6 BIODIVERSITY

WHAT IS BIODIVERSITY ?

The term biodiversity was coined by Walter G. Rosen in 1985. It has been defined variously such as "the richness in variety and variability of species of all living organisms in a given region (habitat)". A concise definition of biodiversity is "the totality of genes, species, and ecosystems in a region (IUCN, UNEP, 1992).

According to the U.S. Office of Technology Assessment (1987), biological diversity is "the variety and variability among living organisms and the ecological complexes in which they occur". This concept can be subdivided at three levels as follows :

Genetic diversity

At finer levels of organisation, biodiversity includes the genetic variation within species, both among geographically separated populations and among individuals within single population.

Species diversity

Biodiversity at its most basic level includes the full range of species on earth, from microorganisms such as viruses, bacteria and protists through the multi- cellular kingdoms of plants, animals and fungi.

Community/Ecosystem diversity

On a wider scale, biodiversity includes variations a the biological communities in which species live, the ecosystem in which communities exist, and the interactions among these levels.

MEASURING BIODIVERSITY

At its simplest level, diversity can be defined as the number of species found in a community, a measure known as *species richness.* Diversity is "a single statistic in which

KEYSTONE SPECIES

Within biological communities, some species may be important in determining the ability of large number of other species to persist in the community. These crucial species have been termed *keystone species* (Paine, 1966; Terborgh, 1986; Howe, 1984). Protection of keystone species is a priority for conservation efforts, because if a keystone species is lost from a conservation area, numerous other species might be lost as well. For example, the severe decline and extinction of many species of pteropid bats, or flying foxes, in the Old World tropics had a dramatic effect upon many important plant species in the islands of the Pacific and Indian Oceans. Some biologists fear that the loss of flying fox species invites an ecological disaster that could profoundly affect human societies in these regions. Flying foxes are widespread throughout the Old World tropics. About 50 species of the genus *Pteropus* are concentrated in the islands of the South Pacific where they are the most important, and often the only, pollinators and seed dispersers for literally hundreds of species of tropical plants. Many plant species are entirely dependent upon bats for pollination and seed dispersal; some have even coevolved features such as night-blooming flowers, that would prevent other potential pollinators from taking over the role in absence of bats. Extinction of flying foxes is thus potentially devastating for these bat-dependent plant species of economic value to local and international markets. Such plant species include important timber species like ebony *(Diospyros melanoxylon)* and mahogany *(Calophyllum inophyllum),* medicinal plants, and plants yielding fibres, dyes and other products. Wild bananas are also bat-pollinated.

the number of species and evenness are compounded". Many methods of calculating diversity have been proposed that combine these two types of information. Mathematical indiccs of biodiversity have also been developed to connate species diversity at different geographical scales as follows:

Alpha diversity

This refers to number of species in a single community. This diversity comes closest to the popular concept of species richness and can be used to compare the number of species in different ecosystem types.

Beta diversity

This refers to the degree to which species composition changes along an environmental gradient. Beta diversity is high for example, if the species composition of moss communities changes at successively higher elevations on a mountain slope, but is low if the same species occupy the whole mountain side.

Gamma diversity

This applies to larger geographical scales and defined as "the rate at which additional species are encountered as geographical replacements within a habitat type in different localities. Thus gamma diversity is a species turnover rate with distance between sites of similar habitat or with expanding geographic areas".

NO. OF SPECIES WORLDWIDE

There are 1,413,000 identified species. A large number unidentified. If it is done number could be 5 million or more.

Insects	—	751,000
Plants	—	248,000
Other animals	—	281.000
Fungi	—	69,000
Protists	—	30,000
Algae	—	26,000
Bacteria and similar forms	—	4,800
Viruses	—	1,000

REASONS FOR THE RICHNESS OF THE BIODIVERSIY IN TROPICS

(1) Over geological times the tropics have had a more stable climate than the temperate zones. In tropics, therefore, local species continued to live there itself, whereas in temperate they tend to disperse to other areas.

(2) Tropical communities are older than temperate ones and, therefore, there has been more time for them to evolve. This could have allowed them greater degree of specialisation and local adaptation to occur.

(3) Warm temperatures and high humidity in most tropical areas provide favourable conditions for many species that are unable to survive temperate areas.

(4) In tropics, there may be greater pressure pests, parasites and diseases. This does allow any single species to dominate anc there is opportunity for many species lo exist. On the contrary in temperate zones is reduced pest pressure due to cold, anc is one or a few dominating species that e many other species.

(5) Among plants, rates of outcrossing appear be higher in tropics. Higher rates of out may lead to higher levels of genetic van

(6) Tropical areas receive more solar energy the year. Thus tropical communities are productive or greater resource base that support a wider range of species.

BIODIVERSITY HOTSPOTS

The British biologist Norman Myers coined the term 'biodiversity hotspot' in 1998 as a biogeographic region characterized both by exceptional levels of plant endemism and by serious levels of habitat loss. **Endemism** means a species is found in a particular area only, it is confined to that area and not found outside. According to Conservation International (Cl), to qualify as a hotspot a region must meet two criteria: it must contain at least 1500 species of vascular plants (more than 0.5% of the world's total) as endemics, and it has to have lost at least

70% of its original habitat. At present there are total 34 biodiversity hotspots in the world, of which 3 are in India:

(1) Western Ghats

(2) North-east India; and

(3) Himalayas

Collectively these areas held as endemics include about 44% of the world's plants and 35% of terrestrial vertebrates. The habitat extent of this area has been reduced by 88% of its original extent, such that this wealth of biodiversity is now restricted to only around 2% of earth's land surface. Thus, identification of biodiversity hotspots gives us the address of places where there is a need to start the measures for protection and conservation of biodiversity. The common regions of biodiversity hotspots are mentioned in the next topic 'gene pool'.

INDIAN BIODIVERSITY

The different species of plants (including bacteria and fungi) are as follows :

Bacteria	850
Fungi	23,000
Algae	2,500
Bryophytes	2,564
Pteridophytes	10,22
Gymnosperms	64
Angiosperms	15,000/17,500
Total	45,000/47,500
The different species of Insects	57,525
Lower groups	9,214
Molluscs	5,042
Fish	2,546
Birds	1228
Echinoderms	765
Reptiles	428
Amphibia	204
Mammals	372
Protochordates	116
Hemichordates	12
Total	77,452

INDIAN BIODIVERSITY UNDER SERIOUS THREAT

Tropical forests of the country have been disappearing very fast, at a rate of about 0.6% per year (about 7.3 mha). If this continuous unchecked, all closed tropical forests would disappear within next 175 years or so. According to one estimate 90% of the tropical forest area (500 world plant species) will be destroyed by 2020.

McNeely et al. (1990) estimated that 70% of the world's total flowering plants occur in 12 countries and these have been designated as the Mega-diversity centers or Mega-diversity countries. They are Brazil, Columbia, Ecuador, Mexico and Peru in Latin America; India, Malaysia, China, Indonesia and Philippines in Asia, and Australia. India gets the tenth place in the world and fourth in Asia. India is rich centre for endemic plants.

ENDANGERED FLORA AND FAUNA OF INDIA

Some plants and animals have already become extinct and there are many facing danger of extinction. The basic reasons of extinction of wildlife are as follows:

- Destruction of their natural habitats due to expanding agriculture, urbanisation and industrialisation.

