in buyback arrangements • Demonstrated benefits for local communities from conservation effort insignificant.
Opportunities	Threats
<ul style="list-style-type: none"> • TNFD can be a nodal agency to coordinate among stakeholders • Tremendous opportunities in field of <ol style="list-style-type: none"> a) Research in conservation biology of threatened species, sustainable utilisation of MP resources (NWFP studies), and rehabilitation and recovery plan for TMPs b) Training of various kinds of stakeholders c) Conservation with community participation d) Opportunity to serve millions of households, Nattu vaidyas, ISM practitioners, R&D institutions, herbal manufacturing industries • Area is rich in biodiversity. Being world's second largest supplier of MPs, India can make use of developing model of conservation and sustainable use of its rich stock of MPs • International market is over US \$62 billion per year, and growing @ 7% per annum • Demand is about 2.5 lakh tonnes annually and growing @ 20% per year • Interest amongst financial institutions and donors • Government development programmes recognising MPs as a potential sector • Employment/income generating sector • Zeal for diversified medicinal products is increasing • All win game (Producer – price, Consumer – quality) • Products are in great demand in US/EU/Japan • R&D institutions for support; existence of NMPB and State MPBs. 	<ul style="list-style-type: none"> • Threats of extinction of several species in wild, presently ca. 53 MPs. No specific measures for rehabilitation and recovery plan of these TMPs • Destruction of habitat by diversion of forestland for non-forestry purpose. Proposed road connecting Tirunelveli to Tiruvananthapuram through KMTR • Excessive harvest of timber, fuel and MFP in past caused heavy loss of natural habitat. 28 forest enclaves inside KMTR cause biotic pressure to adjoining areas • Non availability of cultivation package of several MPs • Lack of extension activities • Understanding of conservation biology non-existent, possibility that conservation action may be too little too late • Unorganised sector • Wrong enforcement of regulations • Loss of traditional knowledge and bio-piracy of knowledge.

Exhibit 4 Policy Recommendation Tree for Conservation and Sustainable use of MPs



An effective modus operandi would be for the Ministry of Environment and Forests to conduct a centrally coordinated threat assessment exercise, comprising experts from government organisations like the National Biological

Authority and the Botanical Survey of India, state level research institutes and biodiversity boards, universities and colleges, and NGOs. The programme could be an annual time-bound nationwide programme with the state as the unit. This would

Exhibit 5 Proposed State Policy for Strategic Management of Medicinal Plants

Introduction	Transparency in all problems
Preamble	<ul style="list-style-type: none"> • Inventory MPs Resource: preparation of checklist and recovery plan, potential scope of MPs in India. • Legislation; enforcement mechanism
Approach	<ul style="list-style-type: none"> • Fringe Areas – Local Community Management (1988 Policy Joint Forest Management concept) • High Forests – Forest Development with other sister departments, stakeholders (1882 ACT, 1927 Policy, 1972 & 2002 WLPA, Export/Import with Additional Legal Provisions). • Outside Forest Areas – all stakeholders in coordination
Strategy	<ul style="list-style-type: none"> • Conservation • Cultivation • Marketing • Trade • Training and capacity building • Future research

yield a comprehensive checklist of TMPs, which can be used to prepare schedules of threatened plants to be included under the Wildlife Protection Amendment Act 2002, and the Biological Diversity Act 2002.

Technology Issues

More than 80% of potentially valuable biodiversity resources of the country are yet to be studied²³. Sophisticated biochemical technology is required for the study of these resources. Forensic biochemical laboratories also need to be

established for identification of seized plant material. Tissue culture and other technologies should be developed and facilitated for *in-situ* and *ex-situ* propagation of medicinal plants and their conservation (particularly critically endangered species without affecting the source material). Exhibit 6 represents a flow chart of technology issues related to identification, propagation and conservation of MPs.

Training and Capacity Building (HRD)

