



## A REVIEW

# Conservation of medicinal plants bio-diversity: Need, ways and initiatives

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**Abstract :** The paper discusses about bio-diversity of medicinal plants, the need to conserve, and ways to conserve including the latest tools and approaches besides conventional ones. A special emphasis has been given in listing the species which needs immediate conservation measures especially in the state of Karnataka. Loss of medicinal plants bio-diversity and its impact has also been highlighted. The efforts and initiatives of the University of Horticultural Sciences, Bagalkot, Karnataka in the direction of medicinal plants bio-diversity conservation is elaborated in detail. The approaches and strategies both research and developmental by keeping the future needs of medicinal plants bio-diversity conservation in mind have been discussed.

**Key Words :** Conservation, Bio-diversity, Initiatives, Medicinal plants

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## INTRODUCTION

Medicinal plants are an important source of raw material for traditional and modern medicines and a large number of people derive employment and income from the collection, processing and trade of these plants. With the sharp rise in popularity of traditional medicine, the economic importance of these plants has increased enormously. We are richly endowed with a large variety of plant species, many of which have medicinal properties. A large proportion of the rural and tribal population depends on locally available medicinal plants to meet their health care requirements. Furthermore, the collection and marketing of these plants provide an important source of income for communities.

Unfortunately, the increase in demand has also increased the threat of depletion, as many of these plants are largely collected from the wild.

It is clear that the conservation of medicinal plants is vitally important for the maintenance of biodiversity and the preservation of indigenous knowledge.

A large proportion of medicinal plants are collected from the wild. In most of the countries, the proportion of collected material ranges between 70-99 per cent. The rising commercial demand for herbal drugs and dependence on material harvested from the wild, has led to the rapid depletion of a number of medicinal plant species (Parrotta, 2002). As a result, a large and increasing number of medicinal plant species are

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threatened with extinction. For example, according to the International Union for Conservation of Nature and Natural Resources (IUCN) Red List of Threatened Species has reached more than 300 plant species, of which a large number are medicinal plants, are threatened with extinction (<http://www.redlist.org/>).

In the case of medicinal plants, it is known that populations of a particular species from certain localities have been traditionally preferred. There are no systematic studies on medicinal plants with reference to gene based differences in the production of therapeutically active chemical constituents, but there are several indications. For example, a therapeutically useful lectin (a specific class of protein, detailed in a later chapter) from the seed of Jack fruit (*Artocarpus heterophyllus*) showed 2,500 times more activity in a sample from Bangalore, than in a sample from Madras. This is one aspect of chemical diversity, a component of genetic diversity. Studies on chemical diversity, both quantitative and qualitative, on medicinal plants are largely absent and very much needed.

In view of these considerations, it seems necessary that at least the important and the more commonly used medicinal plants are studied systematically with reference to their genetic diversity.

#### **Need to conserve bio-diversity :**

- A large number of people derive employment and income from the collection, processing and trade of medicinal plants. Unless such species are conserved, there is a serious threat on the livelihoods of people who are dependent on those plants

- Conservation becomes very vital since there is a serious threat on depletion of bio-diversity

- Non-sustainable harvesting by plant collectors has resulted in the depletion of many medicinal species. Non-destructive, low-intensity collection practices have often been replaced by destructive harvesting practices.

- There has been a steady decline in the use of traditional knowledge and medicinal plants by the local communities. As a result, the interest of these communities in conservation has declined

- There has also been a shift from local use of medicinal plants to commercial sale. With the improvement in transportation networks, remote forest areas have become increasingly accessible to outside traders. Also, there has been a large increase in the international demand for medicinal plants. As a result,

large volumes of commercially important species are being harvested beyond sustainable levels

- The marketing chains are long. As the number of agents involved between the collection of plants and their final sale to the user industry/consumers is large, the prices paid to the collectors are low. This forces them to over-harvest the material to supplement their income. For example, in India, the difference between the prices paid to collectors and the final market prices ranges between 50 per cent-255 per cent (Farnsworth and Soejarto, 1991).

The species which needs to be conserved are obviously those which are rare, endangered and threatened and are of great industrial and traditional significance (Table 1).

Among the above listed table, *Decalepis hamiltonii* Wight & Arn., *Salacia reticulata* Wight, *Aegle marmelos* (L.) Corr., *Baliospermum montanum* (Willd.) Mull. Arg., *Embelia ribes* Burm.f., *Garcinia indica* (Thouars) Choisy, *Operculina turpethum* (L.) Silva Manso, *Salacia oblonga* Wall. ex Wight & Arn., *Santalum album* L. and *Celastrus paniculatus* Willd., have been conserved already in the field gene bank of UHS Bagalkot and the planting material is being given to the interested and needy.

