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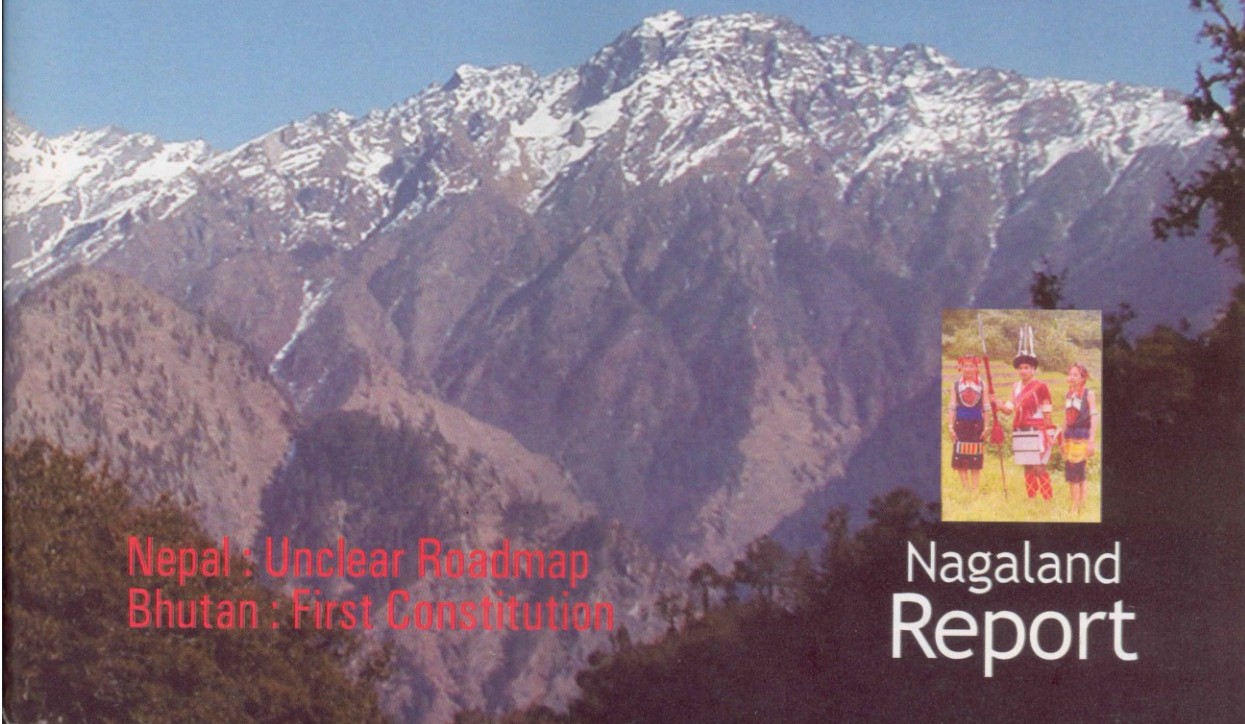
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BIOLOGICAL DIVERSITY IN Northeast India : Conservation Strategies

■ Highland Kayang

The Eastern Himalayas including the Northeast 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'. This is used to denote areas or ecosystem, which are rich in Biological diversity 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 Northeast 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.

Tribal of Northeast 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 conservation, which requires accurate and up to date information on the status of

plant populations, on the extent and nature of plant used 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 economic importance of biodiversity. It is also useful in creating awareness of the importance of biological diversity, as it is generally easier for the general public to relate to the results of scientific trials.

Conservation of Biological Diversity in northeast region 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 (i) when the forest trees and many medicinal plants, spices, ornamentals, food and forage plants are directly harvested or grazed in the wild (ii) 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 (iii) when a dominant or keystone species and food plants of animals of major concern is crucial for the well being of an ecosystem and (iv) When a species is designated as endangered, particularly when it is chosen as the object of a recovery plan.

Conservation of Biological Resources

Prominent among biological resources 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 as it has long been recognised that *in situ* conservation is the primary method for this purpose.

Waning Tribalism

Love of the tribal 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. These have led to the rapid depletion of forest cover and a disturbance in the ecological balance. The Northeast region has lost approximately 633sq.km of forest cover between 1991 and 1993. There has been something very seriously wrong in approach towards utilisation of this immense wealth. According to an estimate based on satellite images (survey report of FSI), northeast region has 1, 63,799 km² of forest, which is about 25% of the total forest cover in the country (Anon, 2000).

The management of the forest has suffered in the recent past due to pressure on land, decreasing cycle of shifting cultivation, exploitation of forest for timber and lack of scientific management strategy. 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. The genetic resources of forest trees are in most instances located in primeval, or old growth forests. Due to deforestation many tree species of Northeast 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.

Shifting Cultivation

Shifting cultivation is practiced primarily in the entire Northeast viz. Arunachal Pradesh, Assam, Tripura, Nagaland, Meghalaya, Mizoram and Manipur. Whatever may be the views of administrators, agriculturists and

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soil conservatisms about soil erosion and soil degradation in shifting cultivation areas, the facts remain that trees are felled over extensive areas, herbs, shrubs, and climbers are also weeded out and the area is burnt. 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 forestlands became a limiting factor, resulting in shortening of Jhum cycles. The repercussions of this are too many losses of biological diversity, 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 primeval forests, but otherwise in secondary and remnant populations.

