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LAND DEGRADATION AND CONSERVATION OF BIO-DEVERSITY WITH SPECIAL REFERENCE TO NORTH EAST INDIA

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Degradation of land and water resources is a serious problem in North Eastern Region comprising Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland and Tripura states. The region occupies a geographical area of 2.55 lakh sq. km. with North Eastern Hills and basin alone accounting for 65% of total land area while the Brahmaputra valley and Meghalaya Plateau cover 22% and 13% of the areas respectively. Substantial part of the land are however steep hills, deep terrains and thick forests. The region provides varied climatic zones and ecological niches for plants, animals and human beings and also is important from strategic, ecological, social and cultural point of view. It is characterized by large variations in topography (ranging from few meters to 5000 meter above msl) and receives annual rainfall ranging from 750 mm to 12500 mm. The vast area of hills, interspersed with fertile valleys represents agroclimates of unique diversity ranging from extreme temperate to typical tropical. Hilly topography, high rainfall, primitive form of agriculture, execessive exploitation of forest wealth, expansion of road communication and urbanization etc. have affected land and water resources in the region. The entire North Eastern Region (NER) with the exception of Brahmaputra and Surma vallies is the abode of numerous ethnic groups of tribal population differing linguistically and culturally some times over very short distances. Though strategically very important for the country, the region has remained socially and economically very backward; its geographical isolation from the rest of the country, besides its topography and terrain have also been contributing factors for the regions comparative backwardness. It is reported that the region has highest per capita availability of natural resources in the country. Unfortunately, the demographic pressure has been pressurising and changing the land-man ratio and balance. Population growth in the North Eastern States are markedly higher than the national average through population density is lower. Despite low population density, the pressure on land is heavy as only a very small proportion of the geographical area is culturable. Owing to preponderence of forests and barren and incultivated land, per capita availability of land for cultivation in the hill areas is lower than the all India average of about .3 ha (Anonymous 1976). The lowest is in Arunachal Pradesh and Mizoram (0.12 ha). Cultivation has been extended to marginal lands through extensive deforestation and shifting cultivation resulting in low productivity and soil erosion. The local environment is under strain from escalating population growth and the need for food fuel and shelter from existing resources. There are also rapid rise of organized violence and terrorism in the area with the growth of armed cadres of youth displaying the back to the wall mentality.

Distribution of wastelands

The realistic estimates of various types of land degradation in the region are however rare; most of the figures are based on secondary information. The most recent study conducted by soil and water conservation Division of the Ministry of Agriculture has found that of the total geographical area of 283.15 m.ha. encompassing 20 states in India, an area of 98.53 m ha constituting 34.7% is found to be affected by one or other major type of degradation (Table 1).

Table 1 . Status of Land Degradation in north eastern states - present assessment vis-a-vis earlier data

(Area in lakh ha).

State	Geographical area	Earlier assessment		Present assessment	
		Area	% of Geographical area	Area	% of Geographical area
Arunachal Pradesh	83.74	26.54	31.7	11.95	14.3
Pradesh					
Assam	78.44	29.99	38.2	19.63	25.0
Manipur	22.33	7.34	32.9	13.26	59.4
Meghalaya	22.43	11.02	49.3	11.02	49.1
Mizoram	21.08	6.20	29.4	10.02	47.5
Nagaland	16.58	10.38	62.6	8.21	49.5
Tripura	10.49	2.79	26.6	2.95	28.1

(Source : Sethi et al, 1994)

The states of Manipur, Mizoram and Tripura have shown increase of degradation as against general trend of decrease. According to another survey report-among the 10 leading states as far as wastelands are concerned 6 are from NER (Sethi et al 1994). What is important for hills is the proportions of net area sown to geographical area on the one hand and fallow land (both current and others) and culturable waste land on the other that have got bearing on shifting cultivation *(jhum)*. Proportion of net area sown to geographical area is negligible in Arunachal Pradesh (2.05% in 1988-89) and Mizoram (3.08% in 1988-89). It was 10.86% and 8.74% respectively in Nagaland and Meghalaya in the said years. Proportion of fallow and cultivable wastelands is extremely low in Arunachal Pradesh (0.88%) and Tripura (0.28%) but high in Nagaland (21%), Mizoram (24.5%) and in Meghalaya (32.77%) in 1988-89 (Neog 1997). Land degradation is not only a function of natural environment but also of land use and management or human interference. It is well recognised that apart from natural causes improvident and unscientific land and water management practices result in productive land into waste lands. Many undesirable and inappropriate land use practices operate in different parts of the region.

