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In situ Conservation of Useful and Endangered Wild Plant Species of North East India

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At the Earth summit of the United Nations Conference on Environmental Conservation (UNCED) held at Rio de Janeiro in 1992 all the Nations and India being one of them unanimously decides that the global biodiversity must be conserved immediately since many plant and animal species have become extinct during 20th century and several others are at the verge of extinction due to their exploitation, ignorance and / or degradation of habitats. The support of nature to mankind will be everlasting provided we maintain balance between exploitation and conservation.

The Eastern Himalayas including the North East Region of India, were given a special status in the Rio de Janeiro Conference (1992) along with the Western Ghats where these regions have been classified as areas possessing high biodiversity in terms of flora and fauna and categorised as one of the "**Ecological Hotspots**", the term used to denote areas or ecosystem which are rich in Biodiversity and possess rare and endangered species. Such a rich biodiversity of this region has become possible due to its range of micro-climate of different light, moisture and temperature regimes. As many as 50 types of forests are found in the North East region ranging from tropical rain forest, deciduous forest to snow-clad, alpine and sub-alpine forests.

The mountains, lakes, waterfall, caves, sacred groves and wild species of many hill areas, from Meghalaya to Arunachal Pradesh and Assam to Manipur, will not only stand testimony but also serve as eye openers to the modern man today, especially to the policy makers involved in the conservation of Biodiversity of this region .Therefore there is a need for better information on the input of human activities on biological diversity and the conservation values of different forests and to formulate strategy for the conservation and *in situ* cultivation of these species for supply as raw materials to

industries, users and above all to maintain ecological balance of these areas.

However, it is also possible for the conservation process to take another course. Propagules and other plant parts may be collected from the wild and transferred to a suitable form of *ex situ* storage facility. Orthodox seeds and pollen may be maintained in cold storage of different types, whole plants and perennating organs in a field collection, arboretum or botanical garden and *in vitro* samples in the tissue culture laboratory under slow growth conditions or cryopreservation. In the gene bank and botanic garden, germplasm is both conserved and made available for study and use. Different species and situations will require different mixes of *in situ* and *ex situ* approaches.

Conservation of Biodiversity can be best achieved by *in situ* conservation of useful and wild species through protection of habitats and ecosystem. *In situ* conservation is the conservation of the plant community in its natural location without special focus upon any particular species. It is more precisely directed towards maintaining balance between species, their forms and populations. Indeed, for any plant species to survive in nature unaided by humans, it must do so within a community of interacting organisms. Some of these interactions (e.g. with pollinators, seed dispersers, microbial symbionts) are crucial to its survival. Thus it is impossible to have meaningful species conservation *in situ* without ecosystem conservation and any prescription for a species must recognise this. On the other hand, the converse is not necessarily true it is possible to have ecosystem conservation while some species disappear.

However, Frankel et al., (1995) stated that whenever the community includes particular wild species of concern to humans, a general ecosystem approach to *in situ* conservation could prove inadequate. Single species become prominent in conservation planning for a variety of reasons, as follows:

- When the forest trees and many medicinal plants, spices, ornamentals, food and forage plants are directly harvested or grazed in the wild.
- When populations such as forage plants and wild relatives of field and horticultural crops are used as sources of propagating material for planting elsewhere, and as

sources of genetic variation for breeding programmes.

- When a dominant or keystone species and food plants of animals of major concern is crucial for the well being of an ecosystem.
- When a species is designated as endangered, particularly when it is chosen as the object of a recovery plan.

Species targets for *in situ* conservation

Forest trees

Prominent among wild plant species that call for individual conservation planning are the tree species used in forestry. They are outstanding, first economically, as the source of many products essential to society such as industrial raw materials, timber, fuel, food and fodder. Therefore they are prone to decimation from harvesting. Second, they are prominent environmentally, as forests help to stabilise the environment by fixing carbon- dioxide, by preventing soil erosion and by lowering the water table. Third, trees are dominant ecologically as they determine a wealth of interactions with other life forms in the community. Since forest tree species inevitably sustain reduction in numbers from human exploitation, safeguarding their genetic resources is the key to their conservation. It has long been recognised that conservation *in situ* is the primary method for this purpose (Frankel and Bennett, 1970) .

