Biodiversity Threat Assessment of Ethnomedicinal Plants

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Abstract- Documentation of herbal practices reveals the number of species used in disease treatment locally. However, without exception, every area and forest region of the country faces danger of over-exploitation. Therefore, for biodiversity threat assessment of ethnomedicinal plants in Warud tahsil of Amravati district in Maharashtra, field observations were made pertaining to the medicinal plants; regarding over-exploitation, destructive methods of harvest, exploitation for purposes other than medicinal and indiscriminate destruction/cutting, etc. The species under these threats are separately enumerated.

Index Terms- Threat Assessment, Ethnomedicinal Plants, Warud, Amravati District, M. S.

I. Introduction

According to Jain (1992), when natural regeneration of a species is not able to keep pace with its exploitation or destruction by anthropogenic or natural means, and as a consequence there is serious decline in the population, the species is said to be threatened (Reddy et al., 2012). Uncontrolled utilization of medicinal plant materials poses threats to wild populations, species and the ecosystems from which they are sourced. Threats include- overexploitation, increasing demand, unmonitored trade, destructive harvesting, anthropogenic pressure, climate change, extensive agriculture and global habitat loss and alteration.

Some species that are threatened on the global scale may not be threatened at a regional scale, and species that are not threatened on a global scale might be threatened in some parts of their range (Gardenfors et al., 2001). Moreover, knowing the regional status of species is important as the loss of population and genetic diversity has become a major concern in the present scenario (Grammont and Cuaron, 2006). The IUCN status of the species based on the published flora, reports and research papers, and threat assessments based on opinion and perception of specialists during workshops and meetings (Ved et al., 2003, 2005; Goraya et al., 2013) do not provide the authentic information on the actual status of the species, which is only possible through ground validation. Therefore, location specific studies and assessment of the status of species using qualitative and quantitative attributes is necessary (Samant et al., 1996; Airi et al., 1997).

About 12.5% of Worlds flora is facing threats of extinction and about 10-12% of Indian medicinal plants are threatened. Forest plays a significant role in life and wealth of human beings by providing natural resources, medicines and commercial products (Paul et al., 2015). The Indian forests include about 90% of medicinal plant diversity and about 10% diversity is restricted to non-forest habitats. Large amount of money is poured into the conservation programmes every year. However, improvement in the status of the plant species in nature is very poor and the number of threatened plant species is increasing gradually (Wakdikar, 2004; Tripathi, 2008). Many of these medicinally important plant species are restricted to small pockets of habitat and their size of population is decreasing at an alarming rate (Lohani et al., 2013). They serves as sources and functions as integral parts of local agricultural production systems (Kumari et al., 2012).

Loss of biodiversity has serious economic and social costs. It has resulted into decrease of plant cover, deterioration of soil productivity and aggravation of soil erosion (Batanouny, 1983). Due to habitat destruction and overharvesting, world is losing drug plant every year. It makes medicinal plants less available to the indigenous, poor communities that are dependent on these plants as readily available and affordable medicines. As these environmental changes are likely to continue into the future (Millennium Ecosystem Assessment, 2005b), it is important to assess their impacts on biodiversity for effective prioritization of conservation efforts (Lee and Jetz, 2008).

Two third of Worlds plant species are in danger of extinction due to habitat transformation (Plant Conservation Report, 2009). Approximately half of the habitable surface of the earth has been altered (Daily, 1995; Singh, 2002). This ultimately leads to habitat fragmentation. The loss, decline or fragmentation of natural habitats due to recent increase in anthropogenic pressure and weakening of customary laws are major causes of threatening the medicinal plant species (Belt et al., 2003; Ghimire et al., 2005; Kala, 2005; Bisht et al., 2006). Pressure from agricultural expansion, wide-spread cutting for fuel wood and seasonal droughts are also responsible factors (Mesfin et al., 2013). Demand of land for housing, agriculture, industrial activities, tourism development and road construction is posing threats to the wild plant species through habitat fragmentation. This has severely affected the natural habitats resulting into scattered and restricted distribution of medicinal plants (Bisht et al., 2006); created barriers to normal dispersal and colonization processes (Pushpangadan et al., 2001) and has threatened survival of plant species (Mukherjee, 2010). Globally, 91% of plant species have been threatened due to loss and degradation of habitats (IUCN, 2000). Destruction and degradation of wild land resulted into loss of unique and precious species. With them we are losing potential

resources to combat hunger, poverty, natural disasters, and social and economic insecurity.