Mutual understanding, respect, trust and benefit flow sharing

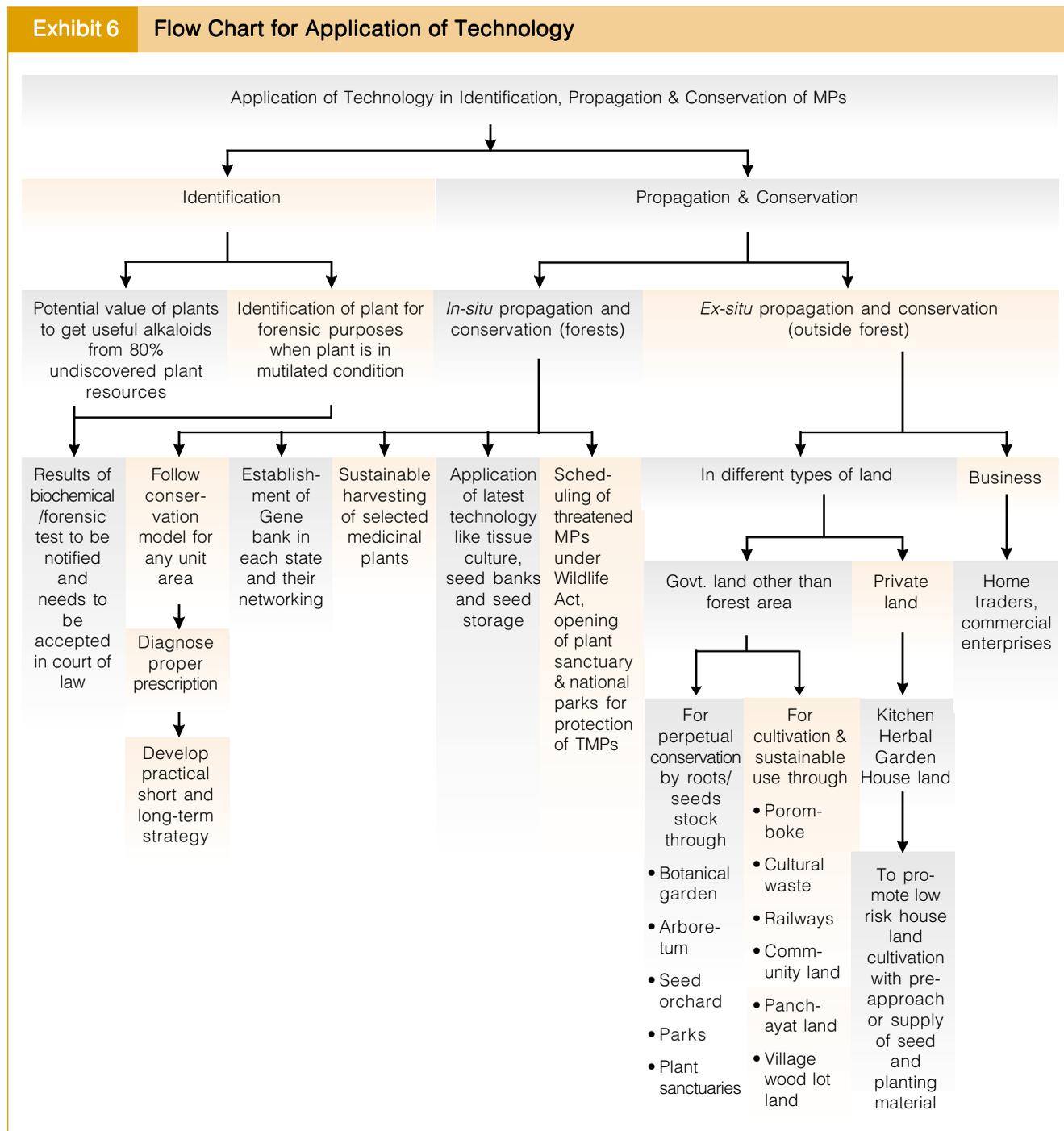
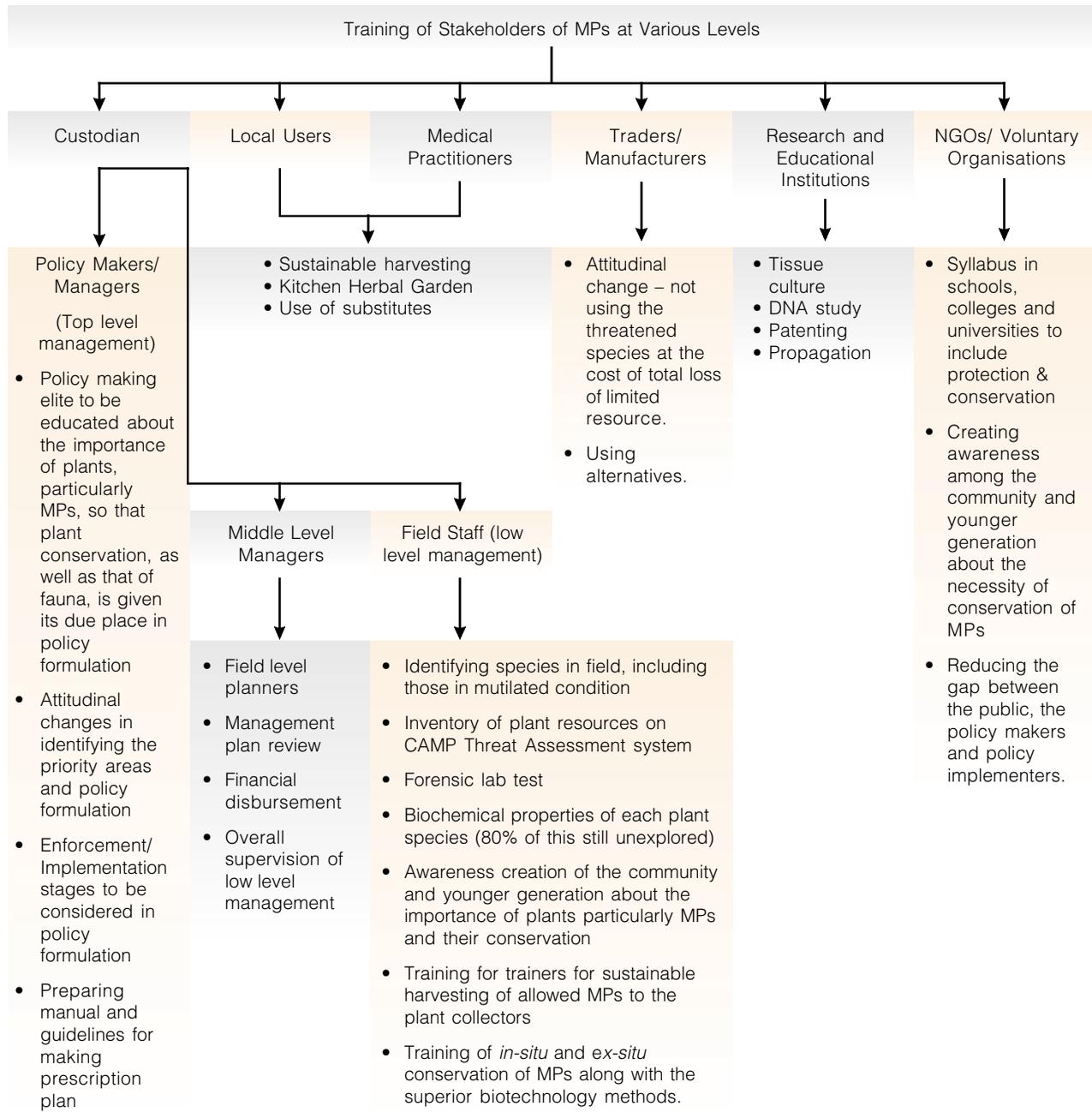