Deforestation

In the NEH region, the forests has emerged as the central natural resource, governing the basic needs of people. The state of forests is therefore is an important determinant of the quality of life of the people and is itself determined by the way in which they are used an managed. The illicit felling of trees in the area is rampant. Trees have been mercilessly cut for a variety of reasons, some of which are commercial exploitation by greedy businessmen from outside the region who exploit the simple minds of the local tribals making them sell their trees for a pittance. This is because large chunks of forests are owned by individual owners. Grants of permit by District councils are liberal and it is the main source of their revenue; this has led to frequent confrontations of the local people, District Councils and the state forests departments. The forest survey of India (FSI) initiated the work of assessment of the forest cover on a two year cycle using satellite data since 1983 and opined that the north eastern states are the area of great concern and they have been loosing forests continuously with the exception of Tripura.The region which had a forest cover of 67% lost 783 sq.km. during 1993-95 (Table 2). Among North Eastern States, Assam recorded the maximum loss of 237 sq.km. while Nagaland lost 70 sq.km.. North Eastern States lost 300 sq.km forest cover since 1995.

Table 2.. Forest cover in different assessment during 1987 to 1997 in North Eastern States

State	Year						Total change in 1995-97 assessment
	1987	1989	1991	1993	1995	1997	
Arunachal Pradesh	64,132	69,002	68,757	68,661	68,621	68,602	–19
Assam	25,160	24,832	24,751	24,508	24,061	23,824	–237
Manipur	17,475	17,685	17,685	17,621	17,558	17,418	–140
Mizoram	19,084	18,170	18,853	18,697	15,657	–57	
Nagaland	14,394	14,399	14,321	14,348	18,576	18,775	+199
Tripura	5,953	5,535	5,535	5,538	5,538	5,546	+8
Meghalaya	16,466	16,466	15,875	15,769	15714	15,657	–70

(Source : Anonymous, 1997)

There are large number of forest based industry operating in different states of the region. Arunachal Pradesh alone licensed 241 wood based industry which requires large quantities of forest based products. The region has a long border with Bangladesh and the portion on the Bangladesh side is all wetland and the smuggling of timber across the border is rampant. It has been reported that a number of saw mills are running in Bangladesh with the timbers from North Eastern States. Bamboo forests are being harvested in a major way by the pulping industry. Fuel wood also consumes a sizeable chunk of forest areas. The major sources of fuel - firewood and charcoal both are wood based. Much of the fuel wood consumed in the region comes from secondary forests, only small part comes from the primary forest. However, increased population pressure and rapid depletion of primary forest cover in the region is

rapidly changing the situation. If about 250 kg of fuel wood is taken as the annual average consumption by an individual (Ramakrishnan 1993), then for a population of 31.55 million (according to 1991 census), the fuel wood need in the region itself works out to be 7887.5 × 10^6 kg. The annual demand of railway sleepers also take a sizable chunk of forests in the region.

Hydrological deterioration

Drying up of wells, springs and seasonal streams and lengthening of dry season is noticeable in many areas; Reservoir siltation is another serious problem. Almost 10% of the total rain of the country is received in this region. Brahmaputra basin including Barak have an average annual flow of 54.0 million ham; however, utilisable flow is only 2.4 m ha m. The very life of the Manipur valley depends on the Loktak lake which is a drying one from hydrological and ecological angles. The water surface area is understood to have shrunk by more than 50% (Anonymous, 1990) calling for immediate and proper remedial measures. The hydrographic surveys of the Umiam reservoir (Meghalaya) conducted during January 1990 revealed a sediment deposition of 11703 ac. ft. during the last 25 years, giving an annual rte of sedimentation of 26.05 ham per 100 sq. km of catchment area (Anonymous, 1990). High rainfall and steep hilly topography is always associated with problem of severe soil erosion, particularly when the land use systems have biotic interference. Quantitative facts on soil erosion hazards from soil erosion studies in the region indicate that except forest land use, none of the land uses are safe and lead to land degradation process (Table 3 & 4). The Brahmaputra is one of the most heavily sediment laden among large rivers of the world, carrying an average annual suspended load of 15200 ham (402 million metric tons) at Pandu in Assam. During the rainy season (May — Octorber) the river transports more than 95% of the annual suspended load at an average daily rate of 80 ham (2, 12 million metric tonnes). The river characterised by high seasonal variability in flow, sediment transport and channel configuration is currently experiencing a secular period of aggradation (Goswami, 1985).

