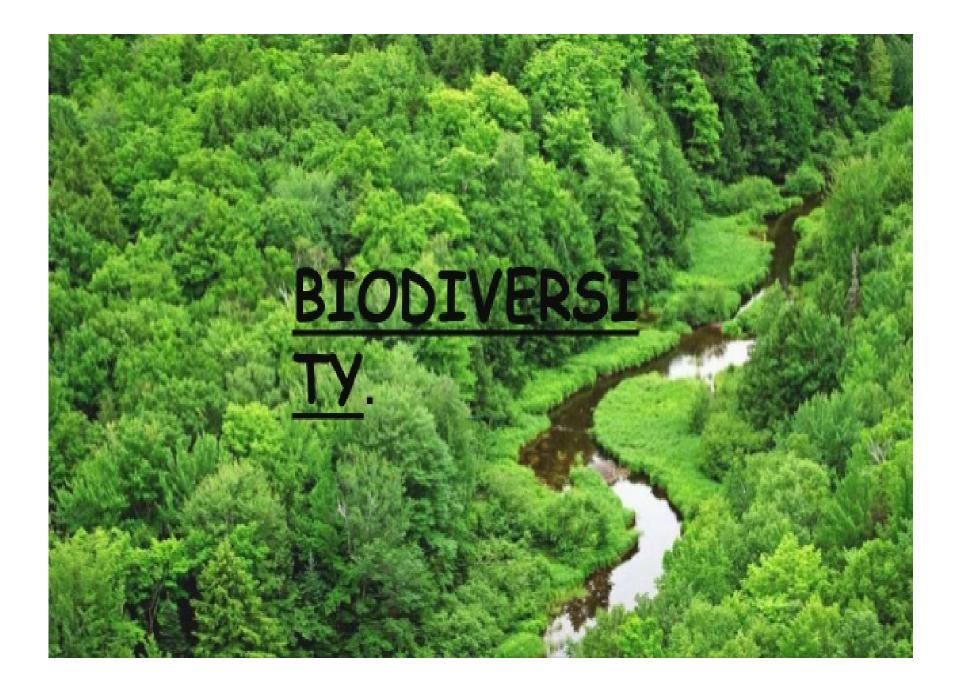


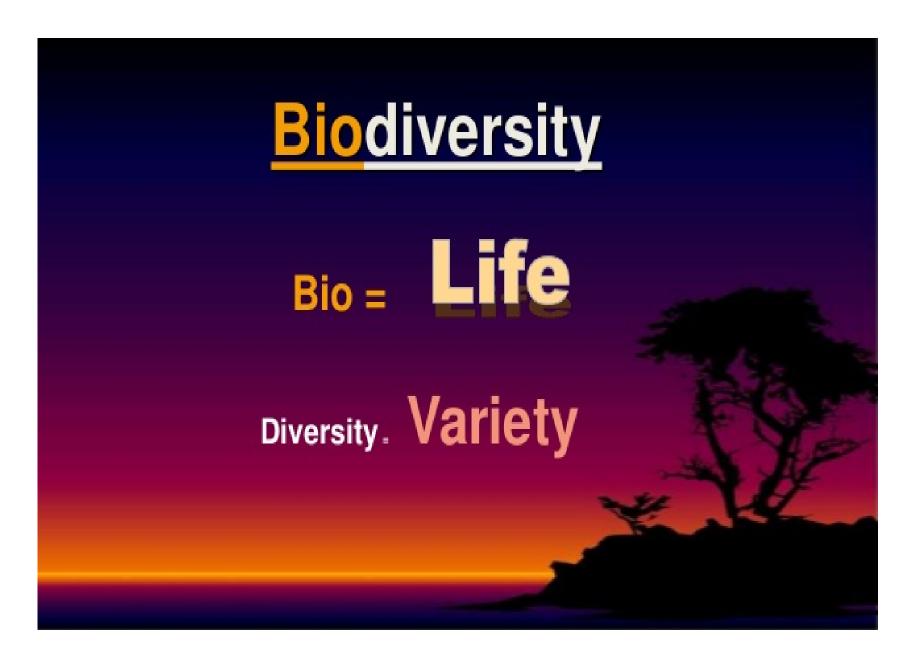
Shaping Lives... Empowering Communities

# By Dr.M.L.N.ACHARYULU ASSOC.Prof in Chemistry

# Bio-diversity and its ConservationBio-diversity and its Conservation

- Definition: genetic, species and ecosystem diversity. ï
- Biogeographical classification of India. ï
- Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
- ¡Biodiversity at global, national and local levels.
- ï India as a maga-diversity nation, Hot-spots of biodiversity.
- Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India.
- ïConservation of biodiversity: In-situ and Ex-situ conserva- tion of biodiversity.





