BIODIVERSITY AND CONSERVATION OF MEDICINAL PLANTS

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ABSTRACT

India is a vast repository of medicinal plants, accounting for more than 8,000 species in its natural habitat. Indian system of medicines (ISM) such as Siddha, Ayurveda, Unani and the Homeopathy use around 2,000 species of herbal plants for their therapeutic uses. There are around 50 species, widely used under cultivation. About 90 % demand of the herbal industry is met from the destructive forest collection. Though India has a rich biodiversity, the growing demand is putting a heavy strain on the existing resources. While the demand for medicinal plants is growing, some of them are increasingly being threatened in their natural habitat. This situation warrants for short listing conservation of these valuable resources for our own needs and for posterity.

INTRODUCTION

India, with its diverse agro-climatic conditions and regional topography, has been considered as the treasure house or botanical garden of plant genetic resources. Hence, India is recognized as one of the world's top 12 mega diversity nations. Our herbal wealth constitutes more than 8,000 species and accounts for around 50 % of all higher flowering plant species of India; around 70 % of the medicinal plants in the country are spread across the tropical forests of Western Ghats. However, available information shows that 1,800 species are used in Classical Indian systems of medicines. Ayurveda uses 1,200, Siddha – 900, Unani – 700, Amchi – 600, Tibetan – 450.

The emerging field of herbal products industry holds a great potential to the economic development of the Indian region. Usage of herbs as a source of food, medicine, fragrance, flavour, dyes and other items in Indian systems of medicine is in increasing trend. It is estimated that, 95 % of the medicinal plants used in Indian herbal industry today are collected from wild. About half a million tonnes of dry material is collected through destructive means indiscriminately and 1.65 lakh ha. of forest is cleaned and felled each year.

With the increase in population, rapid expansion of area under food and commercial crops, deforestation, extension of urban area, establishment of industries in rural areas, etc., there is considerable depletion of plant genetic resources wealth, many of them being in the process of extinction day by day. (Vijayalatha, 2004 and Singh, 2005).

In the present context of ‘back to nature’ in health care, it is very relevant that the valuable plant species are not only preserved but also their cultivation developed in order to meet the entire demand of the industries and export.

Unless steps are being taken to conserve and increase the cultivation of important plants, many of our native plant species will become extinct and endangered.

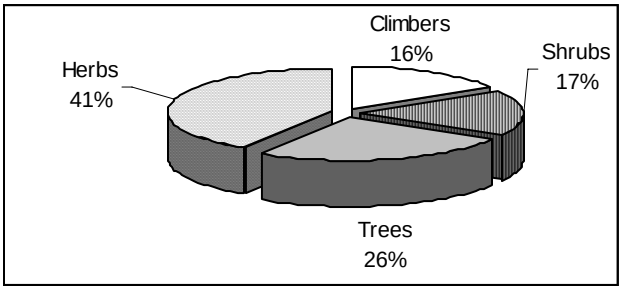
BIODIVERSITY – OVERVIEW

Although there are around 8,000 medicinal plant species used by different communities in India across different ecosystems, only around 10% of them (880 species) are in active trade. Among these, around 48 species are exported in the form of raw drugs and extracts, while around 42 species are imported. The wild populations of about 100 of the traded species are known to have declined, thereby making them to be considered threatened. This is the situation of raw drug trade in India that unfolds. Before ascertaining the reasons for this, let us try to understand the "what", "where" and "how much" of these raw drugs.

HOW MANY HERBS?

Habit wise analysis of these 880 medicinal plants, indicates that these are well distributed across different life forms with the majority belonging to the herbaceous category. The highest proportion of herbs (41%), including grasses, is followed by trees (26%), shrubs (17%) and climbers (16%) (Fig. 1).

Fig. 1. Proportion of different life forms of medicinal plant species in trade



BOTANICAL BASE

It is interesting to note that these 880 traded plants are distributed across 151 families. Of these 79% belong to the Dicots while the Monocots constitutes 11% followed by Pteridophytes 5% and Gymnosperms 3% and one percent each from Fungi and Lichens. This indicates that a very small proportion of raw drugs belong to the category of lower classes in the plant kingdom (Table 2).