Love of the tribal people for the forest has been maintaining the greenery in the past because they considered themselves as an integral part of the forest. However, with the rise of consumerism their attitudes is gradually changing and they have started looking at the forest as a source of wealth to sustain their increasing daily needs and luxuries. This have led to the rapid depletion of forest cover and a disturbance in the ecological balance. The North Eastern Region has loss approximately 633 sq. km of forest cover between 1991 - 1993. There has been something very seriously wrong in approach towards utilisation of this immense wealth. This region had a long traditional system for maintenance, upkeep and preservation of natural resources. This can be seen from the cultural practices of various indigenous people of the region. Conservation of biodiversity and more specifically forest genetic resources is, therefore, becoming increasingly important. The genetic resources of forest trees are in

most instances located in primaeval, or old growth forests. Due to deforestation many tree species of North East Region are endangered. The list of endangered tree species include *Albizia arunachalensis, Artabotrys caudatus, Artocarpus lacoocha, Baliospermum micranthus, Elaeocarpus acuminatus, E. prunifolius, Rhododendron formosa, Schima khasiana, Salix tetrasperma, Wrightia coccinea* etc.

Aquilaria agallocha, a valuable tree of Assam and Tripura evergreen forests and occur sporadically. It is much exploited for highly scented wood which is used as incense, commanding a high price. One kg of Agar wood is reported to be at Rs. 40,000/kg in the Indian market. Incense is obtained from various plants and enormous quantities are collected, posing a serious threat to the already scant flora. It is being planted but it is not known if the timber would produce that incense.

In india, shifting cultivation is practiced primarily in all the seven North Eastern states viz Arunachal Pradesh, Assam, Tripura, Nagaland, Meghalaya, Mizoram and Manipur. Whatever may be view of administrators, agriculturists and soil conservatists about soil erosion and soil degradation in shifting cultivation areas, blatant facts are that trees are felled over extensive areas, herbs, shrubs, and climbers are also weeded out and the area is burnt, and the resultant secondary crop are a few fire hardy and resistance trees, a few resistant grasses, some shrubs and bamboos. The Jhum cultivation system has also caused much damage to forests. In the ultimate analysis the forests in the tribal belts have also been threatened with over exploitation and destruction. So long as the tribal population remained within the sustainable level, the Jhum system remained a viable system with the manpower as the only input. But with the increase in tribal population, the forest lands became a limiting factor, resulting in shortening of Jhum cycles. The repercussions of this are too many loss of biodiversity, invasion of adventive weeds, decrease in food and fodder resources, erosion of plant based traditional knowledge, etc. Correct assessment on the area under shifting cultivation cannot be made very accurately. The extent to which it has happened in the last 30 to 40 years is extremely important for *in situ* preservation of habitats. However, there is still scope for conserving a broad range of genetic diversity for most species, if possible in primaeval forests, but otherwise in secondary and remnant populations.

Medicinal Plants

Medicinal plants are another diverse category of plants directly used from the wild. Exploitation of traditional knowledge of medicinal plants is another key issue the world over. The conservation needs of medicinal plants were the subject of a recent International meeting organised by WHO, IUCN and WWF (Akerele et al., 1991). Medicinal plants are significant to both developing and developed countries. Estimates indicate that over 75 % of the world's rural people rely on traditional herbal medicine. About half of the world 's medicinal compounds are still derived or obtained from plants (Hamann, 1991). Many of the most important drugs of recent times were first isolated from plants, including the curare alkaloids like reserpine, and both cortisone and contraceptive steroids that are derivatives of diosgenin.