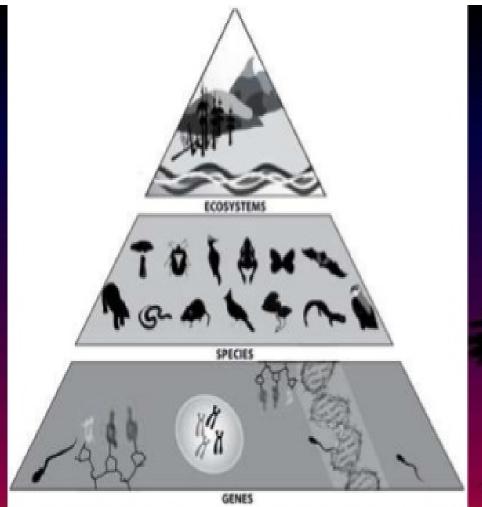
# **Definition**: genetic, species and ecosystem diversity

Biodiversity refers to the variety and variability among all groups of living organisms and the ecosystem complexes in which they occur

Biodiversity has been defined as the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part.

#### Ecosystem

diversity refers to the diversity of a place at the level of ecosystems. The term differs from biodiversity, which refers to variation in species rather than ecosystems.

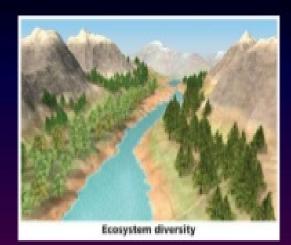


Genetic diversity, the level of biodiversity refers to the total number of genetic characteristics in the genetic makeup of a species.

# Species diversity is the effective number of different species that are represented in a collection of

individuals

#### ECOSYSTEM DIVERSITY

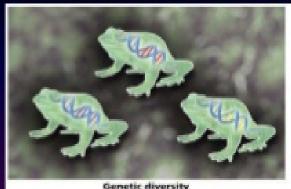


- Includes diversity above the species level. Biologists have viewed diversity above the species level in various ways. Some alternative ways to categorize it include:
  - Community diversity
  - Habitat diversity
  - Landscape diversity

#### GENETIC DIVERSITY

# SPECIES

- species = a particular type of organism; a population or group of populations whose members share certain characteristics and can freely breed with one another and produce fertile offspring
- Species diversity = the number or variety of species in a particular region
- Species richness = number of species
- Evenness, or relative abundance = extent to which numbers of different species are equal or skewed



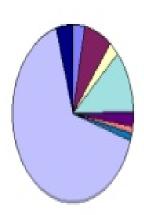
- Genetic diversity
- Includes the differences in DNA composition among individuals within a given species.
- Adaptation to particular environmental conditions may weed out genetic variants that are not successful.
- But populations benefit from some genetic diversity, so as to avoid inbreeding or disease epidemics.

### **GENETIC DIVERSITY**

It is the basic source of biodiversity. The genes found in organisms can form enormous number of combinations each of which gives rise to some variability.

Genes are the basic units of hereditary information transmitted from one generation to other. When the genes within the same species show different versions due to new combinations, it is called genetic variability.

#### Summary of the biodiversity



Biosphere 13 500 000 species

- Viruses
- Bacteria
- Algae
- Fungi
- Terrestrial plants
- Protozoans and related species
- Molluscs
- Insects and related species
- Other invertebrates
- Fishes and funicates
- Amphibians
- Reptiles
- Birds
- Mammals