- Overgrazing by domestic animals that convert the area into deserts.
- Poaching for meat, skin, fur, ivory, rhino horns etc.
- Export of some species.

The Botanical Survey of India (BSI) has it to complete survey of plant resources of the country. As per the targets set, BSI should have completed survey by 1998. It had planned to publish National Flora of the country in 24 volumes by 2000 A.D.

The Zoological Survey of India (ZSI) could also so far survey only about 1/3rd of the country, and planned to complete the survey by 2000 A.D. Sixty- two volumes of Fauna of India were to be brought out by 2000.

Data regarding all endangered plant and animal species of the country are also not complete. It was set that data regarding all endangered plant species will be inventorised by 1992, for which BSI had been restructured. In its Annual Report (1987-88), D.O. En. has reported to have published Vol. I of Red Data Book of Indian plants covering 235 species. Red Data Book of Indian Plants Vol. II containing about 200 rare and endangered species is completed and printed (D.O. En. Annual Report, 1988-89). The status survey of endangered animal species was being done and claimed to be completed and Red Data Book compiled by 1995.

According to the Red Data Book of IUCN (International Union for Conservation of Nature and Natural Resources), more than 1000 creatures are threatened with extinction, some very soon, some within a decade or so. Among these facing most immediate danger are, all species of rhinoceros, particularly the Indian variety—the Royal Bengal, and Siberian Tigers, the Mexican grizzly bear, the red wolf, the mountain gorilla, the Arabian oryx and the Asiatic lion.

ENDANGERED ANIMALS IN INDIA

Critically Endangered species in India According to the Red Data Book of International Union for Conservation of Nature (IUCN), there are 47 critically endangered species in India (As of 5 September 2011): The Red List of 2012 was released at the Rio +20 Earth Summit. It contains 132 species of plants and animals in India listed as critically endangered.

Birds

White-bellied Heron (Ardea insignis)

Great Indian Bustard (Ardeotis nigriceps)

Forest Owlet (Athene blewitti)

CONSERVATION CATEGORIES

To highlight the legal status of rare species for purpose of conservation' the IUCN (1984,1988) has established the following five main conservation categories.

Extinct species that are no longer known to exist in the wild. Searches of localities where they were once found and of other possible sites have failed to detect the species.

Endangered species that have a high likelihood of going extinct m the near future.

Vulnerable species that may become endangered in the near future because populations of the species are decreasing in size throughout its range.

Rare species that have small total numbers of individuals often due to limited geographical ranges or low population densities.

Insufficiently known species that probably belong to one of the conservation categories but are not sufficiently well known to be assigned to a specific category.

Mace and Lande (1991) have proposed a three-level system of classification based on the probability of extinction.

Critical species with a 50% or greater probability of extinction within 5 years or 2 generations whichever is longer.

Endangered species with a 20% probability of extinction within 20 years or 10 generations.

Vulnerable species with a 10% probability of extinction within 100 years.

Human activity is the major threat to biodiversity and following are the chief causes of extinction of species caused by man to fulfill its needs.

Baer's Pochard (Aythya baeri)

Spoon-billed Sandpiper (Eurynorhynchus pygmeus)

Siberian Crane (Grus leucogeranus)

White-rumped Vulture (Gyps bengalensis)

Indian Vulture (Gyps indicus)

Slender-billed Vulture (Gyps tenuirostris)

Bengal Florican (Houbaropsis bengalensis)

Himalayan Quail (Ophrysia superciliosa)

Jerdon's Courser (Rhinoptilus bitorquatus)

Pink-headed Duck (Rhodonessa caryophyllacea)

Red-headed Vulture (Sarcogyps calvus)

Sociable Lapwing (Vanellus gregarius)

Fish

Knifetooth sawfish (Anoxypristis cuspidata)

Pondicherry shark (Carcharhinus hemiodon)

Ganges shark (Glyphis gangeticus)

Deccan labeo (Labeo potail)

Largetooth sawfish (Pristis microdon)

Longcomb sawfish (Pristis zijsron)

Reptiles and amphibians

Northern river terrapin (Batagur baska)

Red-crowned roofed turtle (Batagur kachuga)

Leatherback sea turtle (Dermochelys coriacea)

Hawksbill sea turtle (Eretmochelys imbricata)

Ghats wart frog (Fejervarya murthii)

Gharial (Gavialis gangeticus)

Gundia Indian frog (Indirana gundia)

Toad-skinned frog (Indirana phrynoderma)

Charles Darwin's frog (Ingerana charlesdarwini)

Rao's torrent frog (Micrixalus kottigeharensis)

Amboli bush frog (Pseudophilautus amboli)

White-spotted bush frog (Raorchestes chalazodes)

Griet bush frog (Raorchestes griet)

Munnar bush frog (Raorchestes munnarensis)

Ponmudi bush frog (Raorchestes ponmudi)

Sacred Grove bush frog (Raorchestes sanctisilvaticus)

Shillong bubble-nest frog (Raorchestes shillongensis)

Anaimalai flying frog (Rhacophorus pseudomalabaricus)

Mammals

Namdapha flying squirrel (Biswamoyopterus biswasi)

Himalayan wolf ("Canis himalayensis")

Kashmir stag (Cervus canadensis hanglu)

Elvira rat (Cremnomys elvira)

Andaman shrew (Crocidura andamanensis)

Jenkins' shrew (Crocidura jenkinsi)

INDIAN BIODIVERSITY

India has a rich and varied heritage of biodiversity, encompassing a wide spectrum of habitats from tropical rainforests to alpine vegetation and from temperate forests to coastal wetlands. India figured with two hotspots - the Western Ghats and the Eastern Himalayas.

India contributes significantly to latitudinal biodiversity trend. With a mere 2.4% of the world's area, India accounts for 7.31% of the global faunal total with a faunal species count of 89,451 species.

India has two major realms called the Palaearctic and the Indo-Malayan, and three biomass, namely the tropical humid forests, the tropical dry/deciduous forests, and the warm desert/semi-deserts. India has ten biogeographic regions including the Trans-Himalayan, the Himalayan, the Indian desert, the semi-arid zone(s), the Western Ghats, the Deccan Peninsula, the Gangetic Plain, North-East India, and the islands and coasts.

India is one of the 12 centres of origin of cultivated plants. India has 5 world heritage sites, 12 biosphere reserves, and 6 Ramsar wetlands. Amongst the protected areas, India has 88 national parks and 490 sanctuaries covering an area of 1.53 lakh sq. km.

India's record in agro-biodiversity is equally impressive. There are 167 crop species and wild relatives. India is considered to be the centre of origin of 30,000-50,000 varieties of rice, pigeon-pea, mango, turmeric, ginger, sugarcane, gooseberries etc and ranks seventh in terms of contribution to world agriculture.