Table 3 soil erosion hazards culti[illegible] with various landuse practices

Land Use System/practices	Experimental plot size	Soil loss (t/ha/yr)	Average annual rainfall (mm)
Shifting cultivation	Small	30.2.170.2	1600
Shifting cultivation	Field	5.1-83.3	1600
Tuber crops on raised bed (un)	Medium	40.0-50.0	1800
Pineapple cultivation along the slope (first 2 years)	Small	24.0-62.6	1600
Homestead areas	Field	16.8	1600
Mixed crop of maize and rice	Small	19.7-21.0	1600
Rice crop on slope	Small	32.9-45.0	1600
Bare fallow	Small	83.8	1600
Cropping systems	Medium	51.0-83.8	1600
Grass cover (planted)	Medium	10.83	1600
Natural bamboo forest	Field	0.04-0.52	1600

Note : Area of small, medium and field size plots were in ranges of 2-5, 16.40 and 69.000 m^2 respectively.

In high rainfall area, The relationship between soil loss and soil productivity is similar as crop yields fall in roughly exponential fashion as erosion increase. Roads are now build to connect each isolated village - in PWD style - with each Kilometre of road causing between 40,000 to 80,000 cubic metre of rock and soil to slide upon the fields and rivers below.

Table 4. Soil erosion calendar of shifting cultivation system

Month	Agricultural operation	Erosion problem	Soil erosion (t/ha) Min	Max
January, February & March April	Selection of plot, forest cutting, burning and clearing of hill slopes of burnt pices Clearing of area of burnt pieces continues and sowing begins	Displacement of loose soil materials to down hill and rolling down of earth worn castings, Soil erosion as above and wash due to rains	0.0	22.4
May	Sowing/weeding	Heavy soil wash, faint rilling at foot hills on silt deposits.	0.2	61.9
June	Weeding	Heavy wash of soil aggregates.	0.2	45.4
July	Weeding/harvesting begins	Heavy wash of soil aggregates, crop root exposed, farm soil visible	1.8	21.9
August	Harvesting and occasional weeding	Soil wash continues	1.0	29.6
September	Harvesting	Moss appears, soil erosion slows down	0.1	13.8
October	Harvesting	Soil erosion appreciably reduced	0.0	2.7
November	Harvesting	No erosion, moss turns brackish	0.0	0.0
December	Harvesting/threshing/carry harvest back to home	No erosion	0.0	0.0
Year	Cropping with zero tillage on steep slope	Heavy soil wash	3.3	201.4

(Source : Singh *et al*, 1981)

The Cherrapunji in Meghalaya has been famous till recently for recording the highest rainfall in the world. The place is suffering from acute scarcity of drinking water. As a result at places vast stretch of plain land is without any human habitation. With an average rainfall of over 1150 cm or more one would expect cherrapunji to be clothed in lush green forest. But what one sees now is a desertified barren beds along the slope. Heavy deforestation for augmenting fuel/fire need and harsh climate of 1150 cm of annual rainfall coming down in 4-5 months during monsoon, are chief factors responsible for the present stte of affairs. The entire

area is barren and practically there is no soil depth and is now appropriately called a wet desert. This is one example, if concentrated efforts are not taken on time, situation like cherrapunji will be repeated in other parts of the region. About 400 vilages in West Khasi hills district of Meghalaya are faced with serious scarcity of drinking water and whatever sources of water are available, are found to be blemished with iron and turbid.