In India approximately 7500 medicinal plant species are traditionally used by the tribals (Anonymous, 1994). A total of 457 plant species have been reported to be used by the tribals of North East India. With the erosion of the tribal cultures, the traditional healers have become a threatened category. Also the genetic diversity in medicinal plants has diminished due to large scale destruction of their natural location. The over exploitation of medicinal resources in unscientific manner by unskilled labour and poor natural or artificial regeneration have resulted in virtual extinction of certain vital species. The medicinal plants of this region has already become extinct and many are struggling for their survival. *Aconitum ferox, Adhatoda vasica, Coix lacryma jobi, Coptis teeta, Costus speciosus, Diospyrus melanoxylon, Enosema chinense, Ficus religiosa, Flemingia vestita, Houttuynia cordata, Myristica officinalis, Ocimum sanctum, Oldenlandia umbellata, Parkia roxburghii, Panax pseudo-ginseng, Plantago sipaghula, Ricinus communis, Solanum barbatum, Thalictrum foliolosum, Vateria indica. Vinga vexiliata* etc. are only few examples of such plants that have been classified as endangered and likely to be endangered (rare) groups. Therefore there is an urgent need for their *ex situ* and *in situ* conservation. The demands of medicinal plant is increasing day by day within and outside the country and serious and effective measures are required to meet the challenge. The degree of risk of extinction totally or locally is one among many criteria to consider, others being value, actual and potential usage, cultural importance, and uniqueness (Heywood, 1991). Perhaps even more than forest tree, the principal threat to such species is not over harvesting but the destruction and conversion of their habitats to other purposes.

Among the many plants of medicinal importance is one species *Taxus baccata* found in the high altitudes of Sub Himalayan forest, particularly Arunachal Pradesh and Meghalaya of North East India. This species is in great demand for its leaf and barks as pharmaceutical raw material and has gained importance recently. *Taxus* yield the drug taxol from its leaves and barks. Taxol is used for the treatment of ovarian and breast cancer. The market price of taxol is far more fantastic, because of its rareness and effectiveness. As per the market price of 1994, one kilogram of taxol costs Rs. 180 crores. However, to produce one kilogram of taxol about 2000 - 3000 fully grown *Taxus* trees will be necessary. Therefore it is apparent that the value of about 25000 trees will far exceed the value of entire forest wealth of a state like Arunachal Pradesh or Meghalaya. Unscientific exploitation has drastically reduced the population of this plant in North East Region. The distribution of this species has already been adversely affected in its natural habitats along with other forest species over last few decades. Area which were abundant in its population, are now devoid of its and the natural stands can be found only on the Northern ridges of Himalaya. In Meghalaya this species was abundant only in the "Law Lyngdoh" sacred grove of Mawphlang. Once the tree is debarked it dries up and rot and due to its slow growth and low regeneration in the wild, this tree is nearly wiped out from its ecosystem. Unless stringent conservation efforts are taken up the species may enter the Extinct list. Destruction of its natural location and illegal trade to be checked to be conserved *in situ* as far as possible or grown in protected areas under similar conditions of habitat and climate, *ex situ* conservation in botanical and Experimental gardens should be considered, propagation through seed and other technique be attempted.

Similarly, with the increasing biotic pressure, the forests are getting degraded and in the process ground vegetation (floras and shrubs) which happen to provide bulk of the medicinal plants are also under strain. Reports are pouring in, which indicate that a number of plants are being endangered due to their unsystematic and unscientific collections, over exploitation and destruction of habitat. However, in many cases heavy or continued exploitation risks the regeneration of the natural source population. In the process of collecting medicinal plants the collectors uproot the whole plant. Sometimes, they gather plants before maturity of fruit and seeds. The cases where reproductive organs (fruits, flowers, seeds), the vegetative organs (roots, rhizomes) or the whole plant are used, the

species is much more endangered in comparison to a species from which only the leaves have been collected. This may be exemplified in case of *Aristolochia cathcartii* (Woody climber) and *Kaempferia rotunda* (Herb) etc., which are medicinal to rural folk and whose roots, rhizomes and whole plant have been over exploited which are reported to be endangered in the state of Meghalaya.

A major aspect of the conservation of medicinal plants is their considerable social and economic value (Farnsworth, 1988). Therefore there is an urgent need for a local or global inventory of medicinal plants, to identify the species that merit priority and to formulate strategy for the *in situ* conservation and cultivation of these species.