Natural resources are also subjected to high grazing pressure (Bisht et al., 2006). Overgrazing is the most serious threat to large number of plant species. Poor's do not have enough land for growing fodder; therefore they graze their animals on natural vegetation causing real damage (Ahmad et al., 2012). Animals which browse leaves and reproductive parts of plant species damage their flowering spikes and thereby restrict their population size and distribution (Ganie and Tali, 2013). Most of the individuals of different species were not able to produce seeds because the flowers are extensively grazed by livestock threatening their long-term survival (Sharma et al., 2017).

Demand for medicinal plants is 14 billion US $ and it will scale up to 5 trillion US $ in 2050 (WHO) (Sharma and Thokchom, 2014). World trade on herbal medicine is increasing with annual growth of 7% (Mukherjee, 2010). Increased demand of medicinal plant raw material motivate local tribal to utilize the same resources repeatedly resulting into overexploitation (Bisht et al., 2006). The resurgence of public interest in plant-based medicine coupled with rapid expansion of pharmaceutical industries (Kumari et al., 2012); increased health awareness and faith in traditional medicine, its low cost without side effects and easy availability all over the world (Patil and Patil, 2010) have threatened the survival of medicinal plants.

When the need arise, local herbal healers collect medicinal plants from the nearby resources. Many times medicinal plants are collected for non-medicinal purposes like fodder, timber and fire-wood. Very few medicinal plants are cultivated and mostly they are directly harvested from the wild by herbal healers. These activities lead to multiple depletion of medicinal plants from the wild (Feyssa et al., 2015). One of the major reasons of over-harvesting is lack of knowledge (IUCN, 2004) because most of the people are unaware of their importance and use large quantity of these valuable plants for fuel and fodder (Ahmad et al., 2012). According to IUCN (2007) about 15,000 medicinal plant species are threatened worldwide due to overharvesting. These activities have actually threatened future vital resources, as well as beauty, diversity and natural heritage of our planet. Over 70% of plant collection involves destructive methods (Patil and Patil, 2010; Sharma et al., 2010). This poses a definite threat to the genetic stocks and to the diversity of medicinal plants. In the Koria district of Chhattisgarh many medicinal plants are on the verge of extinction due to over exploitation and destruction of their habitat. There is an increase of 14 species in Critically endangered category, 71 species in Endangered category (Sinha, 2013). *Santalum album* L. is an economically important tropical tree species. Owing to extensive logging, changes in land-use patterns and poor natural regeneration, the natural sandal populations are rapidly dwindling (Rao et al., 2007).

Distribution and availability of medicinal plants will be affected by climate change and global warming (Ratha et al., 2012). Anthropogenic activities, weakening of customary laws (Kumari et al., 2012), and lack of concerted actions to make traditional knowledge and practices more vibrant are threats to the medicinal plant wealth. Young generations of tribal communities have no appreciation and affection about medicinal plants found in their areas (Pushpangadan et al., 2001). High population growth, its demand for increased standards of living put the available natural resources on risk. Economic development forces the poor to depend heavily on natural resources, which can not be correlated with any measures adopted for the sustainable use of natural resources. Poverty of people led them to cut important plants and sell in the market for their earning (WWF, 1994). Increase in population force the inhabitants to use some extra forest land to fulfill the needs. So natural areas are converted to agricultural lands destroying the habitat of large number of species (IUCN, 2014). Collection of plants, seeds and particularly uprooting of plants from natural areas, threatens a large number of species (Ahmad et al., 2012).