Nicobar shrew (Crocidura nicobarica)
Sumatran rhinoceros (Dicerorhinus sumatrensis)
Kondana soft-furred rat (Millardia kondana)
Pygmy hog (Porcula salvania)
Javan rhinoceros (Rhinoceros sondaicus)
Malabar large-spotted civet (Viverra civettina)
Asian black bear (Ursus thibetanus)
Asian elephant (Elephas maximus)
Bengal tiger (Panthera tigris tigris)
Blue whale (Balaenoptera musculus)
Banteng (Bos javanicus)
Barasingha (Rucervus duvaucelii)
Clouded leopard (Neofelis nebulosa)
Central Kashmir vole (Alticola montosa)
Dhole (Cuon alpinus)
Dugong (Dugong dugon)
Fin whale (Balaenoptera physalus)
Four-horned antelope (Tetracerus quadricornis)
Gee's golden langur (Trachypithecus geei)
Gaur (Bos gaurus)
Hispid hare (Caprolagus hispidus)
Hoolock gibbons (Hoolock spp.)
Lion-tailed macaque (Macaca silenus)
Markhor (Capra falconeri)
Mandelli's mouse-eared bat (Myotis sicarius)
Marbled cat (Pardofelis marmorata)
Nilgiri marten (Martes gwatkinsii)
Nicobar flying fox (Pteropus faunulus)
Nilgiri langur (Trachypithecus johnii)
Nilgiri tahr (Nilgiritragus hylocrius)
Nicobar treeshrew (Tupaia nicobarica)
Palm rat (Rattus palmarum)
Red Panda (Ailurus fulgens)
Red goral (Naemorhedus baileyi)
Rusty-spotted cat (Prionailurus rubiginosus)
Snow leopard (Uncia uncia)
Smooth-coated otter (Lutrogale perspicillata)
Sei whale (Balaenoptera borealis)
Stump-tailed macaque (Macaca arctoides)
Sloth bear (Melursus ursinus)
Servant mouse (Mus famulus)
Sperm whale (Physeter macrocephalus)
Ganges River dolphin (Platanista gangetica gangetica)
Swamp deer/Barasingh("Rucervus duvaucelii")
Takin (Budorcas taxicolor)
Tibetan antelope (Pantholops hodgsonii)
Wild water buffalo (Bubalus arnee)
Wild goat (Capra aegagrus)
Woolly flying squirrel (Eupetaurus cinereus)
Yak (Bos grunniens)

GENE POOL

Gene Pool refers to the total stock of genes found in an interbreeding population. Gene Pool centre refer to areas on the earth which are seen as places where important crop plants and domestic animals originated. These regions have extraordinary range of biodiversity. These are also called global regions of biodiversity. Some such areas are:

(1) Southeast Asia
(2) East Asia (China, Japan)
(3) South Asia (Indian, Indo-Chinese, Indo-Burman)
(4) Central Asia
(5) Asia Minor and Mediterranean
6) Ethiopia
(7) Andes
(8) Mexico and Central America

The importance of gene pools is same as that of biodiversity regions.

WHAT ARE ENDANGERED SPECIES?

An endangered species is a native species that faces a significant risk of extinction in the near future throughout all or a significant portion of its range. Such species may be declining in number due to threats such as habitat destruction, climate change, or pressure from invasive species.

The term endangered species can be used either in general or legal context. When used in a general sense, the term describes a species that faces a risk of extinction but does not necessarily indicate that the species is protected under any law. When used in a legal context, the term refers specifically to a species that is listed on the US Endangered Species List and is defined legally as an animal or plant species in danger of extinction throughout all or a significant portion of its range.

The flora (the plants) of India is one of the richest of the world due to the wide range of climate,topology,and environments in the country.There are over 15000 species of flowering plants in India which account for 6% of total plant species in the world. With the prevalent removal of plant and trees many plant species are being destroyed.According to Encyclopedia of earth over 8000 plant species are officially threatened or endangered at every hour.. Between one-fourth of all plants are at some risk.The combination of global warming and habitat destruction is the sole reason for the disappearance of many plants from earth's face.Though there are thousands of interesting, and unusual plants are there here are some common plants which we have seen thirty years back have become rare and endangered species.This is a list of plants which have become rare and threatened in India.

Corypha Species

Talipot Palms, Corypha species, are tall palm trees that are endangered. Some species are found only in cultivated locations. The tree grows 50 to 60 years before blooming and then slowly dies. This has led to a decline in its population.

Cycas beddomei, commonly called Peritha or Pireetha, is an evergreen plant that grows 15 to 20 feet tall. It grows on dry open slopes, open woodlands and grasslands in the state of Andhra

Some Endangered Plant Species

1 Polygala irregularis
2 Lotus corniculatus
3. Amentotaxus assamica
Arunachala Pradesh (threatened)
4. Psilotum nudum-Karnataka (rare)
5. Ceropegia odorata-(endangered)
6. Diospyros celibica
7. Actinodaphne lawsonii
8. Acacia planifrons-Tamilnadu (rare)
9. Abutilon indicum-Tamilnadu(rare)
11. Chlorophytum malabaricum-Tamilnadu
12. Nymphaea tetragona-Jammu and Kashmir(endangered and threatened
13. Belosynapsis vivipara
14. Colchicum luteum
15. Pterospermum reticulatum

Pradesh. Its population has been decimated by harvesting for trade and medicinal uses, and is considered critically endangered.

Decalepis hamiltonii

Decalepis hamiltonii is a shrub that grows in deciduous forests of Peninsular India. It is endangered due to habitat destruction and over-exploitation. All parts of the plant contain alkaloids and glycosides that are used in medicines and pesticides. Some common names for Decalepis hamiltonii are Maredugeddalu, Nannari and Sariba.

Ilex Khasiana

Another critically endangered shrub is Ilex khasiana. There are only three or four known plants left on Shillong Peak in the Khasi Hills. The plant population has declined due to the plant's low rate of reproduction.

Kingiodendron Pinnatum

Malabar Mahogany, Kingiodendron pinnatum, is a large tree that grows in the forested hills of Karnataka, Kerala and Tamil Nadu. It is endangered due to over exploitation, habitat destruction, and low reproduction rates.

Madhucca Diplostemon

Madhucca diplestomon is a small tree that grows in the forests on Deccan Peninsula. It is endangered due to habit destruction caused by agriculture, clear cutting and human habitations.

Myristica Species

Myristica magnifica and M. malabarica are endangered trees that are native to Western Ghats. The swamp lands and lowlands where they normally grow have been drained for agricultural use.

Pterocarpus Santalinus

Reds Sandalwood, Pterocarpus santalinus, is a tree that only grows in the dry, deciduous forests of Eastern Ghats. It is endangered due to logging and clear cutting of its habitat, in addition to harvesting for use in medicines and cosmetics.

Syzygium Travancoricum

Syzygium travancoricum is a large shrub or small tree that is critically endangered. There are some populations in Guddrikal and Grove Aickad. The swampy wetlands where it normally grows have been drained for use as paddy fields.

India's Biodiversity Hotspots

(1) The Himalayas: Himalayan biodiversity hotspot region stretches over 3000 km in northern Pakistan, India, Nepal, Bhutan, Tibet and Yunnan province of China. It includes many of the world's tallest peaks along with Mt. Everest as well as many of the world's deepest river gorges. This mountain range has been divided into two regions: The Eastern Himalayas and the Western Himalayas with the division occurring approximately in eastern Nepal. The abrupt rise of Himalayan mountains from less than 500 m to more than 8000 m results in diversity of ecosystems that range, in only a couple of hundred kilometres, from alluvial grasslands (in Assam - among the tallest in world) and subtropical broadleaf forests along the foothills to temperate broad leaf forests in mid hills, mixed conifer and conifer forests in the higher hills and alpine meadows above the tree line. Numerous large birds and mammals including vultures, tigers, leopards, elephants,

rhinos, and wild water buffalo are found in Himalayas. The area has 3160 endemic species in the available hotspot vegetation region of around 1,85,427 km^2.