Wild useful species

The local people living in the village particularly on forest areas are still dependent upon wild plants for their various requirements. It has been shown through numerous examples that the tribals of North East India make wide use of a large variety of plants available to them. Fruits of many wild plants are eaten by local people and among them mention may be made of *Baccaurea sapida*, *Calamus esculentus*, *Docynia indica, Dillenia indica, Elaeagnus sp., Ficus neriifolia, F. auriculata, garcinia paniculata, G. lancifolia, Rubus nivcus, R. rugosus, Gardinia campanulata, Syzygium cumini, Lepisanthes rubiginosa, Ardisia floribunda, Meyna spinosa, Debregeasia longifolia and Actinida callosa*. Wild plants used as vegetable are the leaves of *Alternanthera philoxeroides, Bergenia ligulata, Diplazium esculentum, Pteris sp., Mussaenda roxburghii, Vaccinium donianum, Thunbergia grandiflcra, Houttuynia cordata, Sambucus javanica, Medinella erythrophylla, Olax acuminata* and *Tetrastigmata thomsoniantum*, flowers of *Buddleja asiatica* and *Corylopsis himalayana* are often cooked with meat and fish. Seeds of *Hodgsonia macrocarpa, Sterculia hamiltonii* and *S. roxburghii* are also eaten either roasted or cooked. Such activities on one hand contributed to our knowledge of various uses of biodiversity and on the other have resulted in rapid depletion of natural resources. Their demand in the local market has increased causing a threat to these wild species. Such plants too may become the vegetable for the future . Although these wild edible plants wealth are presently under utilised, to meet future needs, this invaluable treasure of native diversity needs care and more research focus on its collection, conservation and use.

Documentation of such species and their uses is of paramount importance as this would help the people in the future. Active measures, both institutional and grass roots, to ensure the conservation of plant genetic resources have thus taken on an increasing urgency of late. So in order to maintain harmony between environment and human needs, plantation of economically important species should be established in degraded forests, marginal lands, cultivable wasteland and fallow lands. At the local community level we must work out ways of giving them adequate authority and incentive to maintain diversity, both of cultivated plants, domestic animals as well as of wild, natural biological communities

Domesticated and Wild relatives of crop plants

Many rare and primitive cultivars of cereals, pseudo cereals, millets, pulses and vegetables are still grown by the people of North East region. They have preserved landraces of important crop plants, useful domesticated plants, wild relatives of economically important cultivated crop plants. These hold the genetic key of main valuable characters. The tuberous root legume *Flemingia vestita* and the millet *Digitaria curciata*, *Coix lacryma jobi* and rice bean *Vigna umbellata* are notable examples of plants domesticated by rural folks of Meghalaya. Among leafy vegetables, they have domesticated *Malva verticillata* and *Cardamine hirsuta* of Brassicae. Among the many species which found in the area of North East Region, legumes like *Cannevalia, Mucuna, Psophocarpus* and *Vigna* are used in their daily diets. A few legumes have high fat content which is extracted for used as a cooking medium. This legume diversity is important for breeding. Some of the legumes, such as *Atylosia* are wild progenitors of *Cajanus*. There are several important germplasms of cultivated as well as wild progenitors of many present day cultivated plants. While these germplasms are preserved through ages by the rural communities, the process of development and awareness about the recent improved varieties is reducing these landraces. It is necessary to keep a balance between development and conservation of the wild germplasm, so that the useful genotypes are not lost for ever.