Table 2 : Classwise representation of traded medicinal plants

Class	No. of Families
Dicots	119
Monocots	17
Pteridophytes	8
Gymnosperms	5
Fungi	1
Lichens	1

Familywise representation of these species is also quite interesting to note. The major share is from 10 families, viz., Bean family (Fabaceae), Aster family (Asteraceae), Castor family (Euphorbiaceae), Tamarind family (Caesalpiniaceae), Coriander family (Apiaceae), Basil family (Lamiaceae), Tomato family (Solanaceae), Cucumber family (Cucurbitaceae), Coffee family (Rubiaceae) and Hibiscus family (Malvaceae) (Table 3).

Table 3 : Familywise representation of Traded Medicinal plants

Family	Species
Fabaceae	67
Asteraceae	54
Euphorbiaceae	48
Caesalpiniaceae	41
Apiaceae	37
Lamiaceae	37
Solanaceae	35
Cucurbitaceae	32
Rubiaceae	29
Malvaceae	28

PART USED

These 880 plants yield a wide range of produce / parts that go as raw drugs. These include Roots (including tubers and rhizomes), Whole plants, barks, Stem (including wood), Fruits, Seeds, Flowers, Leaves, Gum (including resin) and others. There are 12,000 such botanical items (plant parts and products), which are obtained from these 880 species (Table 4).

Table 4 : Partwise representation of traded medicinal plants

Parts	No. of Entities
Root	326
Whole plant	167
Fruit	161
Seeds	141
Leaves	122
Bark	100
Flower	72
Stem	59
Gum	30
Others	22

As most of these raw drugs are obtained from wild collections, this table also gives you an idea of the extent of "destructive" collection inherent in medicinal plants trade. About 66% of these plant entities are harvested for their roots, bark, wood, stem and the whole plant.

REPRESENTATION OF TRADED MEDICINAL PLANTS ACROSS MEDICAL SYSTEMS

The Medical system wise representation of these 880 medicinal plants is another interesting point to note. It is found that the species are used widely across different medical systems. Ayurveda, Siddha, Unani, Tibetan, Folk, Homeopathy and Modern. Majority of these plants (82%) are used in Ayurveda system of medicine while the lowest share (7%) is by Modern system. Similarly, Siddha accounts for 58%, Unani for 53%, Homeopathy for 16% and Tibetan for 25 % (Table 5).

Table 5: Representation of traded medicinal plants across different Medical Systems

	Ayurveda	Folk	Homeo	Modern	Siddha	Tibetan	Unani	Medical system wise Proportion (%) of Traded Species
Ayurveda	**719**	462	126	49	475	215	449	82
Folk	462	**607**	99	44	408	178	343	69

Homeo	126	99	**140**	40	105	63	115	16
Modern	49	44	40	**65**	40	20	45	7
Siddha	475	408	105	40	**508**	193	366	58
Tibetan	215	178	63	20	193	**218**	190	25
Unani	449	343	115	45	366	190	**469**	53

GEOGRAPHIC DISTRIBUTION

The natural occurrence of traded species is another element of interest here. It is found that these species are distributed across different bio-geographic zones, diverse habitats and landscape elements. About 18% of these species are confined to Himalayan and Trans Himalayan zone including North East India while around 4% is restricted to Western Ghats and 0.5% is found only in the Desert zone. The rest of the species (around 77%) have a wide range of distribution across the other bio-geographic zones of the country (Table 6).

Table 6 : Examples of Traded species that occur in different Bio-geographic zones

