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## BIOMES AND BIOSPHERE RESERVE

A biome is a large geographical area of distinctive plant and animal groups, which are adapted to that particular environment. The climate and geography of a region determines what type of biome can exist in that region. Major biomes include deserts, forests, grasslands, tundra, and several types of aquatic environments. Each biome consists of many ecosystems whose communities have adapted to the small differences in climate and the environment inside the biome.

All living things are closely related to their environment. Any change in one part of an environment, like an increase or decrease of a species of animal or plant, causes a ripple effect of change in through other parts of the environment.

The earth includes a huge variety of living things, from complex plants and animals to very simple, one-celled organisms. But large or small, simple or complex, no organism lives alone. Each depends in some way on other living and nonliving things in its surroundings.

### MAJOR BIOMES OF INDIA

India is the seventh largest country in the world and Asia's second largest nation with an area of 3,287,263 sq.km. encompassing a varied landscape rich in natural resources. India is shielded by the world's highest mountains, the Himalayas, in the north. The southern part of India takes the shape of a peninsula and divides the Indian Ocean into the Bay of Bengal to the southeast and the Arabian Sea to the southwest. The southern tip of Kanyakumari is washed by the Indian Ocean. The Andaman and Nicobar Islands in the Bay of Bengal and the Lakshadweep group of islands in the Arabian sea are also a part of India.

India has a great diversity of natural ecosystems from the cold and high Himalayan

ranges to the sea coasts, from the wet northeastern green forests to the dry northwestern arid deserts, different types of forests, wetlands, islands and the oceans. India consists of fertile river plains and high plateaus and several major rivers, including the Ganges, Brahmaputra and Indus. The climate of India is determined by the southwest monsoon between June and October, the northeast monsoon between October and November and dry winds from the north between December and February. From March to May the climate is dry and hot.

India, being a vast country, shows a great diversity in climate, topography and geology and hence the country is very rich in terms of biological diversity.

India's biological diversity is one of the most significant in the world, since India has only 2% of the total landmass of the world containing about 6% of the world's known wildlife.

### THE TRANS-HIMALAYAN REGION

This area is very cold and arid (4,500 CE 6,000 mts. above msl). The only vegetation is a sparse alpine steppe. Extensive areas consist of bare rock and glaciers.

The faunal groups best represented here are wild sheep and goats (chief ancestral stock), ibex, snow leopard, marbled cat, marmots and black-necked crane.

### THE HIMALAYAN REGION

The fantastic altitude gradient results in the tremendous biodiversity of the Himalayan region. Flora and fauna vary according to both altitude and climatic conditions: tropical rainforests in the Eastern Himalayas and dense subtropical and alpine forests in the Central and Himalayas.



*The country has 10 different biogeographic zones and 26 biotic provinces.*

<b>Sl. No.</b>	<b>Biogeographic zones</b>	<b>Biotic provinces</b>
1.	Trans-Himalaya	Ladakh mountains, Tibetan plateau
2.	Himalaya	Northwest, West, Central and East Himalayas
3.	Desert	Thar, Kutch
4.	Semi-arid	Punjab plains, Gujarat Rajputana
5.	Western Ghats	Malabar plains, Western Ghats
6.	Deccan Peninsula	Central highlands, Chotta-Nagpur, Eastern highlands, Central Plateau, Deccan South
7.	Gangetic plains	Upper and Lower Gangetic plains
8.	Coast	West and East coast, Lakshadweep
9.	North-East	Brahmaputra valley, Northeast hills
10.	Islands	Andaman and Nicobar

Western Himalayas. The lower levels of the mountain range support many types of orchids. On the eastern slopes, rhododendrons grow to tree height.

<b>Classification</b>	<b>No. of species</b>
Angiosperms	15,000
Gymnosperms	64
Pteridophytes	1,022
Bryophytes	2,584
Algae	2,500
Fungi	23,000
Bacteria	850
Lichens	1,600



Animals of Himalayas show several behavioural and physiological adaptations. Sambar and muntjac are found in the subtropical foothills; serow, goral and the Himalayan thar are found in the temperate and subalpine regions; snow leopard and brown bear inhabit the alpine region. Carnivores are the most elusive of all mammals in the Himalayas. There are a variety of carnivores in the higher mountains, vulnerable and rare some of which are rare and threatened with extinction.