Many currently threatened plant species will become extinct owing to anthropogenic climate change in the absence of potentially mitigating factors. Human-driven land-use and climatic changes are perhaps the greatest threats to terrestrial biodiversity (Millennium Ecosystem Assessment, 2005a; IPCC, 2007). Anthropogenic activities have built up pressure on existence of many medicinal and economically important plant species (Paul et al., 2015). Patchy conversion patterns lead to the fragmentation of existing forest and reduction in the number and abundance of species that can be supported on unconverted land (Lewis et al., 2009, Laurance et al., 2011). It is found that most species were negatively impacted by agriculture, especially those with small global ranges (Perrings and Halkos, 2015). Loss of wild plants leads to reduction in genetic diversity. This mainly affects agriculture (Dubey et al., 2007). Agricultural activities have reduced the richness of woody plants. Poor enforcement of Laws prohibiting agricultural activities within the buffer zone has heightened the problem of deforestation (Boakye et al., 1015).

Additionally, natural enemies (i.e., pathogens, herbivores, and seed predators) could substantially limit the abundance of rare medicinal plant species in any given area (Bevill et al., 1999; Dhyani and Kala, 2005). Forest fire also causes reduction in some valuable medicinal plants. These fires are mostly deliberately ignited and destroy some important, rare plant species (WWF, 1994).

II. Study Area

Warud is a tahsil place in Amravati district in the Indian state of Maharashtra. Amravati is situated at 20.30°N to 21.50°N and 76.35°E to 78.27°E. Warud is situated between 21°28 0″ N 78°16′ 0″ E and 21.46°N 78.26°E. Warud tahsil is the eastern end of Amravati district, major part of which borders Madhya Pradesh. The Northern border of Warud tahsil is the mountainous stretch of Satpura Hills.

The survey was carried out during 2010-2014. Field visits and observations very clearly indicates that, the biodiversity of the region is at threat. Careful notings were made to know which species are at threat and the reason for threat.

III. Results

Just few decades ago the region was thickly forested. With changed agricultural practices and life-style; apathy towards forest and wild plants has increased to a great extent. Several factors are responsible for forest degradation at human hands. Indiscriminate eradication of natural vegetation, without spareying even

medicinal plants that they are using still today, is something beyond rational understanding. Many medicinal plant species have been threatened. Some of these have been mentioned under different threats.

A) Plants cut to make 'Orange Boxes': For packaging the oranges wooden planks are used. Wood for this purpose is locally procured. Well grown trees of the following species are cut to make boxes. Every year thousands of such boxes are made. As a result, these trees are highly threatened in the region.

*Ailanthus excelsa, Albizia lebbeck, Albizia procera, Bombax ceiba, Buchanania lanzan, Terminalia arjuna, Careya arborea, Cassia fistula, Cordia dichotoma, Erythrina variegata, Ficus benghalensis, Ficus religiosa, Holoptelia integrifolia, Limonia acidissima, Mangifera indica, Madhuca indica, Mitragyna parvifolia***,** *Ougeinia oojeinensis, Soymida febrifuga, Tamarindus indicus, Terminalia bellirica and Terminalia elliptica.* The wild population of *Terminalia chebula* has been completely exploited by the local traders for orange boxes.

Cut logs of *Terminalia bellirica*

B) Plants cut for trade: *Acacia catechu* is exploited for steel industry (since the wood provides intense heat) and tooth powder units. *Dalbergia latifolia* wood is used for furniture making. *Pueraria tuberosa* (root tubers), *Pterocarpus marsupium* (wood), *Momordica dioica* (tubers) and *Sapindus emarginatus* (nuts; for collection directly branches are cut) are supplied to pharmacies on large scale. *Phoenix sylvestris* leaves are cut for making brooms on very large scale. From here, brooms are supplied to many areas of Vidarbha and Madhya Pradesh. Earlier about 10-15 years back, there was sufficient wild population of *Santalum album* and *Dalbergia latifolia*. But the illegal traders have exploited these populations from the wild.