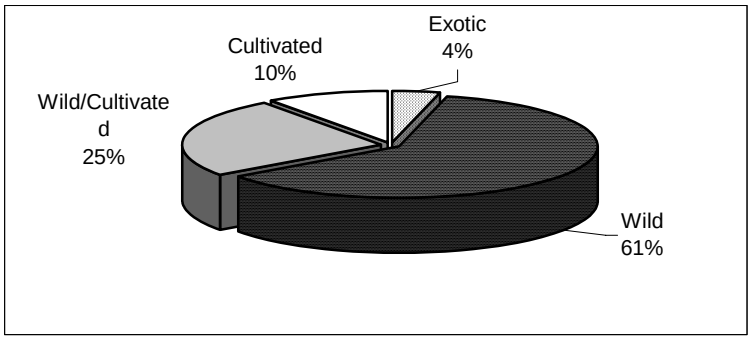
S. No.	Biogeographic zones (Biotic provinces)	Examples of the species
1.	**Trans – Himalayan – 1 (Tibetan – 1A)**	*Ephedra gerardiana, Hippophae rhamnoides, Physochlania praalta, Arnebia euchroma, Ferula jaeschkeana*
2.	**Himalayan – 2** **(North West Himalaya – 2A and West Himalaya – 2B)**	*Aconitum heterophyllum, Arnebia benthamii, Dactylorhiza hatagirea, Podophyllum hexandrum, Picrohiza kurroa, Pistacia chinensis.*
3.	**Himalayan – 2** **(Central Himalaya – 2C and East Himalaya – 2D)**	*Nardostachys grandiflora, Rubia sikkimensis, Coptis teeta, Polygonatum cirrhifolium, Swertia chirayata, Valeriana jatamansi, Rhododendron anthopogon, Taxus wallichiana.*
4.	**Desert – 3** **(Kutch – 3A, Thar – 3B)**	*Tecomella undulata, Tribulus rajasthanensis, Citrullus colocynthis, Commiphora wightii, Acacia nilotica*
5.	**Semi – Arid – 4** **(Punjab – 4A, Gujarat – Rajwar – 4B)**	*Balanites aegyptiaca, Withania coagulens, Tribulus alatus, Commiphora wightii, Boswellia serrata, Canscora, Acacia nilotica.*
6.	**Western Ghats – 5** **(Malabar coast – 5A;** **Western Ghats mountains –**	*Myristica malabarcia, Garcinia indica, Coscinium fenestratum, Hydnocarpus pentatandra, Garcinia gummigutta, Vateria indica,*

	5B)	*Nilgirianthus ciliatus.*
7.	**North East India – 8** **(Brahmaputra valley – 8A and Assam hills – 8B)**	*Aquilaria malacensis, Smilax glabra, Ambroma augusta, Hydnocarpus kurzii, Vetivaria zizaniodes.*
8.	**Deccan peninsula – 6** **(6A to 6E)**	*Embelia tsjeriam-cottam, Caesalpinia digyna, Screbera sweitenoides, Decalepis hamiltonii, Pterocarpus santalinus.*

ORIGIN AND SOURCE

Of these 880 species, nearly 538 (61%) species occur only in the wild (with no known cultivation), while 88 (10%) are recorded only under cultivation in India. However, 212 species (25%) are recorded both in wild and under cultivation. The remaining 42 (4%) are not recorded in the wild or under cultivation in India and, therefore, inferred to be originated in other countries (Fig. 5).

Fig. 5. Source of medicinal plants traded in India.



STATUS OF THESE TRADED PLANTS

The status of the natural populations of these plants is, however, not that encouraging. A Rapid Assessment of selected Medicinal plants of Peninsular India and North India for their threat status as per IUCN guidelines has revealed that the wild populations of 100 species are facing different degrees of threat.

Of these, 14 are threatened globally as these are endemic to India and deserve immediate conservation attention (Table 7).

Table 7: Endemic medicinal plants in trade

S.No.	Botanical Name	Red list status Global
1)	*Adhatoda beddomei*	CR
2)	*Butea monosperma var. lutea*	EN
3)	*Chlorophytum borivilanum*	VU
4)	*Cinnamomum macrocarpum*	VU
5)	*Decalepis hamiltonii*	EN
6)	*Garcinia indica*	VU
7)	*Gardenia gummifera*	VU
8)	*Heracleum candolleanum*	VU
9)	*Hydnocarpus pentandra*	VU
10)	*Myristica malabarica*	VU
11)	*Nilgirianthus ciliatus*	EN
12)	*Pterocarpus santalinus*	EN
13)	*Trichopus zeylanicus Subsp. travancoris*	EN
14)	*Vateria indica*	VU

IUCN RED LIST STATUS: CR- Critically Endangered, EN-Endangered, VU-Vulnerable

The alarming situation of the involvement of “threatened” species, in trade, is not peculiar to India alone. The Chinese Red Data Book lists 388 plant species, of which 69 are found to be in trade.