(2) Eastern Himalayas: This region which was earlier part of Himalayas has been recently made part of broader Indo-Burma hotspot region by the Conservation International (Cl). The WWF has identified the entire Eastern Himalayas as a priority in the list of Global 200 Ecoregions. It includes north-east India from Sikkim, Bhutan, northern Myanmar and southern part of Yunnan of China. At the confluence of Indo- Malayan, Indo-Chinese and Indian biogeographical realms, the region supports 51 forest types, 836 of the 1200 bird species of Indian subcontinent, 6 out of 9 important vegetation types of India, 800 out of 1500 species of flowering plants (and approximately 1235 rich and diverse tribal cultures which have an important roie for conservation of biodiversity in the region). The region has also-been recognized as Endemic Bird Area. As per IUCN, the region also has exceptional fresh water diversity.

(3) Western Ghats and Sri Lanka: This region is characterized by very high endemicity (52%) i.e around 3000 vascular plant species are endemic to the region. The highest concentration of species is believed to be around Agasthyamalai Hills. The region also harbours over 450 bird species, 140 mammalian species, 260 reptiles and 175 amphibians. Over 60% of amphibians and reptiles are endemic to the region. This area is under tremendous pressure of rapid loss of biodiversity and habitat due to deforestation, urbanization and development projects. Today only 44000 km^2 out of the original 1,80,000 km^2 and 1.5% of Sri Lanka's original forest cover is remaining. Recently UNESCO granted the recognition of World Heritage Site to Western Ghats Ecological Region due.

CAUSES OF LOSS OF BIODIVERSITY

Habitat Destruction

The primary cause of the loss of biodiversity is not direct human exploitation but the habitat destruction that inevitably results from the expansion of human populations and human activities. The greatest destruction of biological communities has occurred during the last 150 years with human population increasing from 1 billion in 1850, to 2 billion in 1930, to 5.3 billion in 1990, and an estimated figure of 6.5 billion by the year 2000. Habitat loss is the primary threat to majority of vertebrates currently facing extinction. In many countries, particularly on islands and where human population density is high, most of the original habitat has been destroyed. More than 50% of the wildlife habitat has been destroyed in 49 out of 61 Old World tropical countries (IUCN, UNEP 1986). In tropical Asia, fully 65% of the wildlife

ENDEMISM

An endemic species is a species which is only found in a given region or location and nowhere else in the world. This definition requires that the region that the species is endemic to, be defined, such as a "site endemic" (e.g. just found on Mount Celaque), 6 a "national endemic" (e.g. found only in Honduras), a "geographical range endemic" (e.g. found in the Himalayan region, which however covers several Himalayan countries and therefore is not a national endemic), or a political region endemic (e.g. found in countries of Central America). Taken to an extreme, a cosmopolite species is still endemic to Earth!

It must be noted, that the concept of endemism very much depends on the knowledge of the geographical range of a species. Usually, a newly discovered species has only been found in a limited site, and with the knowledge of that moment, it should be considered a site and national endemic. However, this only lasts until the moment that someone discovers it in another country. At that moment its original status of national endemism will be lost. This is bound to be the case for many endemic organisms which are difficult to be noticed or recognised, such as species from very large and complex groups (plants, arthropods) or small organisms. Endemic status of well studied, conspicuous taxa with manageable numbers of species (birds, mammals, herpetofauna, icthyofauna), tend to be more stable.

habitat has been lost, with particularly high rates of destruction in Bangladesh (94%), Hong Kong (95%), Sri Lanka (85%), Vietnam (80%), and India (80%).

In many cases, the factors causing habitat destruction are the large industrial and commercial activities, associated with a global economy, such as mining, cattle ranching, commercial fishing, forestry, plantation, agriculture, manufacturing, and dam construction, initiated with the goal of making a profit. Huge amounts of habitat are lost each year as the world's forests are cut down. Rain forests, tropical dry forests, wetlands, mangroves and grasslands are threatened habitats and leading to desertification.

Habitat fragmentation

Habitats that formerly occupied wide areas are now often divided up into pieces by roads, fields, towns, canals, powerlines etc. Habitat fragmentation is the process where a large, continuous area of habitat is both, reduced in area and divided into two or more fragments. When habitat is destroyed there is often a patchwork of habitat fragments left behind. These fragments are often isolated from one another by a highly modified or degraded landscape. Habitat fragments differ from the original habitat in two ways. One, fragments have a greater amount of edge for the area of habitat, and second, the centre of each habitat fragment is closer to an edge. Habitat fragmentation may limit the potential of species for dispersal and colonisation. It also reduces the foraging ability of animals. Habitat fragmentation causes such edge effects as microclimatic changes in light, temperature, wind etc.

Habitat degradation and pollution

Some activities may not affect the dominant species in the community, but other species are greatly affected by such habitat degradation. For example, physical degradation of forest habitat by uncontrolled ground fires, might not kill the trees, but the rich perennial wild plant community and insect fauna on the forest floor would be greatly affected. Boating and diving in coral reef areas degrade the fragile species. The most subtle form of habitat degradation is environmental pollution, the most common causes of which are pesticides, industrial chemicals and wastes, emissions from factories and automobiles, and sediment deposits from eroded hill sides. Effects of pesticide pollution, water pollution and air pollution on environment are well known. Problem of acid rains and global climate change are also well known and are of global concern.

Introduction of exotic species

Habitat destruction, fragmentation, and degradation have obvious harmful effects on biodiversity. But even when biological communities are intact, significant losses can be taking place due to changes caused by human activities. Three such changes are the introduction of exotic species, increased levels of diseases, and excessive exploitation of particular species by people. The three chief factors responsible for introduction of exotic species are, European colonisation, horticulture and agriculture, and accidental transport. The great majority of the exotic species do not become established in the introduced new places. However, some of the species are able to establish in new area. Such successful exotic species may kill or eat native species to the point of extinction, or may so alter the habitat that many natives are no longer able to persist. The effect of exotic species is maximum on islands. Disease causing microorganisms, if introduced to new virgin areas may cause epidemics and native species are eliminated completely.

Disease

Human activities may increase the incidence of disease in wild species. The extent of the disease increases when animals are confined to a nature reserve rather than being able to disperse over a large area. Also, animals are more prone to infection when they are under stress. Animals held in captivity are also more prone to higher level of disease.

Overexploitation

Increasing human population has escalated the use of natural resources. Methods of harvesting have been dramatically modified to have maximum gains.

In traditional societies, there existed some controls to prevent overexploitation in several ways, ii contrast to this, in much of the world todi} resources are exploited as rapidly as possit'c Overexploitation of resources also occurs when i commercial market develops for a previous!} unexploited or locally used species. The be>: example is trade in furs. Overexploitation threatens about one-third of the endangered vertebrates in the world, as well as other species. Growing rura^ poverty, increasingly efficient methods of harvesting and the globalisation of the economy combine to exploit species to the point of extinction. Even if a species is not completely eliminated by overexploitation the population size may become so low that the species is unable to recover.