Forage Plants

Many wild plant species are utilised as animal feed; grasses and legumes are the major component. Other forage species are also important, particularly during lean period, when green forage is scare. The use of plants for fodder, green or dry, is still practised in

the rural areas. The family Poaceae provides the maximum forage species followed by Leguminoceae. The other plant families viz, Asteraceae, Muraceae, Euphorbiaceae, Rubiaceae, Rosaceae, Polygonaceae, etc., also have an important place in providing herbage to livestock. The North East Region also represents the repository of genetic resources of forage plant. *Digitaria compacta* and other *Digitaria* species are grown in Meghalaya. *Coix lacryma jobi* is also important in Nagaland and the Hills areas of North East Region, which provide a protein rich food and straw as fodder. The naturally available indigenous fodder such as *Bauhinia variegata. B. acuminata, B. purpurea, Ficus religiosa Artocarpus integrefolia, A.heterophyllus, Litsea polyantha, Grewia optiva, Morus alba, etc.* are used in pasture and lands for livestock production. *Pemphis purpureum, Penisetum pedicellatum,* etc. are the main fodder grasses having bright prospects, however many of the fodder trees are dwindling fast due to lopping or pollarding for fodder and stumps with short branches and some leaves are the mute witness of their existence. The process of collection of fodder from the trees should be avoided during the budding of shoots, so that profuse regeneration of shoots could take place.

Since populations form the native range of forage species are an important genetic resource, there is a need for concern about their conservation and continuing adaptation *in situ.* Many species are widely distributed, or locally common and well adapted to disturbed situations as befits a resilient forage plant.

Rare and Endangered species

Rare and endangered species in tropical rain forests and other developing areas of the world has been the focus of much conservation attention, but the same development pressures and destructive phenomena are also at work in the relatively wealthy and developed areas of North East India .

There are some plants which deserve a special mention which immediately needs conservation and trade restrictions. *Nepenthes khasiana* (pitcher plant) is an insectivorous plant which is endemic to Meghalaya, listed in the Cites Index and IUCN as the most Endangered species and the whole world knows about the presence of this species only in in Meghalaya (War Jaintia of Jowai and Garo Hills Districts). The pitcher water is used as medicine by the villages and trade in this species is also unregulated and rampant

in the West Khasi hills. Trade restrictions or ban is needed at present to save this species from extinction .

All orchids have found their market internationally. The locals collect these orchids from the wild and sell them in all localities of the region as well as in other states of the country. The cost will depend on the bloom and the species. This trade is unchecked in Meghalaya apart from the fact that Orchid Trade is being carried out right in front of the authorities who have to check these species. Some of the important orchids have already vanished and few others are on the verge of extinction. The endangered and rare orchids of North East region are horticulturally most important and naming all of them is a laborious exercise. A few important ones are *Paphiopedilum venestrum, P. villosum, Cymbidium cochleare, Hebenaria khasiana, Bulbophyllum rothschildianum, Calanthe herbaceae, Dipiomeris pulchella, Taeniophyllum khasianum, Renanthera imshootiana, Dendrobium sp, Vanda sp,. etc.* The well known Lady 's slipper orchids -*Paphiopedilum insigne* and *P. hirsutissimum* which were abundant in the forest of Cherrapunji have become rare due to the continuous uprooting. In Garo Hills , the Tura peak area contains a number of species of which *Dendrobium densiflorum* and *D. chrysanthum* are common. The Baghmara - Balphakram area in Garo Hills was rich on lowland orchids but gradual deforestation has destroyed many ground orchids.

Because of their narrow distribution and over exploitation coupled with habitat destruction, many of the species are getting endangered in the wild. The species of North East Region which have been reported to be endangered, rare and endemic are *Acer pictum, Adiandra griffithii, Clematis apiculata, Cyathea spinulosa, Diplomeris pulchella, Ginkgo biloba, Mantisia wegneri, Rheum emodi, Sterculia khasiana, Podocarpus nerifolius*, etc. The reported endemic and threatened flora of Meghalaya are *Ardisia quinquanularis* (Myrsinaceae), *Carex rara* (Cyperaceae), *Elaeocarpus aeuminatus* (Elaecarpaceae), *Eurya eastanifolia* (Theaceae), *Festuca rubra* (Poaceae), *Hedychium gratum, H. rubra* (Zingeberaceae), *Inula khalpani* (Asteraceae), *Michelia punduana* (Magnoliaceae). It is extremely importance to take urgent steps for its conservation by banning its utilisation from wild, *in situ* preservation and cultivation in their natural location.