Flood in the valleys

Rainfall in the North Eastern region is rather heavy and the same is concentrated in a few months from May to September. The water retention capacity in the catchment areas have declined due to deforestatioin and other factors with the result that the water, instead of being retained, runs of the hills thus increasing the volume of water being flowing down. The rivers in the region traverses in the valley in a series of deep and narrow constructions (nodal reaches) followed by broad braided reaches. Excessive silt load in the river due to soil erosion and large scale land slides in the hilly catchment areas due to intense rainfall on fragile steep slopes result in unstability of the river and its banks. The continuous migration of both the banks of Brahmaputra on large scale between nodal points has affected many reaches, embankments and number of towns. The problem has been further aggravated by large scale deforestation, widespread practice of shifting cultivation, high seismicity, over grazing and various developmental activities like road construction urbanization etc. resulting in washing down of alrge quantities of sediment into tributaries which ultimately makes its way in the main river, leading to raising of river bed and reducing water holding capaity of the river. The specific yield of Brahmaputra basin (consisiting of major states in NEH Region) is highest in the world - 3.03 cusec per square mile as against 1.61 of Yangtse, 1.09 of the Ganga 0.62 of Yensey and 0.53 of Missisipy (Sharma), 1982). The impact of rainfall in the catchment areas within the territorial boundary of India of the region is so high that the discharge of the Brahmaputra at Dhubri is more than three times of that at Dibrugarh separated by a distance of 600 kms. The river frequently overspills its banks causing flood havocs to vast areas by destroying and demaging cultivated fields, roads, railway, building and even resulting loss of animal and human life; 10-12 percent of the total cultivated area are almost regularly affected by floods (Borthakur, 1992). The loss of life and properties has been collossal. Execessive silt load much beyond the carrying capacity has given rise to serious bank erosion and unstability of river channel. Majuli the river island and the centre of Baishnavite art and culture, has been facing inundation and severe problem of bank erosion by the river Brahmaputra threatening its very existance. Villages situated on the river banks are continuously threatened by erosion and sometimes destroyed during the course of floods without any warning. Out of 244 no. of villages in the island, 35 have already been eroded; Up ahead looms an uncertain future of their incredible cultural heritage. Apart from the direct visible damages, the eroded material that is carried away chokes the stream channel downstream. The magnitude of the problems are such that it is difficult to envisage the time by which the floods would be fully controlled. Some time ago, The Tripura Govt has drawn attention of the Centre about the extensive erosion taking place in the rivers constituting International Borders and the Country loosing the eroded land for ever.

Mining and quarries

The NEH Region is rich in coal, limestone, oil and natural gas, iron other minerals. However, there is no scientific or systematic planning for mining operations. The natural

resources of an ecosystem are seriously altered and disrupted when disturbed by surface mining. Coal mining which are both open cast mining and rat hole mining types have destroyed the ecology of the mining areas. The coal which has a high sulpher content forms sulphuric acid with the rains and streams flow to the rivers; fishes are reported to have disappeared in Myntdu river in the mining area of Jaintia hills. The type of mining is also disorganised and one can see 'dips' (overturned debris) where nothing grows. Holes or small covers are dugout over the place wherever there is deposit. At places, even existing paddy fields are not spared. The coal boom has also been a big factor in prices skyrocketing affecting the salaried and poorer section of the society. The 1987 statistics for coal extracted in the Meghalaya state put the figure at 1,44,800 tones which shows the magnitude of coal mining done in a small state with rapid increase of scattered and indiscriminate open cast coal mining. Pollutants are continuously released in large quantities which the normal environment cannot assimilate to maintain ecological balance. The open cast mining started in Margharita area of Assam in 1984 and since then 500 ha of rain forest has been ruthlessly destroyed; moreover in the last 14 years, it has wrecked havoc to forest flora and fauna and in surrounding areas through pollution of streams, large-scale destruction of agricultural land through deposition of coal dust over the soil. It also renders the soild highly acidic and unfavorable for cultivation and led to displacement of local villagers, loss of large tracts of pristine rainforest, climatic pollution and rise in antisocial activities. The effect on vegetation, loss of nutrient rich top soil and above all dangerous pollution of surface water sources are serious challenges for survival of inhabitants which warrant appropriate urgent measures befor it is too lage. Similarly, quarrying of limestone is also carried out at places scarring permanently the face of the earth. With the increasing demand for sand and stone as construction materials, quarries have been opened up in diverse places including river sides. The result is disfigurement and destruction of land resources.