Shifting or jhum cultivation

jhum cultivation in North-eastern India is practiced in these areas because the farmers are unwilling to spend the time and money required to develop more permanent forms of agriculture on land that they do not own and may not occupy for very long. This system works well and does not degrade environment much as long as human population density is low and there is abundant forest land available. Political instability, lawlessness, and war also force farmers off their land and move to remote, undeveloped areas where they feel more safe. In such situations, rather than being called **shifting cultivators,** however, these newly arrived people would be more appropriately described as **shifted cultivators** in order to distinguish them from traditional farmers who have long inhabited rain forest areas.

The NE Region of India comprises the States of Assam, Arunachal Pradesh, Mizoram, Manipur, Meghalaya, Nagaland, Sikkim and Tripura. Various ethnic groups with different languages, practising different forms of agriculture inhabit this region. Agriculture is the main stay of economy. Rice is major crop, though maize and millets also grown. Traditional agricultural systems of the region are Zabo or Ruza, terrace construction and jhum or shifting cultivation. Zabo is an indigenous farming system of Chakhesang farmers of Nagaland, which combines agro-forestry and animal husbandry. This system is common to individually owned lands of about 2.5 ha. For terrace construction the area is cleaned by cutting and burning the forest vegetation. Jhum cultivation is the most common system practiced by roughly 5 lakhs tribal farm families. In India, a total land area of 4.36 m ha is being affected by jhum cultivation out of which 2.7 m ha is in the NE region. Due to increasing pressure on land the jhum cycle has reduced to 4-5 years in Meghalaya, 5-10 years in Mizoram and Tripura, 6-15 years in Nagaland and Manipur and 5-10 years in Arunachal Pradesh.

Jhum cultivation has resulted into soil erosion and loss of soil fertility. Due to tree cutting the loose top soil is lost and also the stones rolling down the foot hills cause soil erosion. In areas where bamboos are cut and burnt, K-rich ash accumulates for jhum crop. This fallow land invites several weeds and it may take a very long time when the soil supports the growth of crop plants.

Intensive modem agriculture with longer cycles of 10 or more years and agro-forestry system have been suggested for the control of jhum cultivation in this region.

WETLANDS

Wetlands are defined as lands transitional between terrestrial and aquatic eco-systems where the water table is usually at or near the surface or the land is covered by shallow water (Mitch and Gosselink, 1986). The value of the world's wetlands is increasingly receiving due attention as they contribute to a healthy environment in many ways. They retain water during dry periods, thus keeping the water table high and relatively stable. During periods of flooding, they mitigate floods and trap suspended solids and attached nutrients. Thus, streams flowing into lakes by way of wetland areas will transport fewer suspended solids and nutrients to the lakes than if they flow directly into the lakes. The removal of such wetland systems because of urbanization or other factors typically causes lake water quality to worsen. In addition, wetlands are important feeding and breeding areas for wildlife and provide a stopping place and refuge for waterfowls. As with any

natural habitat, wetlands are important in supporting species diversity and have a complex of wetland values.

The present review is aimed at providing, in a nutshell, the distribution of wetlands, the value of wetlands, the causes and consequences of the loss of wetlands. The review attempts to provide a glimpse of the use of modern spatial technology tools, viz., Remote Sensing/GIS for obtaining an assessment, description and monitoring of inland wetlands. The review also gives a methodology for an ongoing nationwide attempt at evolving a conservation area network or a protected area network of inland wetlands.

DISTRIBUTION OF WETLANDS IN INDIA

India, with its annual rainfal1 of over 130 cm, varied topography and climatic regimes, supports and sustains diverse and unique wetland habitats. Natural wetlands in India consists of the high-altitude Himalayan lakes, followed by wetlands situated in the flood plains of the major river systems, saline and temporary wetlands of the arid and semi-arid regions, coastal wetlands such as lagoons, backwaters and estuaries, mangrove swamps, coral reefs and marine wetlands, and so on. In fact with the exception of bogs, fens and typical salt marshes, Indian wetlands cover the whole range of the ecosystem types found. In addition to the various types of natural wetlands, a large number of man-made wetlands also contribute to the faunal and floral diversity. These man-made wetlands, which have resulted from the needs of irrigation, water supply, electricity, fisheries and flood control, are substantial in number. The various reservoirs, shallow ponds and numerous tanks support wetland biodiversity and add to the country's wetland wealth. It is estimated that freshwater wetlands alone support 20 per cent of the known range of biodiversity in India (Deepa and Ramachandra, 1999).

Wetlands in India occupy 58.2 million ha, including areas under wet paddy cultivation (Directory of Indian Wetlands). The majority of the inland wetlands are directly or indirectly dependent on the major rivers like Ganga, Bhramaputra, Narmada, Godavari, Krishna, Kaveri and Tapti. They occur in the hot arid regions of Gujarat and Rajasthan, the deltaic regions of the east and west coasts, highlands of central India, wet humid zones of south peninsular India and the Andaman and Nicobar and Lakshwadeep Islands.

Indian wetlands are grouped as:

(I) **Himalayan wetlands:**

Ladakh and Zanskar

Pangong Tso, Tso Morad, Chantau, Noorichan, Chushul and Hanlay marshes

Kashmir Valley

Dal, Anchar, Wular, Haigam, Malgam, Haukersar and Kranchu lakes

Central Himalayas

Nainital, Bhimtal and Naukuchital

Eastern Himalayas

Numerous wetlands in Sikkim, Assam, Arunachal Pradesh, Meghalaya, Nagaland and Manipur, Beels in the Brahmaputra and Barak valley

(II) **Indo-Gangetic wetlands:**

The Indo-Gangetic flood plain is the largest wetland system in India, extending from the river Indus in the west to Brahmaputra in the east. This includes the wetlands of the Himalayan terai and the Indo-Gangetic plains.

(III) **Coastal wetlands**

The vast intertidal areas, mangroves and lagoons along the 7500 km long coastline in West Bengal, Orissa, Andh,ra Pradesh, Tamil Nadu, Kerala,

Karnataka, Goa, Maharashtra. and Gujarat. Mangrove forests of Sunderbans, West Bengal and Andaman and Nicobar Islands. Offshore coral reefs of Gulf of Kutch, Gulf of Mannar, Lakshwadeep and Andaman and Nicobar Islands.

(IV) **Deccan**

A few natural wetlands, but innumerable small and large reservoirs and several water storage tanks in almost every village in the region.

Wetlands provide many services and commodities to humanity. Regional wetlands are integral parts of larger landscapes; their functions and values to the people in these landscapes depend on both their extent and their location. Each wetland thus is ecologically unique. Wetlands perform numerous valuable functions such as to recycle nutrients, purify water, attenuate floods, maintain stream flow, recharge ground water, and also serve to provide drinking water, fish, fodder, fuel, wildlife habitat, control rate of runoff in urban areas, buffer shorelines against erosion and offer recreation to the society. The interaction of man with wetlands during the last few decades has been of concern largely due to the rapid population growth- accompanied by intensified industrial, commercial and residential development, that further leads to pollution of wetlands by domestic, industrial sewage, and agricultural run-offs, such as fertilizers, insecticides and feedlot wastes. The fact that wetland values are overlooked has resulted in threats to the source of these benefits.