### **THE INDIAN DESERT**

The natural vegetation consists of tropical thorn forests and tropical dry deciduous forests, sandy deserts with seasonal salt marshes and mangroves are found in the main estuaries. Typical shrubs are phog growing on sand dunes. Sewan grass covers extensive areas called pali.

Thar desert possesses most of the major insect species. 43 reptile species and moderate bird endemism are found here. No niche of the Thar is devoid of birds. The black buck was once the dominant mammal of the desert region, now confined only to certain pockets. The gazelle is the only species of the Indian antelope of which the females have horns. Nilgai the largest antelope of India and the wild ass, a distinct subspecies, is now confined to the Rann of Kutch which is also the only breeding site in the Indian subcontinent for the flamingoes. Other species like desert fox, great Indian bustard, chinkara and desert cat are also found.



### **THE SEMI-ARID REGION**

The semi-arid region in the west of India includes the arid desert areas of Thar and Rajasthan extending to the Gulf of Kutch and Cambay and the whole Kathiawar peninsula.

The natural vegetation consists of tropical thorn forests and tropical dry deciduous forests, moisture forests (extreme north) and mangroves. The sandy plains have a few scattered trees of Acacia and Prosopis. The gravelly plains have



Calotropis, Gymnosporia, etc. The rocky habitats are covered by bushes of Euphorbia while species of Salvadora and Tamarix occur mainly near saline depressions.

The lion of Gir is the endemic species in this zone.

### **THE WESTERN GHATS**

They cover only 5% of India's land surface but are home to more than about 4,000 of the country's plant species of which 1800 are endemic. The monsoon forests occur both on the



western margins of the ghats and on the eastern side where there is less rainfall. This zone displays diversity of forests from evergreen to dry deciduous.

The Nilgiri langur, lion tailed macaque, Nilgiri tahr, Malabar grey hornbill and Most amphibian species are endemic to the Western Ghats.

### THE DECCAN PENINSULA

The Deccan Peninsula is a large area of raised land covering about 43% of India's total land surface. It is bound by the Sathpura range on the north, Western Ghats on the west and Eastern Ghats on the east. The elevation of the plateau varies from 900 mts. in the west to 300 mts. in the east. There are four major rivers that support the wetlands of this region which have fertile black and red soil. Large parts are covered



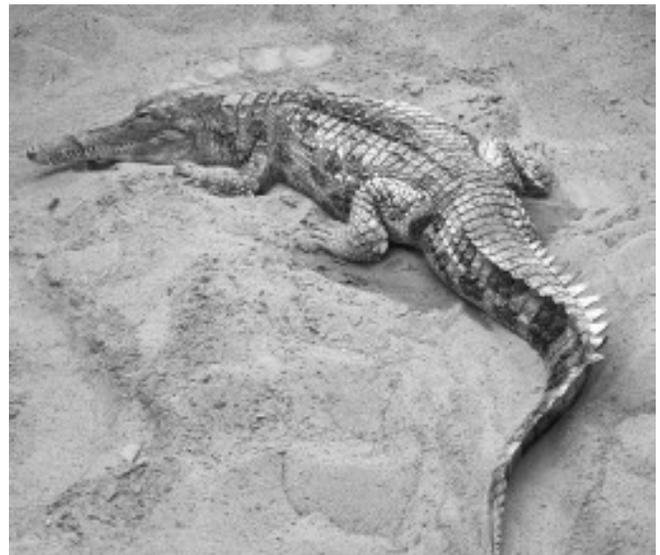
by tropical forests. Tropical dry deciduous forests occur in the northern, central and southern part of the plateau. The eastern part of the plateau in Andhra Pradesh, Madhya Pradesh and Orissa has moist deciduous forests. Fauna like tiger, sloth bear, wild boar, gaur, sambar and chital are found throughout the zone along with small relict populations of wild buffaloes, elephants and barasingha.