Large amount of *Combretum ovalifolium*, *Rivea hypocrateriformis* and *Terminalia bellerica* is collected from the wild and from private lands every day as a "Goat-Fodder". It is sold in the local market without any restrictions. As a result, local populations of these species are highly threatened. Wild population of *Flemingea macrophylla* has been completely eradicated by the illegal traders involved in medicinal plant trading. According to information collected during the survey, one root (about one ft. long) of this plant costs Rs. 100/- to 200/- as per demand.

Acacia catechu

Phoenix sylvestris

Santalum album

C) Plants exploited for Non Timber Forest Produce: *Aegle marmelos* (leaves and fruits), *Anogeissus latifolia* (gum), *Boswellia serrata* (gum), *Buchanania lanzan* (fruits), *Cochlospermum religiosum* (flowers and gum), *Diospyros melanoxylon* (leaves and fruits), *Emblica officinalis* (fruits), *Holarrhena antidysenterica* (bark, flowers and seeds), *Morinda tomentosa* (wood) and *Sterculia urens* (gum).

Forest area, along the Madhya Pradesh border, supports very good vegetation of *Sterculia urens*. However, use of chemical (Ethephon) by local people for tapping gum from this species, whole population of *S. urens* has been threatened.

***Sterculia urens*: gum tapping**

D) Plants disappearing due to grazing and soil erosion: Grazing by domestic animals is the most common threat to the medicinal plant diversity. Heavy grazing leads to soil erosion and loss of valuable medicinal plants like - *Alectra parasitica, Ceropegia bulbosa, Ceropegia oculata, Chlorophytum laxum, Chlorophytum tuberosum, Curculigo orchioides, Flemingia*

macrophylla, Gloriosa superba, Grewia hirsuta, Habenaria roxburghii, Iphigenia indica, Orthosiphon rubicundus, Pueraria tuberosa, Scilla hyacinthiana, Tribulus terrestris and Woodfordia fruticosa.

Ceropegia oculata

Soil Eroded Forest Land

E) Plants disappearing due to eradication of natural fencing: It is the most significant threat to wild populations and is largely a result of changing agricultural practices during the past 100-200 years. Earlier each farm was bounded by green border consisting of several types of herbs, shrubs, tree and lianas. Now people think that this vegetation is unnecessarily decreasing the area of their cultivation land. Secondly in Warud region monkeys are becoming a nuisance for orange growers. They mainly take the shelter of these border vegetations. Farmers are cutting down these hedge plants and fencing of barbed-wires is being made. Following plant species have been threatened due to eradication of natural fencing-

Abrus precatorius, Adhatoda vasica, Alangium salvifolium, Ampelocissus latifolia, Annona squamosa, Balanites aegyptiaca, Baliospermum montanum, Basella rubra, Boerhaavia chinensis, Cadaba fruticosa, Caesalpinia bonduc, Capparis zeylanica, Cissampelos pareira L. var. *hirsuta***,** *Citrullus colocynthis, Clerodendrum multiflorum, Clerodendrum serratum, Cocculus hirsutus, Dolichandrone falcata, Ehretia leavis, Flacourtia indica, Grewia hirsuta, Grewia sclerophylla, Helicteris isora, Hemidesmus indicus, Ichnocarpus frutescence, Lawsonia alba, Leptadenia reticulata, Mitragyna parvifolia, Moringa tomentosa, Mucuna pruriens, Opuntia elatior, Ougeinia oojeinensis, Paracalyx scariosus, Phoenix sylvestris, Plumbago zeylanica, Pupalia lappacea, Rivea hypocrateriformis, Securinega virosa, Telosma pallida, Trichosanthes cucumerina, Vallaris solanacea, Ventilago maderaspatana and Vitis trifoliata.*