Wetlands are often described as "kidneys of the landscape" (Mitch and Gosselink, 1986). Hydrological conditions can directly modify or change chemical and physical properties such as nutrient availability, degree of substrate anoxia, soil salinity, sediment properties, and pH. These modifications of the physicochemical environment, in turn, have a direct impact on the biotic response in the wetlands (Gosselink and Turner, 1978). When hydrological conditions in wetlands change even slightly, the biota may respond with massive changes in

EXTINCTION OF WILD SPECIES

Type of extinction : Species become extinct through three types of processes.

(i) Natural extinction: Due to change in environmental conditions. (Also called background extinction)

(ii) Mass extinction: Due to catastrophe.

(iii) Anthropogenic extinction: Due to human activities like hunting, settlements, over exploitation and habitat destruction.

Large number of plants and animals have become extinct during the past 10,000 years. The various reasons for this state are as follows:

(i) Hunting: Hunting or killing of wild animals is of three types -subsistence hunting for food and safety, spoct hunting for recreation and commercial hunting for obtaining a commodity like musk, ivory or fur.

(ii) Destruction of Habitats: Use of fire for hunting by the primitive man destroyed a large number of habitats of wild life.

(iii) Dams and Reservoirs: They are large impoundments of water which submerge natural habitats of several species of wild life bringing about extinction of some and decrease in population of others.

(iv) Pollution: Acid rain kills both terrestrial and aquatic life. Water pollution harms aquatic animals and plants.

(v) Highways: They disturb wild life. Some of the animals are killed by passing vehicles.

(vi) Cleanliness: Carcases are being burnt or buried in order to reduce stench. This has caused decline in the population of California Condor *(Gymnogyps californianus)*, a scavanger bird.

(vii) Migratory Routes: Physical alterations are going on everywhere. Changes in route and settling areas of migratory animals may result in their going astray and getting killed.

(viii) Over-Exploitation: Excessive hunting, overgrazing, excessive felling and overfishing are resulting in depletion of a number of species of wild life.

species composition and richness and in ecosystem productivity. Traditional limnological methods of assessment of water quality are time consuming and uneconomical, but using remote-sensing data assessment of water quality and productivity in surface impoundment is both cost-effective and fast. The indicators useful for such an assessment include suspended materials visible to the human eye, which include suspended inorganic material, phytoplankton, organic detritus and dyes.

RAMSAR CONVENTION

The Ramsar Convention (formally, the Convention on Wetlands of International Importance, especially as Waterfowl Habitat) is an international treaty for the conservation and sustainable utilization of wetlands, i.e., to stem the progressive encroachment on and loss of wetlands now and in the future, recognizing the fundamental ecological functions of wetlands and their economic, cultural, scientific, and recreational value. It is named after the city of Ramsar in Iran, where the Convention was signed in 1971.

Convention

The convention was developed and adopted by participating nations at a meeting in Ramsar, Mazandaran, Iran on February 2, 1971, hosted by the Iranian Department of Environment, and came into force on December 21, 1975.

The Ramsar List of Wetlands of International Importance now includes 2,122 sites (known as Ramsar Sites) covering 205,366,160 ha (507,470,800 acres), up from 1,021 sites in 2000. The nation with the highest number of sites is the United Kingdom at 169; the nation with the greatest area of listed wetlands is Canada, with over 130,000 km2 (50,000 sq mi), including the Queen Maud Gulf Migratory Bird Sanctuary at 62,800 km2 (24,200 sq mi). The Ramsar definition of wetlands is fairly wide, including "areas of marine water the depth of which at low tide does not exceed six meters" as well as fish ponds, rice paddies and salt pans.

Presently there are 168 contracting parties, up from 119 in 1999 and from 21 initial signatory nations in 1971. The state parties meet every three years as the Conference of the Contracting Parties (CCP), the first held in Cagliari, Italy in 1980. Amendments to the original convention have been agreed to in Paris (in 1982) and Regina (in 1987).

There is a standing committee, a scientific review panel, and a secretariat. The headquarters is located in Gland, Switzerland, shared with the IUCN.

List of contracting parties

As of 2 November 2013 the number of Ramsar sites is 2,168 covering an area of 206,632,105 hectares (510,599,050 acres). There are 168 Contracting parties.

International Organization Partners

The Ramsar Convention works closely with five other organisations known as International Organization Partners (IOPs). These are Birdlife International, the International Union for Conservation of Nature (IUCN), the International Water Management Institute (IWMI), Wetlands International and WWF International. These support the work of the Convention by providing expert technical advice, helping implement field studies and providing financial support. The IOPs also participate regularly as observers in all meetings of the Conference of the Parties and as full members of the Scientific and Technical Review Panel. For example, at the 2008 Convention of Parties, IWMI scientists contributed directly to a number of resolutions including those relating to wetlands' links to human health, biofuels, poverty reduction, biogeographic regionalization and biodiversity in rice paddies.

CONSERVATION OF BIODIVERSITY

One of the most pressing environmental issues today is the conservation of biodiversity. Many factors threaten the world's biological heritage. The challenge is for nations, government agencies, organisations and individuals to protect and enhance biological diversity, while continuing to meet people's needs for natural resources.

This challenge exists from local to global scales. If not met, future generations will live

in a biologically impoverished world and perhaps one that is less capable of producing desired resources as well.

Conserving biological diversity involves restoring, protecting, conserving or enhancing the variety of life in an area so that the abundance and distribution of species and communities provide for continued existence and normal ecological functioning, including adaptation and extinction. Today our biosphere is in danger of extinction for a variety of reasons like lack of conservation in ecological planning; and destruction of natural habitats as space is given over to either alternative uses or is over-exploited and polluted. It is reported that during the next 20to30 years, the world would lose more than a million species of plants and animals-primarily because of environmental changes brought about by human beings. This demands an urgent attention for the conservation of biosphere.

The Global biodiversity assessment warns, "Unless actions are taken to protect biodiversity, we will lose forever the opportunity of reaping its full potential benefit to humankind." Effective and implementable methods of stopping further genetic erosion and fostering the rehabilitation of degraded ecosystems in mega biodiversity regions are the need of the hour. Efforts have been initiated to save biodiversity both by ex-situ and in-situ conservation.

In-situ Conservation

This type of conservation includes conservation of plant and animals in their native ecosystems or in manmade ecosystem where they naturally occur.

This type of conservation applies only to wild fauna and flora and not to the domesticated animals and plants because conservation is possible by protection of population in nature.

In-situ conservation includes a system of protected areas of different categories, e.g., National Park, Sanctuaries, Biosphere Reserves, Cultural Landscapes, and National Monument etc. According to the World Conservation Union, protected area is defined as: "An area of land and/or sea specially dedicated to the protection and maintenance of biological diversity and of natural and associated cultural resources and managed through legal or other effective mean."

Ex-situ Conservation

Ex-situ conservation means conservation of species (sample of genetic diversity), particularly of endangered species away from their natural habitat. It is done through establishment of 'gene banks', which include genetic resource centres, botanical gardens, cultural collection and zoos etc.

Wild Life Conservation in India

The shocking death of many tigers and lions due to a mysterious disease in our sanctuaries has brought wildlife conservation policies and their implementation into public focus. India has a wide variety of wildlife, many of them endangered, ranging from the snow leopard in the Himalayas to the giant Malabar squirrel in the rain forests of Kerala. Wildlife conservation has been very much in forefront of government policy and India is a signatory to the Convention on International Trade in Endangered Species (CITES).