MEDICINAL PLANTS IMPORTED INTO INDIA

Of the 880 species about 42 species are imported. These include species like *Glycirrhiza glabra* (Jeshtimadhu), *Panax pseudoginseng* (Ginseng), *Commiphora myrrha* (Hirabol), *Boswellia frereana* (African elemi), *Uncaria gambier* (Kath), and *Salvia haematodes* (Behman) amounting to 4.7% of the total traded species. Some of these imported species are semi processed in India and are further exported as extracts. The imported species are sourced from countries like Afghanistan, Bangladesh, Bhutan, Cameroon, China, Ghana, Indonesia, Iran, Morocco, Nepal, Pakistan, Singapore and Sri Lanka. It may be noted that the majority (16) of the imported drugs are from tree species. Fourteen drugs are from herbs while 9 are from shrubs and 3 from climbers. (Noorunnisa Begam and Ved, 2003).

CONSERVATION AND DEVELOPMENTAL STRATEGIES FOR MEDICINAL PLANTS

Several national and international agencies have formulated appropriate policies and strategies for the conservation of medicinal Plants. The world conservation strategy (IUCN, UNEP & WWF, 1980) defines conservation as "the management of human use of the biodiversity so that it may yield the greatest sustainable benefit to present generation". The primary goals of biodiversity conservation as envisaged in the world conservation strategy are:

- Maintenance of essential ecological processes and life support systems on which human survival and economic activities depend,
- Preservation of species and genetic diversity and
- Sustainable use of species and ecosystems, which support millions of rural communities as well as major industries.

NEED FOR BIODIVERSITY OF MEDICINAL PLANTS

Medicinal plants are found in forest areas from the planes to the high Himalayas with the greatest concentration in the tropical and subtropical belts and arid region of the desert. Some of these, found at high altitudes in particularly stressful environments, grow very slowly and cannot live elsewhere. Others withstand more easily different ecological conditions.

During the past decade, a dramatic increase in exports of medicinal plants attests to worldwide interest in these products as well as in traditional health systems. In the last 10 years, for example, India's exports of medicinal plants have trebled. But with most of these plants being taken from the wild, hundreds of species are now threatened with extinction because of overharvesting, destructive collection techniques, and conversion of habitats to crop-based agriculture. For instance, the small coniferous Himalayan yew

(*Taxus baccata*) has recently become a heavily traded species. Similarly, senna is being grown extensively in arid regions of India.

LOSS OF BIODIVERSITY OF MEDICINAL PLANTS

The medicinal plant wealth of India is declining constantly over the years.

CAUSAL FACTORS

Many factors both natural and manmade, have been responsible for limiting the distribution of medicinal plants species and are causing them to become rare or even extinct.

1. Environmental factors

a) Rainfall: For the past few years the annual rainfall has decreased resulting in the health of many herbaceous species during summer months.

b) Deforestations: Deforestations have been reported over the last two decades. The spread of agriculture, logging, fire wood collection, heavy wood collection, heavy grazing, etc., are the main reasons for reduction in area under valuable forests. Many valuable wild medicinal plant species are eradicated or minimized every year due to the deforestation activities.

c) Siltation of water bodies: Siltation of water bodies in the forests has resulted in the reduction of water holding capacity heading to depletion of underground water.

d) Lack of pollinators: Honey bee colonies have declined in numbers to the extent of 50-60%, in forests and other areas. Loss of pollinators has resulted in reduced seed set and dispersal of seeds.

2. Developmental influences

a) Submersion: Loss of many species of medicinal plants has been noticed in forests due to submersion, eg., the Maradavally forest is the catchments of Linganamakki Dam, the main reservoir of Karnataka for irrigation and power generation. Submersion of nearly 10 sq. km of forest area during monsoons has resulted in loss of valuable medicinal plant species.

b) Infrastructure: Expansion of roads, installation of power lines and construction of buildings has caused extensive damage to forests and medicinal plants, eg., Devanarayandurga forest in Karnataka.

3. Agriculture and forestry methods

c) Monoculture: There has been a progressive increase in monoculture plantations of economically important indigenous as well as exotic species in forest. Monoculture plantation totally affects the organic productivity and reduces the natural stability and complexity resulting in loss of medicinal plants. eg., *Eucalyptus* and *Acacia* species in many forests.

d) Encroachments: Encroachments over forestlands have assumed alarming levels. Apart from felling of trees and clearing vegetation, the cultivation practices followed on high sloppy lands has caused soil erosion, and decline of medicinal plant wealth.

e) Overexploitation: Gathering of medicinal plants from the forests are rampant. The collection was by unorganized forest collectors, who, in turn sold the product to a contractor at the price fixed by the latter. But now, due to the awareness created by the members of the 'Local Traditional Medicinal Practitioners Association', illegal gathering has been controlled to a certain extent.