Burnt green fence

Fencing of barbed-wires

F) Plants disappearing due to herbicide spray: Several herbs and climbers growing in and around agricultural fields are destroyed because of herbicide sprays. These species are – Achyranthes aspera, *Calotropis procera, Calotropis gigantea, Capparis zeylanica, Cardiospermum helicacabum, Clitorea turnatea, Cocculus hirsutus, Cyperus rotundus, Evolvulus alsinoides, Gloriosa superba, Goniocaulon indicum, Hemidesmus indicus, Merremia gangetica Plumbago zeylanica, Sida acuta, Sida cordifolia, Solanum nigrum, Solanum verginianum, Spilanthus calva, Trichosanthes cucumerina*.

Herbicide spray along crop field

G) Plants used as fire-wood: Following plants species are cut for fire wood - *Acacia catechu, Anogeissus latifolia, Annona squamosa, Bridelia retusa, Buchanania lanzan, Cassine glauca, Celastrus paniculatus, Cordia macleodii, Embelia ribes, Helicteris isora, Ixora pavetta, Lagerstroemia parvifolia, Madhuca indica, Maytenus senegalensis, Ougeinia oojeinensis, Soymida febrifuga, Terminalia arjuna,* and *Vitex negundo,*.

Fire wood collection activities have affected the population of *Ixora pavetta, Celastrus paniculatus* and *Cassine glauca* severely in the wild. These plants are preferred as fire wood by the locals because fresh wood of these plants can be burnt in 'Chullhas' due to oil content of the wood. Recent rise in competition for fire-wood, poor locals are cutting every kind of live shrubs and trees to increase their fire-wood stock. Some of these locals are involved in illegal fire-wood trade and supplying it to the traders in cities and towns. Illegal 'Wine Extraction' units are run by the local tribals to extract wine from dried flowers of *Madhuca indica* along the state border forest area. These units utilize large amount of fire wood from September to February. Every kind of tree is cut and burnt in these extraction units.

Collection of fire-wood from forest area

H) Plants used for house construction: This include plants like - *Nyctanthes arbor-tristis, Vitex negundo* and *Woodfordia fruticosa*. *W. fruticosa* is highly threatened.

I) Destructive Harvesting and Over-exploitation: To harvest the bark by felling the whole tree, or to collect the leaves and fruits by cutting whole twigs may damage the plant significantly or even destroy it. For example, collection of leaves of *Bauhinia racemosa* and *B. variegata* for 'Vijayadashmi' festival is destructive and the population of these two species has been reduced significantly in the wild. Other destructive collections include- 1) collection of *Aegle marmelos* leaves during the month of 'Shravan'. Hundreds of trees are cut into a stump. 2) about one-meter long twigs of *Butea monosperma* are cut every year for "Pola" festival (festival of bullocks). 3) to collect fruits of *Buchanania lanzan* a meter long twigs are cut. 4) to collect flowers of *Cochlospermum religiosum* long branches or sometimes whole tree is cut. Flowers are offered to the Lord Shiva on 'Mahashivaratri'.

J) Road construction: These activities are threatening plant populations to a great extent. About 1.5 Km long 'Maharukh Ban' (a thick population of *Ailanthus excelsa*) along the Warud – Multai (M. P.) road has been destroyed. Only 5-6 trees have been left now. Population of *Balanites aegyptiaca, Baliospermum montanum, Cadaba fruticosa* and *Plumbago zeylanica* has also been eradicated due to widening of inter-state highways and village panchyayat roads.

Maharukh Ban

K) Forest fires: These are becoming common every year before the season of 'Tendu Patta' collection. Forests are also burnt for the collection of flowers of *Madhuca indica* and fresh fruits of *Buchenania lanzan* in early summer season when there is lot of dried litter on the forest-flore. These fires really cause damage to the valuable forest vegetation.