Enforcement of wildlife protection is done under the Wildlife Protection Act, 1972. The Indian Board for Wildlife (IBWL) is the apex advisory body in the field of wildlife conservation in the country and is headed by the Prime Minister.

Indian wildlife is protected in 107 zoos, 49 deer parks, 16 safari parks, 6 snake parks, 24 breeding centres and 6 aquariums, besides of course 95 national parks and 500 sanctuaries. Forest staff looks after anti-poaching activities, habitat management and improvement. Besides, there are also projects for the flagship species like Project Tiger and Project Elephant where the habitats are maintained according to the requirements of the flagships species like tiger or elephant.

NATIONAL BIODIVERSITY AUTHORITY

The National Biodiversity Authority (NBA) was set up under the Biological Diversity Act, 2002 to deal with requests for access to genetic resources by foreigners, and to manage requests to transfer the results of any related research

out of India. The NBA will also decide how benefits of the research are to be shared with the local communities.

If Indians are carrying out research on genetic resources in India, then they do not need to get any permission from the NBA or any other body set up by the Biodiversity Act. Permission is required if either a foreigner or an Indian wants to commercialize the results of any research based on India's biodiversity, or when foreigners want to access India's biodiversity for research purposes or when an Indian organization wants to share research results with anyone overseas. But no permission is needed for government sponsored collaborative research projects as long as the research falls within policy guidelines drawn up by the central government. When the Act defines "commercialize." It specifically excludes the use of genetic materials in agriculture and animal husbandry to make sure that local communities are not adversely affect by the law.

Eight out of India's 26 states have set up their o State Biodiversity Boards so far. We at the NB have given them some funding and will hoi workshops for them and the State Boards are starti to collaborate themselves to share information an best practice. The Punjab Biodiversity Board, f example, has been training people from other state and we have received practical support from som non-governmental organizations who will help wi raising awareness about the law.

CONVENTION ON BIOLOGICAL DIVERSITY

The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is a multilateral treaty. The Convention has three main goals:

- conservation of biological diversity (or biodiversity);
- sustainable use of its components; and
- fair and equitable sharing of benefits arising from genetic resources

In other words, its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development.

The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993.

2010 was the International Year of Biodiversity. The Secretariat of the Convention on Biological Diversity is the focal point for the International Year of Biodiversity. At the 2010 10th Conference of Parties (COP) to the Convention on Biological Diversity in October in Nagoya, Japan, the Nagoya Protocol was adopted. On 22 December 2010, the UN declared the period from 2011 to 2020 as the UN-Decade on Biodiversity. They, hence, followed a recommendation of the CBD signatories during COP10 at Nagoya in October 2010.

The convention recognized for the first time in international law that the conservation of biological diversity is "a common concern of humankind" and is an integral part of the development process. The agreement covers all ecosystems, species, and genetic resources. It links traditional conservation efforts to the economic goal of using biological resources sustainably. It sets principles for the fair and equitable sharing of the benefits arising from the use of genetic resources, notably those destined for commercial use. It also covers the rapidly expanding field of biotechnology through its Cartagena Protocol on Biosafety, addressing technology development and transfer, benefit-sharing and biosafety issues. Importantly, the Convention is legally binding; countries that join it ('Parties') are obliged to implement its provisions.

The convention reminds decision-makers that natural resources are not infinite and sets out a philosophy of sustainable use. While past conservation efforts were aimed at protecting particular species and habitats, the Convention recognizes that ecosystems, species and genes must be used for the benefit of humans. However, this should be done in a way and at a rate that does not lead to the long-term decline of biological diversity.

The convention also offers decision-makers guidance based on the precautionary principle

that where there is a threat of significant reduction or loss of biological diversity, lack of full scientific certainty should not be used as a reason for postponing measures to avoid or minimize such a threat. The Convention acknowledges that substantial investments are required to conserve biological diversity. It argues, however, that conservation will bring us significant environmental, economic and social benefits in return.

The Convention on Biological Diversity of 2010 would ban some forms of geoengineering.

Issues under the convention

Some of the many issues dealt with under the convention include:

Measures and incentives for the conservation and sustainable use of biological diversity. Regulated access to genetic resources and traditional knowledge, including Prior Informed Consent of the party providing resources.

Sharing, in a fair and equitable way, the results of research and development and the benefits arising from the commercial and other utilization of genetic resources with the Contracting Party providing such resources (governments and/or local communities that provided the traditional knowledge or biodiversity resources utilized).

Access to and transfer of technology, including biotechnology, to the governments and/or local communities that provided traditional knowledge and/or biodiversity resources.

Technical and scientific cooperation

Coordination of a global directory of taxonomic expertise (Global Taxonomy Initiative).

- Impact assessment.
- Education and public awareness.
- Provision of financial resources.
- National reporting on efforts to implement treaty commitments.

Cartagena Protocol

The Cartagena Protocol on Biosafety of the Convention, also known as the Biosafety Protocol, was adopted in January 2000. The Biosafety Protocol seeks to protect biological diversity from the potential risks posed by living modified organisms resulting from modern biotechnology.

The Biosafety Protocol makes clear that products from new technologies must be based on the precautionary principle and allow developing nations to balance public health against economic benefits. It will for example let countries ban imports of a genetically modified organism if they feel there is not enough scientific evidence the product is safe and requires exporters to label shipments containing genetically modified commodities such as corn or cotton.

The required number of 50 instruments of ratification/accession/approval/acceptance by countries was reached in May 2003. In accordance with the provisions of its Article 37, the Protocol entered into force on 11 September 2004.

Global Strategy for Plant Conservation

In April 2002, the parties of the UN CBD adopted the recommendations of the Gran Canaria Declaration Calling for a Global Plant Conservation Strategy, and adopted a 16-point plan aiming to slow the rate of plant extinctions around the world by 2010.

Parties

One hundred and ninety-three states and the European Union are parties to the convention. All UN member states—with the exception of the United States and Andorra—have ratified the treaty. Non-UN member states that have ratified are the Cook Islands and Niue. The Holy See and the states with limited recognition are non-parties. The US has signed but not ratified the treaty, and is unlikely to now that it has passed into law the Farmer Assurance Provision of 2013.

International bodies established by the convention

Conference of the parties: The convention's governing body is the Conference of the parties

(COP), consisting of all governments (and regional economic integration organizations) that have ratified the treaty. This ultimate authority reviews progress under the Convention, identifies new priorities, and sets work plans for members. The COP can also make amendments to the Convention, create expert advisory bodies, review progress reports by member nations, and collaborate with other international organizations and agreements.

The Conference of the Parties uses expertise and support from several other bodies that are established by the Convention. In addition to committees or mechanisms established on an ad hoc basis, two main organs are:

Secretariat: The CBD Secretariat. Based in Montreal, it operates under the United Nations Environment Programme. Its main functions are to organize meetings, draft documents, assist member governments in the implementation of the programme of work, coordinate with other international organizations, and collect and disseminate information.