CONSERVATION OF BIOLOGICAL / GENETIC DIVERSITY

Conservation has been defined as the management of resources of the biosphere for the benefit of all life including human, so that sustainable benefit may be derived by the present with potentials to meet the needs and aspirations of the future generations. Biological diversity refers to the richness of species, i.e., number of species in a community of living systems, while genetic diversity is a heritable diversity within and between the species of a genus. Basic rationale behind the conservation of biological diversity is to ensure sustainability in the utilization of species and ecosystems by marinating essential ecological processes in the life-support systems. Indian region is the center of diversity of 152 economic species.

The concept of biosphere reserve is a method wherein specific ecosystems are conserved and managed for posterity. The germplasm collection in the herbal gardens/drug farms of valuable medicinal species can be a major tool in conserving genetic/biological diversity. It will provide the basic material for future cultivation of desired plants (Sharma, 2004).

***IN SITU* CONSERVATION**

In has been established that the best and cost effective way of protecting the existing biological and genetic diversity is the '*in situ*' or on the site conservation wherein a wild species or stock of a biological community is protected and preserved in its natural habitat. The prospect of such an 'ecocentric' rather than a species centered

approach is that it should prevent species from becoming endangered by human activities and reduce the need for human intervening to prevent premature extinctions. To achieve this *in situ* conservation the central government has initiated several measures recently by the involvement of appropriate NGOs.

MEDICINAL PLANTS CONSERVATION AREAS (MPCAs)

Between 1993 and 1997 FRLHT (Foundation for Revitalization of Local Health Traditions) Bangalore (Karnataka), in collaboration with State Forest departments has established a coordinated network of 30 *in situ* medicinal plants conservation areas located with in the protected areas of Kerala, Tamil Nadu and Karnataka with involvement of local communities on conservation, inventorization, threat assessment and Nursery Raising programme.

The concept has received further boost through "Task force on Conservation and sustainable use of Medicinal plants" set up by GOI (1999) in the Planning Commission which has recommended the establishment of 200 MPCAs, each of about 500 ha in medicinal plants rich Protected Areas (Pas) of the country to cover different forest types.

The key activities of the MPCAs include:

- Systematic survey and documentation of intra-specific variation; generation of data on distribution pattern, macro- and micro-habitats, association and cultural inputs of each species.

- Development of suitable species recovery programme of endangered and enrichment planting programme for economically valuable species.

- Building up and strengthening community institution for long term management of the sites.

- Training of wildlife staff and others of *in situ* conservation of medicinal plants. The involvement of Botanical Survey of India (BSI), Department of Botany along with NGOs would ensure success of such initiatives.

EX SITU CONSERVATION

Conservation of medicinal plants can be accomplished by the *ex situ,* i.e., outside natural habitat by cultivating and maintaining plants in biotic gardens, parks and other suitable sites, and through long term preservation of plant propagules in gene banks (seed bank, pollen bank, DNA libraries, etc.) and in plant tissue culture repositories and by cryo-preservation.

ETHNO-MEDICINAL PLANT GARDENS

A valuable *ex situ* conservation measure would be the creating of a network or regional and sub-regional ethno-medicinal plant gardens, which should contain accessions of all the medicinal plants known to the various ethnic communities in different regions of India. The chain of gardens will act as regional repositories of our cultural and ethno medicinal history and embody living traditions of our society's knowledge of medicinal plants.

GENE BANKS

While it is known that the largest proportion of local biodiversity in all our eco-system is used for medicinal purposes, very little is known about their conservation status in the wild. What is likely is that a large number of medicinal plant species are under various degrees of threat. The 'precautionary principle' would suggest that an immediate and countrywide exercise be taken up to deposit seeds of endemic species. A simultaneous effort should also be launched to evaluate the genetic variation of economic plants with a view to promoting their domestication and breeding.