Today many rare plants remain as remnant populations along road sides and on private land near developments. Indigenous

peoples can also have particular knowledge of endangered species within a country or region. This can both increase the level of awareness of conservation biologists to the needs for adopting conservation measures, this is especially the case for species with useful properties. It is necessary to spread the awareness of the need to treat biological resources as capital assets and invest accordingly to prevent their depletion. It is in this context that conservation and scientific verification of such rare and lesser known plants assume great significance. Endangered species call for individual attention not because of a recognised use, but because they are deemed to be under threat of imminent extinction. We would thus expect that the *in situ* conservation of endangered species will require a higher level of human intervention than the conservation of forest trees, forage plants, or wild relatives of crops.

Broadly we can recognise two phase in safeguarding endangered species *in situ*. First is the recovery phase, and second the maintenance phase. The former is the more intensive effort, requiring a definite plan. A recovery plan is a detailed strategy to conserve an endangered species (Cropper, 1993). Its essentials are a review of botanical and ecological knowledge of the species, the current and likely threats to its populations and the proposed research and management for existing and any new populations of that species. Its ultimate objective is to establish self sustaining populations in nature .

In situ conservation in terms of ecosystem type of management

There are extensive tracts of forests protected as Reserves in the North East India where many useful and endangered wild species are found. Unfortunately, rapid depletion of forests due to excessive pressure from human habitation, grazing, timber collection, local medicine and illegal collection for local or International markets, plant species are under severe pressure . In spite of protection in the parks, species are lost. Therefore *in situ* conservation aims at preservation of genetic resources in its natural environment.

The forest areas Meghalaya constitute just a little more than 36 % of the geographical area of the state and only 4.43 % are state Government forests. Therefore the wide varieties of useful wild species and valuable medicinal plants which are collected in different area of

the state are procured from the area not owned by the Government. Under para -2 of the sixth schedule to the constitution of India , three District councils have been constituted in the state , viz , the Khasi Hills, Autonomous District council, the Jaintia Hills Autonomous District council and the Garo Hills Autonomous District council and as per para 3 (b) of the sixth schedule, these District councils have been empowered to make laws with respect to the management of any forest, not being a Reserved forest. In exercise of the powers conferred by the Provisions of the Sixth Schedule. the forests in Khasi and Jaintia Hills Districts are classified under the following categories :—

1. (a) ***Private forests*** : These forests owned by individuals, clan of joint clan, which are grown or inherited in recognised private land.
(b) ***Clan Forests*** : These are the forests belonging to an individual clan or joint clan grown or inherited in village or common Raj Land.

The above two categories of forest are managed by the owners subject to the provisions of forest act and Rules that may be framed by the District Councils from time to time.

2. ***Village Forest*** : These are Village Forest hitherto reserved by the villagers themselves for water conservation etc and they are managed by the Headman or Sirdar with the help of the Village Durbar subject to strict compliance with the forest Rules framed by the District Councils from time to time .

3. ***Community Forests*** : These forest are looked after by the Head of the Raid or community, under the overall supervision and management of the local administrative head. It is however mandatory on the part of the local administrative head to strictly comply with the provisions of forest Act and rules framed by the District councils.

4. ***Protected Forests*** : These are forest areas already declared protected for the growth of trees in order to benefit the local inhabitants. These types of forest are managed by local administrative Heads in accordance with the district Council Act and rules.

5. ***District Council Reserved Forests*** : These are forest that may be so declared by the Executive Committee of the District Councils and they are owned, managed and controlled by the District Councils.

6. ***Green Block*** : These are forests belonging either to an individual family or clan or joint clan or Raj Land and / or community land, already declared as Green Block by the Government, for aesthetic

beauty and for ensuring regular water supply. Any forest area can also be declared as green Block by the provision of forest rules framed by the District Council from time to time. these patches of forest or Green Blocks are supposed to be looked after by the owners in accordance with the forest Act and rules of the District councils.