#### **Loss of biodiversity and its impact :**

There has been a rapid decline in the biodiversity of the world, more particularly during the past two decades or so. Biodiversity losses have been alarming in the developing countries in the tropics. For example, in the Uttara Kannada district of Karnataka, the forest area has come down from 8,000 sq km to 6,000 sq km, in about 40 years (Potter, 1996). This constitutes an enormous loss of biodiversity in a small area over a short period of time. There are innumerable such examples, the world over. The underdeveloped countries are generally less aware of the degree of biodiversity loss in their countries and its consequences.

Biodiversity losses occur due to habitat destruction, over harvesting, pollution, inappropriate and often accidental, introduction of exotic plants and animals, etc. Habitat destruction is often related to development projects like land conversion, construction of dams, etc. Biodiversity is also lost due to sudden natural calamities like floods, cyclones, hurricanes, earth quakes, etc. Conservation of biodiversity is one of the paramount concerns the world over. Governments, non-

**Table 1 : Medicinal plants of conservation concern in Karnataka**

Sr. No.	Botanical name	Habit	Status in Karnataka	RL status (Global)	Tarde (100 mt/year on dry weight)
1.	<i>Madhuca insignis</i> (Radlk.) H.J.Lam.	T	EX	EX	
2.	<i>Coscinium fenestratum</i> (Gaertn.) Coleb.	C	CR	-	H
3.	<i>Cycas circinalis</i> L.	T	CR	-	
4.	<i>Eulophia cullenii</i> (Wight) Blume	H	CR	CR	
5.	<i>Paphiopedilum druryi</i> (Bedd.) Pfitz.	H	CR	CR	
6.	<i>Pueraria tuberosa</i> (Roxb. ex Willd.) DC.	C	CR	-	
7.	<i>Valeriana leschenaultii</i> DC.	H	CR	CR	
8.	<i>Ampelocissus indica</i> (L.) Planch.	C	EN		
9.	<i>Chonemorpha fragrans</i> (Moon) Alston	C	EN	-	
10.	<i>Cinnamomum wightii</i> Meisn.	T	EN	EN	
11.	<i>Decalepis hamiltonii</i> Wight & Arn.	C	EN	EN	H
12.	<i>Dipterocarpus indicus</i> Bedd.	T	EN	EN	
13.	<i>Drosera indica</i> L.	H	EN	-	
14.	<i>Drosera peltata</i> J.E.Sm. ex Willd.	H	EN		
15.	<i>Dysoxylum malabaricum</i> Bedd. ex Hiern	T	EN	EN	
16.	<i>Gymnema montanum</i> (Roxb.) Hook.f.	C	EN	EN	
17.	<i>Humboldtia vahliana</i> Wight	T	EN	EN	
18.	<i>Hydnocarpus macrocarpa</i> (Bedd.) Warb.	T	EN	EN	
19.	<i>Michelia champaca</i> L.	T	EN	-	
20.	<i>Nilgirianthus ciliatus</i> (Nees) Bremek.	S	EN	EN	H
21.	<i>Nothapodytes nimmoniana</i> (Graham) Mabber.	T	EN		
22.	<i>Persea macrantha</i> (Nees) Kosterm.	T	EN		
23.	<i>Plectranthus nilgherricus</i> Benth.	H	EN	EN	
24.	<i>Rauvolfia serpentina</i> (L.) Benth. ex Kurz	H	EN		H
25.	<i>Salacia reticulata</i> Wight	S	EN		
26.	<i>Saraca asoca</i> (Roxb.) W.J. de Wilde	T	EN		H
27.	<i>Strychnos aenea</i> A.W.Hill	C	EN	EN	
28.	<i>Swertia lawii</i> (Wight ex C.B.Clarke) Burkill	H	EN	EN	
29.	<i>Adenia hondala</i> (Gaertn.) W.J.de Wilde	C	VU		
30.	<i>Aegle marmelos</i> (L.) Corr.	T	VH		H
31.	<i>Amorphophallus commutatus</i> (Schott) Engl.	H	VU	VU	
32.	<i>Ampelocissus araneosa</i> (Dalz. & Gibson) Planch.	C	VU	VU	
33.	<i>Aphanamixis polystachya</i> (Wall.) Parker	T	VU		
34.	<i>Aristolochia tagala</i> Cham	C	VU		
35.	<i>Artocarpus hirsutus</i> Lam.	T	VU	VU	
36.	<i>Baliospermum montanum</i> (Willd.) Mull.Arg.	S	VU		H
37.	<i>Calophyllum apetalum</i> Willd.	T	VU	VU	
38.	<i>Canarium strictum</i> Roxb.	T	VU		
39.	<i>Cinnamomum macrocarpum</i> Hook.f.	T	VU	VU	
40.	<i>Cinnamomum sulphuratum</i> Nees	T	VU	VU	H
41.	<i>Curcuma pseudomontana</i> Graham	H	VU	VU	
42.	<i>Diospyros candolleana</i> Wight	T	VU	VU	
43.	<i>Diospyros paniculata</i> Dalz.	T	VU	VU	
44.	<i>Embelia ribes</i> Burm.f.	C	VU		H
45.	<i>Embelia tsjeriam-cottam</i> (Roem. & Schult.) A. DC.	S	VU		H
46.	<i>Garcinia indica</i> (Thouars) Choisy	T	VU	VU	H

Table 1 contd...