### THE GANGETIC PLAIN

The Gangetic plain is one of India's most fertile regions. The soil of this region is formed by the alluvial deposits of the anges and its tributaries. The four important surface differences recognized in the geomorphology of the plains are:

- **Bhabar** - pebble studded zone with porous beds
- **Terai** - marshy tract
- **Bhangar** - older alluvium of the flood plain
- **Terai** - marshy tract
- **Khadar**-newer alluvium

The Gangetic plains stretching from India possesses little more than 7% of the total eastern Rajasthan through Uttar Pradesh animal species of the world. This percentage is to Bihar and West Bengal are mostly higher than that of the plant species. Out of a total under agriculture. The large forest area is of 86,874 animal species,



insects alone comprise under tropical dry deciduous forest and 68.52% and chordates 5.70% the southeastern end of the Gangetic plain merges with the littoral and Among the large animals, 173 species of mammals, mangroves regions of the Sunderbans birds, 15 of reptiles, 3 of amphibians and 2 of fishes are considered endangered.

The fauna includes elephants, black buck, gazelle, rhinoceros, Bengal florican, crocodile, freshwater turtle and a dense waterfowl community.

Larger animals	No. of species
Mammals	390
Birds	1,232
Reptiles	456
Amphibians	209
Fishes	2,546

### THE COASTAL REGION

The natural vegetation consists of mangroves. Animal species include dugong, dolphins, crocodiles and avifauna. There are 26 species of fresh water turtles and tortoises in India and 5 species of marine turtles, which inhabit and feed in coastal waters and lay their eggs on suitable beaches. Tortoise live and breed mainly on the land.

Over 200,000 Olive Ridley turtles come to Orissa to nest in the space of three or four nights. The highest tiger population is found in the Sunderbans along the east coast adjoining the Bay of Bengal.



Lakshadweep consists of 36 major islands -12 atolls, 3 reefs and 5 submerged coral banks - make up this group of islands more than three hundred kilometers to the west of the Kerala coast. The geographical area is 32 sq. km. and the usable land area is 26.32 sq. km. The fauna consists mainly of four species of turtles, 36 species of crabs, 12 bivalves, 41 species of sponges including typical coral, ornamental fishes and dugongs. A total of 104 scleractinian corals belonging to 37 genera are reported.

### THE NORTH-EAST

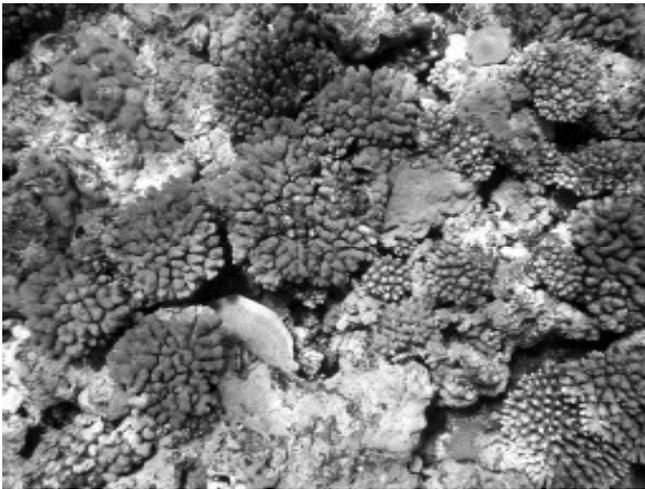
Biological resources are rich in this zone. The tropical vegetation of northeast India is rich in evergreen and semievergreen rain forests, moist deciduous monsoon forests, swamps and largest of all existing rhinoceros grasslands. Mammalian fauna includes 390 species of which 63% are found in Assam. The area is rich in smaller carnivores. The country's highest population of elephants are found here.



## THE INDIAN ISLANDS

It is a group of 325 islands: Andaman to the north and Nicobar to the south. The two are separated by about 160 kms. by the Ten Degree Channel of the sea. The rainfall is heavy, with both Northeast and Southwest monsoons. At present, 21 of the 325 islands in the Andaman & Nicobar Islands are inhabited. Many unique plants and animals are found here. About 2,200 species of higher plants are found here of which 200 are endemic. The Andaman & Nicobar Islands have tropical evergreen forests and tropical semievergreen forests as well as moist deciduous forests, littoral and mangrove forests.