Biological degradation

The NE region is globally recognised as genetic paradise and mega bio diversity area from the point of view of its endowments in flora and fauna as well as micro flora and micor fauna. This region of great genetic diversity, however is under serious threat of rapid extinction (Table 5) or depletion of the germplasm. It has already lost many valuable genes. Loss of genetic material can be attributed to various factors such as environmental destruction caused by large scale deforestation, shifting cultivation, soil erosion, floods and earthquakes etc. Mushroom growth of industries, like paper mills, plywood factories etc. without proper planning and population explosion have also led to depletion of the genetic resources. Out of about 1500 threatened forest species in the country about 650 plant species are said to be from NE region alone. In a case study at Burnihat in Meghalaya, the species of trees observed to have been affected in the process of shifting cultivation are shown in Table 6. In addition to forest vegetation being burnt, even grasses useful for animal nutrition are eliminated. The composition of fauna is as diverse as the flora. Most of the wild fauna are now being threatened for extinction due to forest depletion, human depredation, poaching and other non forestry activities. According to Zoological survey of India, Shillong, there are over 66 species that are listed as endangered animlas that once thrived well in the region. The region has been identified as one of the 18 hotspots areas in the world with reference to rich bio-diversity, thereby stressing the need for urgent steps to halt genetic erosion.

Table 5. Orchid species on the verge of being extinct from the N. E. Region

A. multiflorium	Cymbidium elegans	Oberonia libulata
A. sikkimensis	Cypripedium cordigerum	Paphiopedilum wardii
Acanthophippium sylthetense	Cymbidium macrohizon	Galeola lindieyana
Aerides biswasianum	Cymbidium sikkimense	Galeola lindieyana
Anoectochilus griffithi	Cymbidium whiteae	Ppahiopedilum druryi
Anoectochilus roxburghii	Cymbidium macrophizon	Paphiopedilum insigne
Arachnanthe clarkei	C. elegans	Paphiopedilum wardii
Arundina graminifolia	Dendrobium hookerianum	Paphiopedium venustum
Bulbophyllum piluliferum	Dendrobium palpebrae	Pleione humilis
C. assamica	Diplomeris pulchella	Vanda coerulea, V. pumila
C. mossiae	Eria crassicaulis	Yoania prainii
C. rigida	Eulophia sanguinea	Zeuxine pulchra
C. treutleri	Galeola cathcartii	
Calanthe whiteana	Dendrobium parishii	Spathogiottes ixioides
Castrodia exilis	Dendrobium wardianum	Vvanda alpina
Coelogyne albolutea	Dendrobium crassinode	Vanda amesiana

(Source : Borthakur, 1992)

Table 6. Forest species affected in the process of shifting cultivation

Local name	Botanical name
Koko bamboo	Dendrocalamus hamiloni
Ahani	Vitex penduncularis
Kokan	Duabanga senerosides
Jia	Goruga pinnata
Bahara	Terminalia belerica
Toon or Poma	Cedrella toona
Amloki	Emblica officinalis
Sunaloo	Cassi fistula
Oksi	Dillenia pentogyna
Ghargra	Schima wallichii
Sida	Lagurstromae parviflora
Dhobisnut	Semicarpus anacherdium
Kanchan	Bauhinia purpuria
Gamari	Gmelina arborea

Sal	Shorea robusta
–	Sterosperumm chelonoides
–	Careya arborea
–	Callicarpa arborea
–	Linea grandis
–	Litsea chipinsis
Silika	Terminalia (Sp.)

(Source : Borthakur, 1992)

An estimated amount of diversities in major crops on the NE India is reported to be 9650 in rice, 15 races and 3 sub-races (1200) in maize, 300 in taros, 230 yams, 17 sps + 52 varieties in citrus, 16 texa in banana, 78 texa in bamboo, 700 texa in orchids and 19 texa in sugarcane.

Biodiversity conservation

Global awareness of rapid loss of biological diversity is increasing everyday. To safeguard the rich bio-diversity of the region, particularly agri-bio-diversity and wild relatives of economic plant species, adequate conservation measures must be adopted. *In situ and ex* situ conservation of plant genetic resources (PGR) should be viewed as an integral part of for conservation of natural resources and ecosystem. Genetic variability inplants has formed the basis for agriculture more than 10,000 years and it continues to provide genetic base for development of new crop varies. The traditional land races and wild relatives of crop plant which constitute the gene pool of genetic diversity must be conserved to develop high yielding adaptable strains to meet the food requirements of the growing population of the country. Conservation and planned utilisation of PGR is essential for the survival of human beings and other living organisms (Singh 1996). PGR includes i) land races and primitive culture, ii) obsolete farmer's named and old released varieties, iii) recently released varieties, vi) parental line of released hybrids, v) genetic stocks with known attributes and vi) wild and weedy relatives of cultivated crops and vegetables.