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47.	<i>Garcinia morella</i> (Gaertn.) Desr.	T	VU		
48.	<i>Gardenia gummifera</i> L.f.	T	VU	VU	
49.	<i>Gloriosa superba</i> L.	C	VU		H
50.	<i>Heracleum candolleianum</i> (Wight & Arn.) Gamble	H	VU	VU	
51.	<i>Holostemma ada-kodien</i> Schult.	V	VU		H
52.	<i>Hydnocarpus alpina</i> Wight	T	VU	VU	
53.	<i>Hydnocarpus pentandra</i> (Buch.-Ham.) Oken	T	VU	VU	
54.	<i>Kingiodendron pinnatum</i> (Roxb. ex DC.) Harms	T	VU	VU	
55.	<i>Madhuca longifolia</i> (Koen.) Macbr.	T	VU		
56.	<i>Madhuca nerifolia</i> (Moon) H.J.Lam	T	VU		
57.	<i>Michelia nilagirica</i> Zenk.	T	VU	VU	
58.	<i>Myristica dactyloides</i> Gaertn.	T	VU		
59.	<i>Myristica malabarica</i> Lam.	T	VU	VU	
60.	<i>Ochreinauclea missionis</i> (Wall. ex G. Don) Ridsdale	T	VU	VU	
61.	<i>Operculina turpethum</i> (L.) Silva Manso	C	VU		H
62.	<i>Oroxylum indicum</i> (L.) Vent.	T	VU		H
63.	<i>Piper mullesua</i> Buch.-Ham. ex D.Don	C	VU		
64.	<i>Pseudarthria viscida</i> (L.) Wight & Arn.	H	VU		H
65.	<i>Rhaphidophora pertusa</i> (Roxb.) Schott	C	VU		
66.	<i>Salacia oblonga</i> Wall. ex Wight & Arn.	C	VU	VU	
67.	<i>Santalum album</i> L.	T	VU		H
68.	<i>Schrebera swietenoides</i> Roxb.	T	VU		H
69.	<i>Swertia corymbosa</i> (Griseb.) Wight ex C.B.Clarke	H	VU	VU	
70.	<i>Symplocos racemosa</i> Roxb.	T	VU		H
71.	<i>Tinospora sinensis</i> (Lour.) Merr.	C	VU		H
72.	<i>Tragia bicolor</i> Miq.	C	VU	VU	
73.	<i>Vateria indica</i> L.	T	VU	VU	H
74.	<i>Celastrus paniculatus</i> Willd.	C	NT		H
75.	<i>Garcinia gummi-gutta</i> (L.) Robson	T	NT	NT	
76.	<i>Hedychium coronarium</i> Koenig	H	NT		
77.	<i>Knema attenuata</i> (Hook.f. & Thoms.) Warb.	T	NT	NT	
78.	<i>Nervilia aragoana</i> Gaud.	H	NT		
79.	<i>Piper nigrum</i> L.	C	NT		
80.	<i>Smilax zeylanica</i> L.	C	NT		
81.	<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn.	T	NT		

Source: Envis news letter of FRLHT, 2010

T : Tree; C : Climber; H : Herb; RL : Red List; EX : Extinct; H : Highly traded; S : Shrub; EN : Endangered; VU : Very vulnerable; NT : Nearly threatened

governmental organisations (NGOs), scientists, are all preoccupied with the problem of devising ways and means of conserving biodiversity, or at least retarding the rapid rate of its loss.

### Ways of bio-diversity conservation :

Broadly speaking, two ways of conservation of medicinal plants - *in situ* and *ex situ* conservation are worth mentioning here. The '*in-situ*' conservation refers to the site conservation wherein a wild species or stock

of a biological community is protected and preserved in its natural habitat (environment). This implies promoting cultivation process in protected areas. Conservation of medicinal plants can also be accomplished by the *ex-situ* i.e. outside natural habitat by cultivating and maintaining plants in botanic gardens parks, other suitable sites, long term preservation of plant propagules in gene banks (seed bank, pollen bank, DNA libraries, cryopreservation, *in-vitro* etc.) etc. Of late the concept of "seed vault" is also being attempted in Norwegian

island (The seed vault is an attempt to provide insurance against the loss of seeds in gene banks, as well as a refuge for seeds in the case of large-scale regional or global crisis) ([http://en.wikipedia.org/wiki/Svalbard\\_Global\\_Seed\\_Vault](http://en.wikipedia.org/wiki/Svalbard_Global_Seed_Vault)). We can think of preserving the rare medicinal plants species in seed vault.