NURSERY OR DEMONSTRATION PLOTS

The most urgent task in order to ensure immediate availability of plants and planting materials to various user groups like farmers, the professional Indian System of Medicines (SM) community, plant breeders, industry and conservation organizations, is to promote nation-wide network of medicinal plant nurseries which will multiply all the regional-specific plants that are used in the current practice of traditional medicine. These nurseries should become the primary sources of supply of plants and seed material that can be subsequently multiplied by various users. The forest departments, agricultural extension agencies, village panchayats, Non-governmental Organizations (NGOs) and private enterprises should be encouraged to establish these nurseries or grow medicinal plants in existing ones. In the initial years, interestfree short-term loans or loans at different rates of interest can be offered by banking institutions to this nursery network.

In view of its importance and urgency, Government can promote national co-ordination of this program through a national nodal institution, which may be called NATIONAL MEDICINAL PLANTS DEVELOPMENT BOARD**.**

CULTIVATION OR DOMESTICATION

The medicinal plants should be domesticated and brought under cultivation to maintain constant supply of quality materials and thus reduce the pressure on the wild populations. The process of domestication of a species involves characterization of its reproductive biology to decide on the method of propagation-seed or propagule and definition of the area in which to cultivate based on the soil and climate characteristics of the plant's natural habitat. The genetic resources of the species screened for its adaptability and yield and quality of the material that will make the end product, to identify suitable genotypes for cultivation. Soil type to be used, irrigation and fertilizer amounts and application schedule and sowing and harvesting times are standardized. Disease and pest problems of standing crop and harvesting material are solved to keep the product safe for consumption. Initiation of plant breeding programme will ensure that in future the crop will be high yielding, resistant to pest diseases and domestic quality.

Cultivation and processing of material harvested from medicinal and neutraceutical (Supplements) plant, already identified useful for restoration and protection of human health, can provide much needed avenues of self-employment to the educated unemployed in villages and small towns. Prospect of plant species for new drugs and other products and genetic engineering for industry are expected to further open such employment opportunities. To make the above developments possible, it is of immediate paramount importance to inventories evaluate and conserve the genetic resources, domesticate and cultivate species of medicinal and industrial importance.

Cultivation of medicinal plants, however, is inversely linked to prevalence of easy and cheap collection from the wild, leak of regulation in trade, cornering of the profits from wild collection by a vast network of traders and middlemen and absence of industry's interest in providing buy-back guarantees to growers. Cultivation of medicinal plants is also difficult due to lack of standardized agronomic practices for most species and unavailability of sources of quality planting materials.

Policy measures to promote cultivation of medicinal plants, therefore, need to facilitate industry's role by way of tax incentives, etc. for investments in cultivation and agricultural research and simultaneously regulate indiscriminate, destructive collection of medicinal plants from the wild, while improving their conservation status *in situ*. In the context of medicinal plants, there is a special case for encouraging organic systems and polyculture models instead of the conventional monoculture models in agriculture and agro forestry.

There is also a special case for encouraging in an 'organized' way, small, marginal farmers and tribes to grow medicinal plants in their household gardens, bunds,

wastelands because this can encourage economic participation of the rural poor in the growth of the herbal industry.

INVOLVEMENT OF PRIMARY STAKEHOLDERS

The very tribal communities who are responsible for sustenance of ethno medicines are engaged in collection and sale of medicinal plants along with other Non-Timber Forest Produce (NTFPs) to agents of big dealers at nominal prices for meeting out their subsistence requirement. According to one estimate, collection of medicinal plants and plant products through forest contributes at least 35 lakh man days /year to the national economy as a source of both full and part employment and poorest of the poor are the involved communities. The forest dwellers are, therefore, best bets to involve in conservation and cultivation of medicinal plants in various eco geographical regions of the country. This is necessary, as the ownership of MFP including medicinal plants has now been conferred on gram sabhas in the fifth scheduled areas of the country.

Attempts have been made to involve these primary stakeholders in conservation, cultivation and trade of medicinal plants in different regions of the country through various schemes sponsored by Ministry of Environment and Forest, Ministry of Health and Family Welfare which has initiated a scheme for improving awareness and availability of medicinal plants and remedies for ISM for Reproductive Child Health (RCH) Programme. Identified NGOs are assisted for Nursery Raising and to educate rural population about the use of locally available medicinal plants for preventive health hazards and for curative purposes.

SUSTAINABLE HARVESTING

This is a very important aspect in sustaining the resource base either from wild or cultivated plants. Therefore, optimal methods of harvesting practices are necessary to be adopted or worked out in the absence of any foolproof system. This will cater to meet the following aspects also.