112 endemic species of avifauna, the Andaman water monitor, giant robber crab, 4 species of turtles, wild boar, Andaman day gecko and the harmless Andaman water snake are found only in these islands. The Narcondam hornbill found only in Narcondam is a large forest bird with a big beak. Coral reefs are stretched over an area of 11,000 sq.km. in the Andamans and 2,700 sq.km. in Nicobar.



### CAUSES OF ECOLOGICAL DESTRUCTION AND DEPLETION

The rapid deterioration of the ecology due to human interference is aiding the disappearance of wildlife from the biosphere.

The common problems are habitat disturbance and destruction, introduction of exotics, exploitation, marine pollution, natural disasters like floods, earthquakes and forest fires.

*The major problems of certain specific zones are as follows:*

- **Wetlands:** siltation, eutrophication, encroachment, tourism.
- **Forests:** deforestation and degradation, extended cultivation, road laying, mining operation.
- **Seas:** hot water from nuclear and thermal power plants, toxic effluents from coastal areas, oil spills, blasting and dredging, collection of undersized fishes and other organisms, exploitation of ornamental seashells, chanks and pearl oysters by domestic shell craft industry, export of sea fans and seaweeds.
- **Corals:** used as a raw material in the cement factories, exploitation of antipatharians and precious red coral for jewellery, commercial exploitation of aquarium fishes from Indian coral reefs.
- **Mangroves:** agriculture, aquaculture, fuel wood extraction, diversion of fresh water for irrigation resulting in increased salinity.
- **Rivers:** heavy metal pollution, persistent biocides, organic wastes, removal of sand from river beds.
- **Animals:** exploited for their skin, fur, wood, tusk, meat, medicine and oil, trade, hunting, poaching.

### LEGISLATION FOR PROTECTING ENDANGERED SPECIES

Considering the importance of flora and fauna, major national and international efforts have been made to protect and conserve the rich biodiversity and endangered species of wildlife and flora. Convention on the International Trade in Endangered Species of Wild Fauna and Flora (CITES), 1973, is a significant step in this direction. The convention recognized that wild fauna and flora in their many beautiful and varied forms are irreplaceable parts of the natural systems of the earth, which must be protected by all means. The United Nations Convention on Biological Diversity, 1992 is another milestone.

The Wildlife (Protection) Act, 1972, is our national initiative to protect wildlife. The Act provides for establishment of a Wildlife Board and setting up of Wildlife Sanctuaries and National Parks. The Act also makes hunting of wild animals a punishable offence. The Biological Diversity Bill, 2000 which is in the offing, also inter alia, strives to protect and conserve the biodiversity and endangered species in India.

### **ECOSYSTEM BALANCE**

There is an urgent need for sustaining wild species due to the following reasons.

- Forests render the climate more equable, prevent soil erosion and landslides and help in flood control
- Most of today's food crops were domesticated from wild tropical plant
- About 80% of the world's population relies on plants or plant extracts for medicines
- Pollination and seed dispersal by birds, insects and animals is essential to increase diversity of genetic recombination
- Agricultural scientists and genetic engineers require the existing total stock of species - most of them still unknown and unnamed - as the source of food and to develop the new crop strains of tomorrow
- Survival of humans and other species is dependent on the producer
- Wildlife serves as a gene library; premature extinction of species leads to irreversible loss of genetic information that influences the future evolution of life on earth Aesthetic value.

Biodiversity and ecological integrity are essential to all life on earth and should not be disturbed by human actions. To save the natural world, ecosystems as a whole have to be saved. Unless the entire ecosystem is preserved, the individual species will not be able to survive for long. The steps taken to preserve our wildlife are:

- Gene banks and Botanical Gardens
- Zoological Gardens and Captive Breeding Centres

- Biosphere Reserves
- National Parks and Wildlife Sanctuaries
- Treaties and laws to protect endangered species

### **ECOLOGICAL RELATIONSHIPS OF BIOMES**

The survival and well being of a biome and its organisms depends on ecological relationships throughout the world. Even changes in distant parts of the world and its atmosphere affect our environment and us. The eruption of a volcano in Mexico, or Southeast Asia can bring the temperature of the whole world down a few degrees for several years.