Further, commercial cultivation could also provide an option for conserving a species besides providing large opportunities of livelihood through income and employment generation. For the conservation of rare plant species cultivation is often considered an alternative to wild-collection (Denham, 1999). Cultivation is even preferred by pharmaceutical firms because supply can be handled more easily and quality control is facilitated

### **Initiatives of UHS Bagalkot in conserving medicinal plants bio-diversity :**

- Established Dhanwanthri medicinal plants garden with a major objective of conserving the wealth of medicinal plants with special reference to species which are under threat (Ex. *Decalepis hamiltoni*) in an area of 10 hectares.

- Educating students, farmers, general public, industries and other stake holders who are key players in medicinal plants sector with special emphasis on bio-diversity conservation

- Promoting farmers in taking up large scale cultivation of selected medicinal plants (Especially those which are destructively collected from wild sources). Unless the conserved bio-diversity is utilized, the interest to conserve diminishes slowly. UHS, realising this, promoting cultivation and helping the farmers in supplying the needs of select industries (Eg. *Mucuna*, *Coleus*)

- Since its establishment, the UHS so far collected and conserved 128 species of medicinal plants including those mentioned in Red Data Book (Ex. *Decalepis*, *Operculana* etc.) at its filed gene bank located in Bagalkot, Karnataka.

- Besides filed gene bank, a seed bank of medicinal plants has also been maintained in the University. Further, it is envisioned to conserve the rare medicinal herbs *in-vitro*.

- Research on medicinal plants with special reference to conserving the genotypes/varieties/cultivars of selected species has been the priority area and thrust has been given. Ex. Eight different genotypes of *Mucuna pruriens* have been identified and are under evaluation for growth, yield and quality parameters (Breeders earlier

thought that pubescence is non-desirable traits, but the trichomes on the pods are one of the best medicines for expelling parasitic worms as per a Belagaum traditional practitioner).

- A three pronged approach involving *conservation-cultivation-utilization* is the need of the hour. Equal thrust has to be given to all these three factors. Lot of thrust is being given only on conservation, other two issues needs to be taken care of to sustain the medicinal plants sector.

- As part of the utilisation strategy, standardization of products from the conserved medicinal plants is also being done (Ex. A health drink from *Hemdesmus indicus* is being popularised among general public, students etc. This health drink is an excellent alternative besides a relishing summer drink)

- University is acting as a facilitator between growers, industries, pharmaceutical companies and other stake holders so as to develop linkages between these stake holders (Ex. A MoU has been signed between local Ayurvedic College to carryout collaborative research and development works).

- University besides conservation is also playing a key role by providing quality planting material of medicinal and aromatic plants to the needy (A model nursery exclusively meant for medicinal plants is located in its head quarter).

### **Future needs :**

- Commune's herbalist or practitioner's views and expertise to be taken into account while conserving these plants (who has sound experience of collecting and processing medicinal plants and preparing the raw material for medical application)

- There is a strong need to validate the traditional know-how with respect to species conservation and bio-diversity

- Special recognitions/awards to be constituted to encourage the individuals/institutions/Societies involved in medicinal plants conservation

- There is a need to prohibit/restrict wild collection in bio-diversity hot-spots (Ex. Western Ghats in Karnataka) which threatens bio-diversity.

- Strong and effective linkages to be developed across institutions involving all the stake holders

- Focused research has to be carried out to come out with cheap conservation protocols

- Sustainable wild-collection may thus increase

among local people the awareness for the need to conserve the species and their habitats (Marshall, 1998 and Schippmann, 1999)

– Emphasis to be given to such species in which the economic part is underground root or rhizome, which faces severe threat from the wild collectors.

– For each species, harvest zones and harvest amounts have to be fixed in advance according to scientific assessments

– Impact of climate change on medicinal plants bio-diversity to be studied critically

### Conclusion :

The conservation of medicinal plants is vitally important for the maintenance of biodiversity and the preservation of indigenous knowledge. Besides traditional method of conservation, new approaches like “Seed vaults” can be considered for conserving rare medicinal plants. The best way to minimise bio-diversity loss is through organised cultivation and utilization of medicinal herbs. Sustained wild collection is still the best way to conserve the medicinal plants and serious importance has to be given to regeneration of species in their natural habitats while collecting from the wild. Sustainable wild collection coupled with commercial cultivation, are still the most practicable options exists for conservation.

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