Conservation of PGR is the management of the human use of the biosphere so that it may yield the greatest sustainable benefit to present generation, while maintaining its potential to meet the needs and aspirations of future generations (IUCN, 1980). The conservation is positive, embarrassing preservation, maintenance, sustainable utilisation, restoration and enhancement of natural resources and environment. Conservation includes elements of both preservation and sustainable use, restoration and enhancement. The use of natural resources for development often takes place against a backdrop of uncontrolled exploitation or consumption. Destruction of habitats such as feiling of forest and dearining of wet land and intensive cultivation with HYV, can decimate plants and destroy indigenous cultures. Often land was cleared of natural vegetation and soils were exhauseted, leaving eroded slopes and dust bowls (Gunn & Edmonds, 1986). Presently species protection is advocated with the belief that all plants and animals have a right to except adequate genetic resources for their sustainable development (Taylor, 1986; Engel & Engel, 1990). Conservation of PGR *in situ* is

dependent on maintaining the essential functional component of the natural habitat of the specis. Establishment of biosphere reserves is being promoted which will facilitate *in situ* conservation of valuable plant varieties developed and protected by farmers for centuries in hill agriculture systems. The 80 sq. km. Nokrek Biosphere reserve in the Burman Monsoon bio-geographic region of Meghalaya is a case in point with enormous genetic wealth (Rana, 1995). The flora of Khasi hills is the richest in India and probably in Asia. The gene pool has to be suitably preserved for future use before they become extinct (Borthakur, 1993; Sarma et al, 1988).

Abundant land, scarce capital and limited technology in the region dictated shifting cultivation as the strategies for subsistence. As population density grew slowly in the first half of twentieth century, these extensive systems evolved into more intensive systems, which, however, failed to adapt to sharply accelerated population growth over thefirst four decades. Traditional uses of land fuel have depleted soil and forest and contributed to an agricultural crisis. Stagnant incomes and absence of improvements in human welffare have impeded the demographic transition. The cultivated and wild biotic resources sustained within the traditional agro-ecosystems deserve our utmost attention to conserve them. Some of the conservation measures are :

- *In situ and ex situ* conservation of forest genetic resources through establishment of biosphere reserves, national parks and sanctuaries;
- Protection of exceptional and rare trees in preservation plots, establishment of sacred groves and botanical and zoological gardens;
- Creation of public awareness of rational utilisation of valuable resources;
- Promotion of public involvement in the managment of protected areas;
- Increasing areas under preservation plots to include all forest types and scientifically monitor the preservation plots;
- Promotion of eco-rstoration of degraded forest areas;
- Regeneration of rare and threatened species and introduction of such plants in suitable habitats;
- Collection, evaluation, documentation and conservation of agri and animal bio-diversity;
- Establishment of ethno-botanical and ethno-medical forest park;
- Vigorous community participation to medicinal plant conservation;
- Creation of state Information and Data Base (SIDB) centre of cultivated plants and their wild relatives and also establishment of a bio-resources centre;
- Identification of traditional knowledge base and species exploration to conserve diversity in agroecosystem and for promoting sustainability in farming systems.
- Massive aforestry programme with proper monitoring;
- Agroforestry land use in marginal fragile zones and collection; identification and plantation of multi-purpose tree species (MPTT) both at species and system level for-conserving resources and optimising production;
- Use of bio technological techniques in laboratories and Post Gradute Institutions for conservation of cultivated plants and their wild relatives;

- Poaching of animals should be controlled to the maximum and wild life health should be menitored;
- High raised areas should be developed for protection of wild life during flood to prevent from migrating wild animals to the vulnerable areas and flood security should be ensured to the wild animals during flood and drought;

Considering all the pros and cons of biological wealth, the conservation of Biological Diversity (CBD) had fixed three objectives : i) the conservation of biological diversity, ii) the sustainable use of its components and iii) the equitable sharing of benefits from use of biological resources in order to support the national development in sustainable way and to reconcile national interest with the maintenance of highest possible level of global bio-diversity.

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