### **MAJOR BIOMES OF THE WORLD**

Have you visited any biomes lately? A biome is a large ecosystem where plants, animals, insects, and people live in a certain type of climate. If you were in northern Alaska, you would be in a frosty biome called the Arctic tundra. If you jumped on a plane and flew to Brazil, you could be in a hot and humid biome called the tropical rainforest. The world contains many other biomes: grasslands, deserts, and mountains, to name a few. The plants and animals living in each are as different as their climates. Which is your favorite?

#### **Arctic Tundra**

The Arctic tundra is a cold, vast, treeless area of low, swampy plains in the far north around the Arctic Ocean. It includes the northern lands of Europe (Lapland and Scandinavia), Asia (Siberia), and North America (Alaska and Canada), as well as most of Greenland. Another type of tundra is the alpine tundra, which is a biome that exists at the tops of high mountains.

#### **Special features**

This is the earth's coldest biome. Since the sun does not rise for nearly six months of the year, it is not unusual for the temperature to be below -30°F in winter. The earth of the Arctic tundra has a permanently frozen subsoil, called permafrost, which makes it impossible for trees to grow. Frozen prehistoric animal remains have been found preserved in the permafrost.

In summer, a thin layer of topsoil thaws and creates many pools, lakes, and marshes, a haven for mosquitoes, midges, and blackflies. More than 100 species of migrant birds are attracted by the insect food and the safe feeding ground of the tundra. Other animals that live in this biome include polar bears, Arctic foxes, caribou, and grey wolves. Plants that you might find include small shrubs and cushion plants, and the lichen which cover the many rocks on the tundra's terrain. The Arctic is also famous for the beauty of its flowers during early autumn.

### **Coniferous Forest**

The coniferous forest biome is south of the Arctic tundra. It stretches from Alaska straight across North America to the Atlantic Ocean and across Eurasia. The largest stretch of coniferous forest in the world, circling the earth in the Northern Hemisphere, is called the "taiga." It supplies the bulk of the world's commercial softwood timber, which is used to make paper.

### **Special features**

These forests consist mainly of cone-bearing trees such as spruce, hemlock, and fir, which are well suited to the cold climate. The soil is not very fertile, however, because there are no leaves to decompose and enrich it. Some animals that thrive in this biome are the ermine, the moose, the red fox, the snowshoe rabbit, and birds such as the crossbill and the great horned owl.

### **Deciduous Forest**

This biome is in the mild temperate zone of the Northern Hemisphere. Major regions are found in eastern North America, Europe, and eastern Asia.

### **Special features**

Deciduous trees lose their leaves in fall. The natural decaying of the fallen leaves enriches the soil and supports all kinds of plant and animal life. The deciduous forest is a lively place, where oak, beech, ash, and maple trees are typical, and wildflowers, berries, and many types of insect and animal life abound. But the fertile soil is also good for people, and in Europe most of the deciduous

forest has been destroyed to make room for farms and homes. In the U.S., the deciduous forest is a home for deer, American gray squirrels, wood mice, rabbits, raccoons, woodpeckers, cardinals, and finches, to name a few.

### **Desert**

A desert is an area where little or no life exists because of a lack of water. Scientists estimate that about one-fifth of the earth's land surface is desert. Deserts can be found on every continent except Europe. There are two different kinds: hot and dry (such as the Arabian and Sahara deserts) and cold and dry (such as Antarctica and the Gobi desert).

In North America, there are four major deserts: the Great Basin, the Mojave, the Sonoran, and the Chihuahuan. All but the Great Basin are hot deserts located in Mexico and the southwestern part of the United States. The Great Basin covers parts of Idaho, Nevada, Oregon, and Utah, and is considered a cold desert.