Exhibit 7 Flow Chart for Training of Stakeholders of MPs at Various Levels



are vital for the conservation and sustainable use of such resources. Therefore training and capacity building of the stakeholders, including foresters at all levels and the local people, is essential. Training packages need to be developed in the vernacular language for training local healers and traders. The MPs authority at the state level must ensure networking of all the stakeholders and continuous interaction and integration of their activities for strengthening the MPs management strategy; awards could be instituted for the best cultivator, best market linkage, best MP management effort

and so on. A flow chart showing the training field of various stakeholders is shown in Exhibit 7.

Operational Working Plans

Plant resources assessments for forestry practices are usually *ad hoc* and confined to tree species whether for formulating working plan prescriptions, harvesting or assessing regeneration status. Even working plans and resources surveys carried out in Tamil Nadu have not made any inventory of shrubs and herbs. The working plan of a unit

The market needs to be thoroughly studied to understand the stakes and movements of this valuable commodity. The surveillance mechanism of trade in MPs has to be researched in order to develop and put in place a system for monitoring the real volume of trade and the species traded and exported, especially at the ports.

area needs to follow a specific format, including the following steps²⁴: preparing a checklist of medicinal plants for each agro climatic region, to be provided to the forest manager and the executive and field staff; putting in place the institutional mechanism at DFO level for threat assessment and negative listing; preparing species-specific working plans; making arrangements for both *in-situ* and *ex-situ* propagation and conservation efforts; creating awareness among the local community; and making specific conservation and recovery plans for threatened plants.

Budget and Resource Allocation

Resource allocation in the budget for taking up both development and conservation work needs the special attention of the policy makers. Budget allocation to the forestry sector is inadequate, never more than 1% of the total allocation in the plan periods. This needs to be enhanced, while simultaneously making a specific budget plan allocation for protection of MPs under the Ministry of Environment and Forests.