7. ***Sacred groves*** : At the time when ecological degradation and deforestation have been taking place at an alarming rate through out the globe in North East India there are hundreds of natural vegetation scattered throughout the region are preserved almost in a pristine condition such pockets are commonly referred to as sacred groves. These sacred groves are completely undisturbed from human interference due to religious beliefs. In Meghalaya these are set aside for religious purposed and are managed by the religious Head or Priest, in accordance with the forest rules that may be framed by the District councils from time to time. One of the facts that makes sacred groves such important factors in conservation is that the behaviour enjoined in regard to them protected not just the trees, but every possible element of the habitat and as such they are very rich in biodiversity. This is true also of sacred species of plants and animals. As Ramakrishnan (1996) observed ecologically valuable species, which perform the function of keystone species in an ecosystem and contributes to the maintenance and enhancement of biodiversity, are also species that are socially valued by local communities for cultural or religious reasons. These forest pockets show optimum growth of vegetation. Perhaps sacred groves could be called as the last refuge for species that could have value for sustainable forestry management practices. Apart from the rich biodiversity that these harbour, they also harbour keystone species of value for forest rehabilitation (Ramakrishnan, 1998a). At least 50 rare and endangered plant species of the state are now confined only to these sacred groves (Haridasan and Rao, 1995). Role of sacred groves in maintenance of biodiversity is undoubtedly significant. It is very important therefore to revive this traditional institution and its further conservation. Awareness generation and participatory management are the key aspects for conservation of valuable biodiversity (Godbole et al., 1998). With rapid and continued decline occurring in the quality and the number of sacred groves, because of change in value system and pressure on land due to increasing population and dwindling natural resources, there is an urgent need to document and monitor the existing groves, analyse the scientific basis of these relict ecosystem functional units and evaluate their value for biodiversity

conservation (Ramakrishnan, 1998b). Efforts should be made to protect these unique habitat locations by declaring them as natural monuments.

8. ***Unclassed Forests*** : Any other forest which do not fall within any of the above classifications, are unknown as Unclassed Forests. These forest are managed and controlled by the District Councils. In Garo Hills, there is no detailed classification of Forest as in Khasi and Jaintia Hills districts but all forest areas, not belonging to the Government are under the control and management of the District Council including the 'A King Land ' where the Nokmas and their Maharis can utilise the Land for their cultivations and also for other needs (including timber) of the households in the villages, with the permission of the District Council. It looks fine and sounds good that the district councils have been vested with the power to manage the forests, not being Government Forests, but in reality there is absolutely no management worth the name, since all forest (not owned by Government) are being mercilessly stripped of their cover at almost every minute of the day since 60 percent of the District council's revenue comes from cutting down the forest. Unscrupulous exploitation of plant species by local people, traders and improper management have also threatened the survival of many valuable species from their natural habitats. Even now many of the important economic species which used to be abundantly available in the past, as assets of the state, are likely to be endangered (rare). Therefore the immediate question that need to be addressed to the general public, administrators, scientists and others either directly or indirectly involved in this matter of grave concern is how to find out strategies for greater involvement to save the situation from becoming worsened everyday.

Conclusion

It is indispensible to identify the intellectual component of tribal communities in the judicious utilisation and conservation of plant genetic resources, which can form a methodology for recognising and rewardings the contributions of tribal communities in the preservation of the donors of the key characters responsible for the commercial values of new varieties of economic plants. Such a system will help to create an economic stake among tribal communities in the conservation of wild plant resources as well as land races and other forms of intra and interspecific variability. Thus, it will serve the cause of both genetic conservation and social equity.

Fragmentation and habitat degradation have led to the extinction or near extinction of many indigenous plant species. Medicinal plants particularly are vulnerable because they are not only uprooted for development but also commercially exploited. This reduces individuals to such low numbers that species may not recover and survive in the wild over the long term. With the ever growing need for more land for human habitation and commercial prospects of extracting and trading, medicinal plants in particular face a high degree of threat of extinction . Intensive management of the species in the wild and also cultivating them for conservation and for sustainable utilisation *in situ* is necessary. Therefore it is very important that forest lands/ protected forests around villages should be properly maintained and managed for maintenance of diversity.