L) Low natural regeneration: Some species have been threatened due to very low rate of natural regeneration. Plant species like *Azadirachta indica* Juss. ssp *Vartakii, Cochlospermum religiosum, Hymenodictyon orixense, Pterocarpus marsupium, Santalum album, Schleichera oleosa and Stereospermum chelenoides***.**

M) Loss of Wild Habitats: This is the major threat to all wild plant species. Anthropogenic pressure and climate change are contributing to loss of wild habitats. Some plant species are found threatened due to wild habitat loss. These are - *Alectra parasitica, Bacopa monnieri, Cassytha filiformis, Catunaregam spinosa, Clematis heynei, Clerodendrum serratum, Costus speciosus, Embelia ribes, Euphorbia ligularia, Gloriosa superb, Gymnema sylvestre, Habenaria roxburghii, Homonoia reparia, Iphigenia indica, Millettia extensa, Mucuna pruriens, Ocimum gratissimum, Oroxylum indicum, Paracalyx scariosus, Pueraria tuberose, Quirivelia frutescens, Sphaeranthus indicus, Ventilago maderaspatana, Woodfordia fruticosa.*

Forest platue cleared for Agriculture land

Construction in forest area

Drastic decline in number of species in the wild during last 30 years is the result of these threats. Some of these plants are threatened by multiple threats. As a result, natural regeneration of these species has been affected. Collection of 'Wild Vegetables' for sale in daily and weekly markets is another factor posing threats to the population of *Cordia dichotoma*, *Goniocaulon indicum*, *Leptadenia reticulata*, *Rivea hypocrateriformis*, *Indigofera cassioides* and *Telosma pallid*.

IV. Discussion and Conclusion

Warud tahsil is bordered by Madhya Pradesh state along the East and North sides. Basically, forest area of Warud tahsil was corridor for wild-life between Melghat Tiger Project (Maharashtra) and the Pench National Park (Madhya Pradesh), which is now completely disturbed. In both the regions belief in traditional health practices is strong. It was found that in all 424 plant species are used medicinally in Amravati district. Threat assessment of ethnomedicinal plant species revealed that 149 species are facing struggle for survival locally due to several reasons. This means 35% species are facing the danger of getting wiped out from the region. Immediate steps need to be taken to save and propagate these species.

With systematic efforts, export of medicinal plants is increasing every year. Considering the opportunities in global market our medicinal plant diversity at every level (even small forest areas around villages) needs to be protected. Distribution of bio-gas plants and LPG connections to the SC, ST and BPL families, residing in and around forest areas, will help to reduce the pressure on firewood- since many of the species used are medicinal.

In many cases several threat factors intensify the overall threat to a species. Proper regulations and harvesting methods must be imposed to ensure sustainability. Listing of commercial plant species and their phytochemical screening is necessary.

The inventory and assessment of the floral resources be conducted to generate knowledge on plant diversity. This knowledge will help us for policy formulation, conserving and properly managing the threatened, endemic, rare and economically important species of plants and their habitats. *Ex-situ* and *in-situ* conservation of species and habitats should be carried out. Each municipality should propagate their threatened, endemic and economically important plants. Collection of threatened and endemic species should be regulated. Denuded land area should be planted with threatened plant species. Threatened and endemic species found in agricultural areas should be protected (Amoroso et al., 2011).

Establishment of nature reserves is one of the most effective methods available for conserving plant species and their habitats. Climate change may affect the ability of nature reserves to protect threatened plant species and even cause extinctions of threatened plant species protected within nature reserves (Araújo et al., 2011). Therefore, mass reproduction using conventional methods, establishment and maintenance of school/college herbal gardens and medicinal plants nurseries, together with education and awareness programmes for large-scale cultivation, are necessary. According to Raimondo and Donaldson (2003) conservation of adult plants is essential for all species (Ahmad et al., 2012). Area specific threat categorization is very important for short or long term management planning (IUCN, 2000).

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