Proposals for Additional Legal Provisions

It was expected that a number of threatened categories of plants would be added to the schedule in the Wildlife (Protection) Amendment Act 2002. However, we have failed to extend the list of threatened plants in the schedule. Separate schedules need to be created for the imperilled plants in either the Wildlife (Protection) Amendment Act or the Biological Diversity Act, based on the list of plants already available in Schedule VI of the WPAA, the Ministry of Commerce list of notified plants, 1997 IUCN Red list of Threatened Plants and

the CAMP lists of TMPs in southern and northern India. This then needs to be legislated as in the case of fauna species. It is suggested that 206 TMPs be covered under three separate Plant Schedules²⁵.

Development of Plans for Conservation of MPs

The process of planning for the conservation of MPs should include the following steps:

- Shortlisting of TMP species by District Forest Officer/ Wildlife Warden/ Deputy Director
- Stakeholders mapping in collaboration with social scientists
- Questionnaire survey format, Literature survey, preparation of scoring list with Threat status (X Axis) and Utility status (Y Axis), and interpolation of individual species based on their threat status and utility range
- Quadrant Analysis for species specific recommendations
- Making recommendations for including the threatened plants in schedule list of Wildlife (Protection) Amendment Act 2002.

Species-specific recommendations have been developed for KMTR, applying two frameworks prepared by Phansalkar²⁶ for Business Development Plans for the Conservation of MPs. Based on the threat status and utility/trade position of each species, operational plans have been developed. These include strategies such as population study, in-situ conservation, in-vitro multiplication, collection of propagules from the wild, afforestation, research and demonstration of sustainable harvesting techniques, developing manuals, establishing demo-plots and commercial nurseries, and skill training for field staff²⁷. The managers of KMTR may study these seven species and carry out operational work based on the field condition and the findings from this analysis.

Directions for Future Research

The medicinal plant trade shows a lot of price variation within a 200 km radius, indicating the extent to which the sector is unorganised and opaque. The market networks, pricing, trends and mechanisms of this sector need to be thoroughly studied to understand the stakes and movements of this valuable commodity. The surveillance mechanism of trade in MPs has to be researched in order to develop and put in place a system for monitoring the real volume of trade and the species traded and exported, especially at Tuticorin port.

Management of natural resources like MPs cannot follow

administrative resources boundaries. Boundaries are to be redrawn based on the natural ecological niche, as in the Medicinal Plants Conservation Areas designed by FRLHT Bangalore. These will form true conservation units for drawing up a scientific plan.

Other areas of potential research include: propagation techniques, seed storage and propagation materials; in-vitro multiplication of rare plants; species specific research; sustainable harvesting of MPs; local community management – health and food security; and research information management systems.

Conclusion

Major policy gaps exist in three areas of the management of MPs in the country. These are: resource conservation and augmentation, promotion of ISM, and organisation of transparent trade of MPs and their by-products. The first of these gaps has been discussed in detail above. For promotion of ISM, the active involvement of the Government of India is required in policy decisions, promotional strategy and investment in the ISM colleges and research institutes. Today more than 880 MP species are used in over 50,000 herbal formulations; the codified medical tradition has nearly 7 lakh registered medical practitioners, and 9000 registered and licensed manufacturing units, but the growth of the ISM sector has stagnated over the years. Teaching and research institutes, including the Central Council for Research in Ayurveda and Siddha, need to be strengthened with quality inputs. Public awareness of ISM needs to be created, and public and private partnership for building the domestic herbal industry encouraged. Finally, the export, import and other policies of the government have to be re-examined, and the many legal, technical and regulatory gaps plugged so that trade in MPs can be effectively monitored.

According to Raven²⁸, 'it is likely that a quarter of all species of Indian plants may be either extinct or on their way to extinction within 25 years, and the great majority of the species present now are likely to be extinct within a century if proper conservation efforts are not in place in time'. If steps are not taken to correct the existing faults in the system at all levels, there is a risk of great economic, cultural, environmental and genetic loss to the country. The protection and management of natural resources need support of various kinds – effective regulations, institutional mechanism and strong legislative support. Systematic short term and long term planning are equally necessary. It is the high time for the custodians of these valuable resources, as well as the authorities of ISM

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and the policy makers for trade and environment, to revamp the existing policy framework and management strategies. Systematic, coordinated and concerted efforts by all the stakeholders to manage both the resources and the technology will ensure that the rich potential of the sector is realised in a sustainable manner.

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