The capacity of the community to protect the forest in an organised way can be effectively used if the indigenous knowledge, especially of medicinal plants and wild useful species, is properly combined .With increasing recognition of the fundamental role that the farmers continue to play in generating and maintaining the diversity of landraces, and indeed of the role of traditional societies in general in developing the many uses of plants, wild and cultivated has come the acknowledgement that they must be involved much more profoundly than has perhaps been the case in the past in the process of systematic germplasm conservation. Maybe *in situ* conservation of many of these cultivars could turn out to be a better economic option.

The best way to enhance the role of protected areas in the conservation of valued plants, is to develop plans to enable the local people to benefit from the resources in a sustainable way, to present guidelines for the selection, planning and management of protected areas. The basis is a survey of the useful species present in a region. Once species targets are decided, harvest techniques, limits and the mechanisms for sharing of benefits with the local people should be planned. As well, the maintenance of the resource may entail varying degrees of intervention. Species of sub-climax communities may require management, such as grazing, burning, logging to open the canopy, thinning, controlling detrimental species or enrichment planting. Thus the aim of their conservation *in situ* is the sustainable supply of useful/ medicinal plants.

In situ and *ex situ* conservation of endangered or likely to be endangered (rare) species should be immediately be started in the appropriate regions of North Eastern Region. It is extremely important to take urgent steps for its *in situ* conservation by banning its collection from the wild. Use of spontaneous and wild collected plants must be limited as far as possible and replaced step by step by their cultivation and rural folks should be encouraged to raise their own ethnobiological gardens or herb gardens in their vicinity to ensure conservation of the depleting biodiversity in medicinal or useful plants.

The active participation and co-operation of the local people should be taken in the implementation of legislation measures as well as other conservation practices. Ideally, the inclusion of a rare species in the endangered plant program collection will be only the first step towards its recovery as naturally reproducing wild populations on protected land. The emphasis now is less on the long term maintenance of the species in cultivation and more on developing the technology to enhance wild populations and to introduce new populations on to protected sites. To avoid pressure from the wild populations, mass propagation of potential species needs to be popularised among the inhabitants, to ensure the adequate quantities are available for future generations. Research priority should be given to develop appropriate technology for propagation, cultivation, processing, chemical characterisation and marketing of medicinal plants, useful and endangered species. Local people should be trained how to propagate, preserve and collect the medicinal plants as a part of extension. They should be educated and provided with the proper guide lines, so that there is a continuous regeneration of wild flora. It is again important that we should not disturb the local forest flora, which is generally susceptible to environmental changes which may lead to extinction of natural species

To eliminate the middleman and stop exploitation of local rural people through unethical trading practices, large size multipurpose co-operative societies are to be set up in North East Region to perform manifold functions of providing investments, procurement and marketing of medicinal plants. Incentives should be given for trade of medicinal plants as available to other industries in order to ensure the market of available medicinal plants. Minimum support price for important medicinal plants should be fixed. To ensure the marketing of collected medicinal plants, pharmaceutical industries should be established in the region.

When a wild species is identified as being of commercial value, it may be exploited in its native habitat, or it may be taken into cultivation, which is likely to result in domestication. Either case will necessitate protection and conservation of the habitat; in the first case, to preserve the natural resource for continuing production, in the second, to conserve the genetic resources for maintenance and improvement of productivity. As for potential useful species, their preservation forms a major reason for the conservation of ecosystems. This is particularly the case for North East India which are the most promising and diverse reservoirs of new useful plant species.

Summary

Local rural people of North East India are generally very knowledgeable about the wild plants around them many of which have local names and are important to them economically or feature in folklore. This knowledge is the best starting point for effective *in situ* conservation, which requires accurate and up to date information on the status of plant populations, on the extent and nature of plant use by local communities and on the capacity of the resource base to support different economic activities. Their knowledge can be used in the evaluation of the cultural, biological and socio-economic importance of biodiversity. It is also useful in creating awareness of the importance of biodiversity, as it is generally easier for the general public to relate to than the results of scientific trials. An understanding of the many aspects of human influences on biodiversity, and their underlying driving forces is of crucial importance for setting priorities and directing conservation and sustainable use measures.

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