### **Special features**

The lack of water and intense heat or cold make this biome inhospitable to most life forms. Most of the plants you'll see in the desert are species of cactus. You might come across yucca, aloe, octillo plants, or the tall saguaro cacti. A few animals—mainly reptiles, like snakes and lizards, and amphibians, like frogs and toads—are well adapted to the hot desert. Another famous desert animal is the camel, which can make water from the fat it stores in its hump. The Emperor and Adélie penguins are well-known animals living at the edge of the Antarctic desert.

### **Grasslands**

Grasslands are places with hot, dry climates that are perfect for growing food. They are known throughout the world by different names. In the U.S. they are called prairies and extend from the Midwest to the Rocky Mountains. In South Africa, grasslands are called the veld. Hot, tropical grasslands called savannas are found in South America and Africa. In Eurasia, temperate zone grasslands are called steppes; in South America, pampas.

## **Special features**

This inland biome is made of vast areas of grassy field. It receives so little rain that very few trees can grow. The U.S. prairies are used to graze cattle and to raise cereal crops. There is little variety of animal life. Some original prairie animals like the wolf and bison have come close to being eliminated from the habitat by hunters. Today, some of the most common grassland animals include the prairie dog and the mule deer in North America, the giraffe and the zebra in Africa, and the lion in Africa and Asia.

## **Mountains**

Mountains exist on all the continents of the earth. Many of the world's mountains lie in two great belts. The Circum-Pacific chain, often called the Ring of Fire, runs from the west coast of the Americas through New Zealand and Australia and up through the Philippines to Japan. The other major belt, called the Alpine-Himalayan, or Tethyan, system, stretches from the Pyrenees in Spain and France through the Alps and on to the Himalayas before ending in Indonesia.

## **Special features**

Mountains are usually found in groups called chains or ranges, although some stand alone. A mountain biome is very cold and windy. The higher the mountain, the colder and windier the environment. There is also less oxygen at high elevations.

The animals of this biome have adapted to the cold, the lack of oxygen, and the rugged landscape. They include the mountain goat, ibex (wild goat), sheep, mountain lion, puma, and yak. All of them are excellent climbers, which means they can move freely in the steep, rocky landscape. Types of plants vary depending on geographic location and altitude. Lower elevations are commonly covered by forests, while very high elevations are usually treeless.

## **Rainforests**

Tropical rainforests are found in Asia, Africa, South America, Central America, and on

many of the Pacific islands. They are often found along the equator. Almost half of the world's tropical rainforests are in the South American country Brazil.

There are other types of rainforests around the world, too. For example, northern Australia has a "dry rainforest" that experiences a dry season each year, and the rainy Pacific Northwest in the United States has a "temperate rainforest" that is made up of evergreen trees.

## **Special features:**

Tropical rainforests receive at least 70 inches of rain each year and have more species of plants and animals than any other biome. Many of the plants used in medicine can only be found in tropical rainforests. The combination of heat and moisture makes this biome the perfect environment for more than 15 million plants and animals. The thick vegetation absorbs moisture, which then evaporates and completes the cycle by falling again as rain.

A rainforest grows in three levels. The canopy, or tallest level, has trees between 100 and 200 feet tall. They block most of the sunlight from the levels below. The second level, or understory, contains a mix of small trees, vines, and palms as well as shrubs and ferns. The third and lowest level is the forest floor, where herbs, mosses, and fungi grow.

Rainforests are an endangered biome. People have cut the trees and sold the wood for firewood, building materials, and paper. Parts of the rainforest have been burned to make space for grazing and farming. Every minute, approximately 30 acres of rainforest are destroyed. The large amounts of carbon dioxide that are released due to the cutting and burning of rainforests contribute to the greenhouse effect.

Some of the animals of the tropical rainforest are the anteater, jaguar, brocket deer, lemur, orangutan, marmoset, macaw, parrot, sloth, and toucan. Among the many plant species are bamboo, banana trees, rubber trees, and cassava.

# 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 indices 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".

**REASONS FOR THE RICHNESS OF THE BIODIVERSITY 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 and there is opportunity for many species to exist. On the contrary in temperate zones is reduced pest pressure due to cold, and is one or a few dominating species that eat 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 variation
- (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.

**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

**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 (CI), 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