COMMUNITY BASED ENTERPRISES

Considering the low value of many medicinal plant species (in raw drug form), a strong case exists for promotion of community-level enterprise for value addition to medicinal plants through simple, on site techniques like drying, cleaning, crushing, powdering, packaging, etc. This will also increase the stake of village communities in conservation. Isolated micro enterprises on their own may find it difficult to manufacture standardized products and market them. Therefore, a way to promote a macro organization to net work and provide financial, technical and marketing support to rural enterprises exists.

RESEARCH

In order to help conservation of medicinal plants, the thrust on research should focus on immediate field-related problems. Priority areas in medicinal plants research need to include *inventorisation* and distribution mapping; threat categorization based on IUCN guidelines, conservation biology, propagation of rare species for reintroduction into their natural habitats; agro-technology of economically and clinically important species along with effective and quick technology transfer.

TRAINING

In-service training programme for staff of various government and non-governmental agencies like forests, wildlife, botanic gardens, schools and colleges in taxonomy and conservation biology need to be developed and supported in a large way. Training of community-based para-taxonomists is also relevant to encourage community involvement in conservation.

To encourage the use and sustainable economic benefit from medicinal plants so that local communities can develop a stake in their conservation, suitable training courses in sustainable harvest (especially for tribal collectors), value addition and marketing of medicinal plants, need to be promoted.

One of the major user groups of medicinal plants is the community of practitioners of traditional medicine, both classical and folk. Unfortunately, this group is least involved in the conservation of medicinal plants. With adequate orientation and training, this large group could make a significant contribution to the conservation of medicinal plants and its sustainable use.

DOCUMENTATION AND DISSEMINATION OF INFORMATION (COMPUTERIZED DATABASE)

This is the greatest drawback as the entrepreneurs are not able to procure adequate information on various aspects like propagation and harvesting methods, marketing, policies, research, etc., at one place, from database or documented literature. A large number of persons/organizations have been working in isolation in this direction in India and abroad without recognizing any nodal agency. WHO could be contacted. The entrepreneurs are, therefore, moving from place to place to gather information for any particular medicinal plant regarding their appropriate utilization, procurement of raw material, their policies, methods of cultivation and value addition for adequate returns, etc., the following areas are required to be covered for dissemination knowledge.

- Geographical Distribution and resource base.
- Methods for sustaining the resource base including packages for cultivation and value addition for short term and long term enterprises.
- Market status of medicinal and aromatic plants for formalizing and organization markets.
- Policies: Domestic policy, conventions, rules and regulations for harvesting/extraction marketing, industries and trade (both internal and external).
- Pricing patterns/ regimes for equitable distribution of profits in marketing channels from harvest to enterprise main markets.
- Social and economic dimensions.
- Coordination of research initiation and results of trials.
- Identification of national and international level authorities.

CONCLUSION

According to the world Health organization (WHO) estimates, about 80% of the population of developing countries relies on traditional medicines, mostly plant drugs, for their primary health care needs. Thus, the picture of raw drug trade that unfolds is quite complex. In order to meet the demand, about 86% of plant collection involves destructive harvesting. Due to this, many plants become endangered. Government regulation on wild collections of endangered species is necessary and inevitable to reduce the loss and degradation of natural habitats and overharvesting of some of these species. A reasonable degree of scientific vigour is needed to assess the threat status of species to be banned and evaluation must be done on several parameters.

Trade in natural products harvested from the wild, is a serious business. Government needs to take immediate steps to collect trade reliable information on current and projected consumption of medicinal plants. The conservation status of all species in trade and the conservation biology of threatened species should also be studied.

Banning trade needs transparent guidelines and scientific inputs in order to take balanced administrative decisions. Where species are not on the verge of extinction and consumption level is high and plant parts used do not involve destruction, i.e., leaf, flower, fruit, etc., a reasonable time can be given to industry to develop cultivation strategies. It is important, in the near future, to take a shift from the current scenario of 86% wild harvest to a more sustainable regime, wherein perhaps 20-30% of the

requirement may still be sourced from the wild, while 70-80% should be from cultivated source.

This clearly opens up a huge challenge for conservationist, policy makers, researchers, industry and farmers to manage and use our natural resources wisely.

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