Medicinal Plants

Medicinal plants are another diverse category of biological resources directly used from the wild. Medicinal plants continue to be a vital resource, both in traditional medical systems, and as a resource for drug discovery. They form an important part of plant resources and are used to improve health care for most people. According to the World Health Organisation estimates the present demand for medicinal plants is about US \$14 billion a year. It is projected to be US \$5 trillion year 2050. Medicinal plant related trade in India is estimated to be around Rs.550 crores per year.

While the value of global trade in medicinal plants has been put at over \$60 billion per year, India's total turnover of Rs. 2300 crores

of Ayurvedic and herbal products, major over-the-counter (OTC) products contribute around Rs.1200 crores.

Other formulations fetch around Rs.650 crores. And classical Ayurvedic formulations contribute the remaining Rs.450 crores. With world demand growing at 1% annually, the export market for medicinal plants appears to be growing faster than the Indian domestic market.

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. Medicinal plants are significant to both developing and developed countries. WHO has estimated that at least 80% of the world population rely on traditional systems of medicine for their primary health needs and these systems are largely plant bases. There are about 89 plant-derived drugs currently prescribed in the industrialised world. 25% of the medicines prescribed in the west contain at least one ingredients derived from medicinal plants. 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.

Costly Exploitation

Many of the medicinal plants of the region that our grandfathers respected and protected for future generations are no longer available to us. Open access to medicinal plants in the wild is perhaps one of the main reasons for the current unsustainable levels of harvesting. Most of these medicinal plants being taken from the wild; hundreds of species are now threatened with extinction because of over-harvesting, destructive collection techniques, and conversion of habitats to crop-based agriculture. Other factors contributing to un-sustainability include lack of sufficient data on wild plant populations, marketing, and trading. Inadequate regulations and legal protection (including intellectual property rights for local practitioners with local knowledge). Poor

access to appropriate technology for sound harvesting and plantation development.

Despite all their importance, medicinal plants in northeast region are, for the moment at least, seldom handled within an organised, regulated sector. Most are still exploited with little or no regard to the future. As noted, escalating consumer demand is already resulting in the indiscriminate harvest of wild medicinal plants. This is damaging both ecosystems and their precious biodiversity. The damage is especially serious when bark, roots, seeds and flowers all essential for the species survival are removed.

In India, approximately 7500 medicinal plant species are traditionally used by the tribal (Anonymous, 1994). A total of 1557 plant species have been reported to be used by the tribal of Northeast 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 have already become extinct and many are struggling for their survival. *Aconitum ferox*, *Adhatoda vasica*, *Coix lacryma jobi*, *Coptis teeta*, *Costus speciosus*, *Diospyrus melanoxylon*, *Eriosema chinense*, *Ficus religiosa*, *Flemingia vestita*, *Houttuynia cordata*, *Myristica officinalis*, *Ocimum sanctum*, *Oldenlandia umbellata*, *Parkia roxburghii*, *Panax pseudo ginseng*, *Plantago ispaghula*, *Ricinus communis*, *Solanum barbatum*, *Thalictrum foliolosum*, *Vateria indica*, *Vinga vexillata* 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 are 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.

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 is medicinal to rural folk, and whose roots, rhizomes and whole plant have been over exploited and reportedly endangered in the state of Meghalaya.

Indeed, cultivation offers the best hope for conserving many medicinal plants found in the wild while maintaining harvested supplies at today's levels. Cultivation also permits better species identification, improved quality control, and increased prospects for genetic improvements.

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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 tribal of Northeast 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 grandiflora*, *Houttuynia cordata*, *Sambucus javanica*, *Medinella erythrophylla*, *Olax acuminata* and *Tetrastigmata thomsonianum*, 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 contributed to our knowledge of various uses of biodiversity and 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. In

Taxus baccata

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 Northeast 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 25,000 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 Northeast 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 it 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 rots 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 need to be checked and 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.

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 Northeast region. They have preserved landraces of important crop plants, useful domesticated plants, and 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 Brassicaceae. Among the many species, which are found in the area of Northeast region, legumes like *Cannavalia*, *Mucuna*, *Psophocarpus* and *Vigna* are used in their daily diets.

A few legumes have high fat content, which is extracted and 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 the rural communities have preserved these germplasms through ages, 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 forever.

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 scarce. 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 Leguminosae. The other plant families viz, Asteraceae, Muraceae, Euphorbiaceae, Rubiaceae, Rosaceae, Polygonaceae etc, also have an important place in providing herbage to livestock. The Northeast 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 Hill areas of Northeast 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.

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 Northeast India. There are some plants, which deserve a special mention that 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

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the presence of this species only in Meghalaya (War Jaintia of Jaintia Hill, Mawsynram of West Khasi Hill 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.

Orchid Trade

All orchids have found their market internationally. The locals collect these orchids from the wild and sell them in all localities of the northeast 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 Northeast 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*, *Diplomeris pulchella*, *Taeniophyllum khasianum*, *Renanthera imshootiana*, *Dendrobium sp.*, *Vanda sp.* etc.

“*Paphiopedilum insigne* and *P. hirsutissimum* that 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 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 Northeast 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* (Elaeocarpaceae), *Eurya eastanifolia* (Theaceae), *Festuca rubra* (Poaceae), *Hedychium gratum*, *H. rubra* (Zingiberaceae), *Inula khalpani* (Asteraceae), *Michelia punduana* (Magnoliaceae). It is extremely important to take urgent steps for their conservation by banning their utilisation from the wild.

Conservation Routes

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

Broadly, we can recognise two phases 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. 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. ■

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