Subsidiary body for Scientific, Technical and Technological Advice (SBSTTA): The Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA). The SBSTTA is a committee composed of experts from member governments competent in relevant fields. It plays a key role in making recommendations to the COP on scientific and technical issues. 13th Meeting of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA-13) held from 18 to 22 February 2008 in the Food and Agriculture Organization at Rome, Italy. SBSTTA-13 delegates met in the Committee of the Whole in the morning to finalize and adopt recommendations on the in-depth reviews of the work programmes on agricultural and forest biodiversity and SBSTTA's modus operandi for the consideration of new and emerging issues. The closing plenary convened in the afternoon to adopt recommendations on inland waters biodiversity, marine biodiversity, invasive alien species and biodiversity and climate change. The current chairperson of the SBSTTA is Dr. Senka Barudanovic.

National Biodiversity Strategies and Action Plans (NBSAP)

"National Biodiversity Strategies and Action Plans (NBSAPs) are the principal instruments for implementing the Convention at the national level (Article 6). The Convention requires countries to prepare a national biodiversity strategy (or equivalent instrument) and to ensure that this strategy is mainstreamed into the planning and activities of all those sectors whose activities can have an impact (positive and negative) on biodiversity. To date [2012-02-01], 173 Parties have developed NBSAPs in line with Article 6."

For example, the United Kingdom, New Zealand and Tanzania have carried out elaborate responses to conserve individual species and specific habitats. The United States of America, a signatory who has not yet ratified the treaty, has produced one of the most thorough implementation programs through species Recovery Programs and other mechanisms long in place in the USA for species conservation.

Singapore has also established a detailed National Biodiversity Strategy and Action Plan. The National Biodiversity Centre of Singapore represents Singapore in the Convention for Biological Diversity.

National Reports

In accordance with Article 26 of the Convention, Parties prepare national reports on the status of implementation of the Convention.

Executive secretary to the convention

The current executive secretary is Braulio Ferreira de Souza Dias, who took up this post on 15 February 2012. Dr. Ahmed Djoghlaf was the previous executive secretary.

Nagoya Protocol

The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity is a supplementary agreement to the Convention on Biological Diversity. It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair

and equitable sharing of benefits arising out of the utilization of genetic resources. The Protocol was adopted on 29 October 2010 in Nagoya, Aichi Province, Japan, and will enter into force 90 days after the fiftieth instrument of ratification. Its objective is the fair and equitable sharing of benefits arising from the utilization of genetic resources, thereby contributing to the conservation and sustainable use of biodiversity.

Relevance

The Nagoya Protocol is intended to create greater legal certainty and transparency for both providers and users of genetic resources by:

Establishing more predictable conditions for access to genetic resources.

Helping to ensure benefit-sharing when genetic resources leave the contracting party providing the genetic resources.

By helping to ensure benefit-sharing, the Nagoya Protocol creates incentives to conserve and sustainably use genetic resources, and therefore enhances the contribution of biodiversity to development and human well-being.

Scope

The Nagoya Protocol applies to genetic resources that are covered by the CBD, and to the benefits arising from their utilization. The Nagoya Protocol also covers traditional knowledge (TK) associated with genetic resources that are covered by the CBD and the benefits arising from its utilization

Obligations

The Nagoya Protocol sets out core obligations for its contracting Parties to take measures in relation to access to genetic resources, benefit-sharing and compliance.

2006 COP

The eighth meeting of the parties to the convention took place in March 2006, in Curitiba, Brazil.

2012 COP 11

Leading up to the Conference of the Parties (COP 11) meeting on biodiversity in Hyderabad, India 2012, preparations for a World Wide Views on Biodiversity has begun, involving old and new partners and building on the experiences from the World Wide Views on Global Warming.

CARTAGENA PROTOCOL ON BIOSAFETY

The Cartagena Protocol on Biosafety is an international agreement on biosafety, as a supplement to the Convention on Biological Diversity. The Biosafety Protocol seeks to protect biological diversity from the potential risks posed by genetically modified organisms resulting from modern biotechnology.

The Biosafety Protocol makes clear that products from new technologies must be based on the precautionary principle and allow developing nations to balance public health against economic benefits. It will for example let countries ban imports of a genetically modified organisms if they feel there is not enough scientific evidence that the product is safe and requires exporters to label shipments containing genetically altered commodities such as corn or cotton.

The required number of 50 instruments of ratification/accession/approval/acceptance by countries was reached in May 2003. In accordance with the provisions of its Article 37, the Protocol entered into force on 11 September 2003. The Protocol has 167 parties, which includes 165 United Nations member states, Niue, and the European Union.

AICHI BIODIVERSITY TARGETS

The tenth meeting of the Conference of the Parties, held in October 2010, in Nagoya, Aichi Prefecture, Japan, adopted a **revised and updated Strategic Plan for Biodiversity,** including the Aichi Biodiversity Targets, for the 2011.-2020 period. This new plan will be the overarching framework on biodiversity, not only for the biodiversity- related conventions, but for the entire United Nations system.

Aichi Biodiversity Targets: Under five broad strategic goals 20 targets have been decided.

- *Strategic Goal A:* Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society.

- *Strategic Goal B:* Reduce the direct pressures on biodiversity and promote sustainable use, ecosystems, species and genetic diversity.
- Strategic Goal C: To improve the status of biodiversity by safeguarding
- Strategic Goal D: Enhance the benefits to all from biodiversity and ecosystem services.
- Strategic Goal E: Enhance implementation through participatory planning, knowledge management and capacity building

Some examples of the Aichi Biodiversity Targets are:

- At least halve and, where feasible, bring close to zero the rate of loss of natural habitats, including forests.
- Establish a conservation target of 17% of terrestrial and inland water areas and 10% of marine and coastal areas
- Restore at least 15% of degraded areas through conservation and restoration activities.
- Make special efforts to reduce the pressures faced by coral reefs.
- Bonn Convention on Conservation of Migratory Species (CMS)

CITES (Convention on International Trade in Endangered Species) of Wild Flora and Fauna (CITES) 1975 — It is a legally binding treaty providing framework for national laws. As the title itself says, it prevents illegal trading of wildlife, particularly endangered species and thus it helps to stop poaching also.

INDIAN MEASURES FOR PROTECTION OF BIODIVERSITY

1. Protected Areas Network as following has been created National Parks; Wildlife Sanctuaries and Biosphere Reserves.
2. Wild Life Management refer to the chapter on Natural Vegetation and Wildlife in Physical Geography of India.
3. Legislations and Institutions:
   - *(i) National Biodiversity Strategy and Action Plan (NBSAP):* This has been formulated as per guidelines of Convention on Biological Diversity (CBD).
   - *(ii) Biodiversity (Biological Diversity) Act, 2002:* The Act aims to protect and conserve the biodiversity of India, protect the knowledge of biological communities and its utilization, to check biopiracy and to promote sustainable use of biodiversity. One of the matn effects of the act is the formation of National Biodiversity Authority (NBA).It is responsible for the protection and promotion of biodiversity of India, the benefits arising out of us^f genetic resources of ecosystems of India and its sharing, management of traditional knowledge of biodiversity etc. In short Biodiversity Act is responsible for implementation of Convention on Biological Diversity (CBD) and its protocols in India.
   - (iii) Forest Policy and Forest Conservation
   - (iv) Joint Forest Management
   - (v) Wildlife Conservation along with The Wildlife Act,1972.
   - (vi) Network of Protected Areas in lndia.