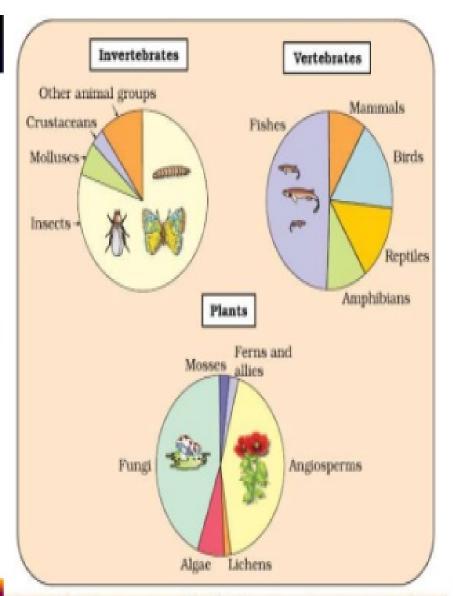
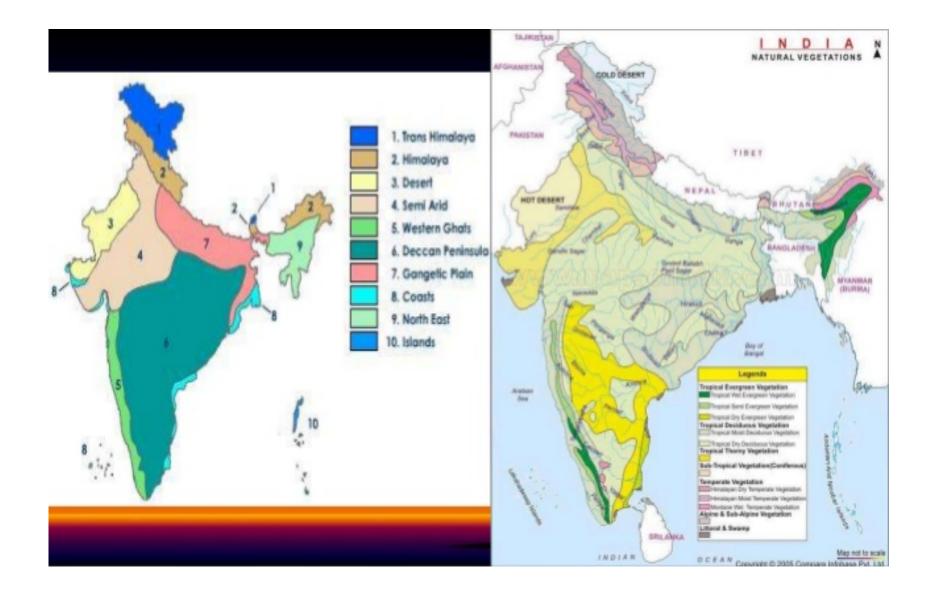


Figure 15.1 Representing global biodiversity: proportionate number of species of major taxa of plants, invertebrates and vertebrates



#### BENEFITS OF BIODIVERSITY

#### Consumptive value:

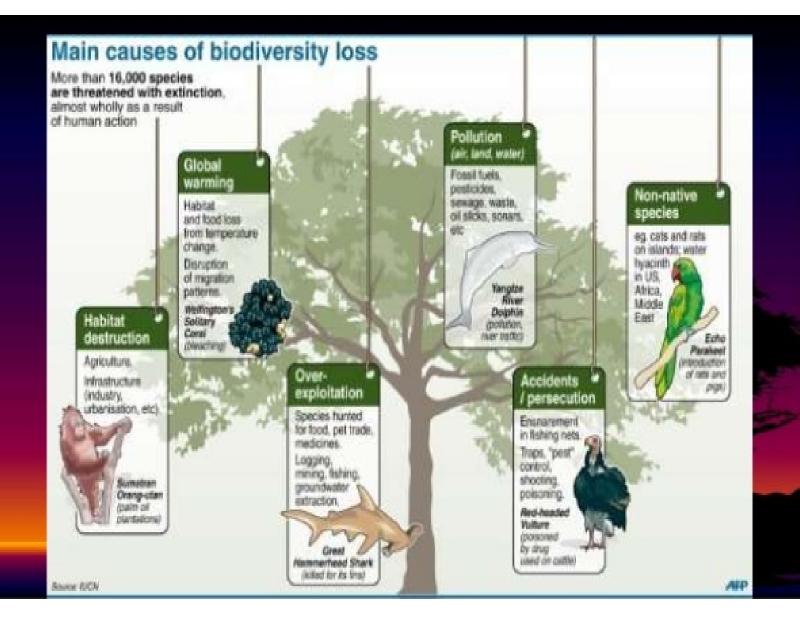
- > Food/Drink
- Fuel
- ➢ Medicine
- ➤ Batter crop varieties
- > Industrial Material

#### Non-Consumptive Value:

- Recreation
- >Education and Research
- >Traditional value

#### **Ecological services:**

- >Balance of nature
- ▶Biological productivity
- ▶Regulation of climate
- >Degradation of waste
- Cleaning of air and water
- >Cycling of nutrients
- Control of potential pest and disease causing species
- Detoxification of soil and sediments
- ➤Stabilization of land against erosion
- ➤ Carbon sequestration and global climate change
- ➤ Maintenance of Soil fertility



## **GENETIC DIVERSITY**

For example, all rice varieties belong to the species Oryza sativa, but there are thousands of wild and cultivated va- rieties of rice which show variations at the genetic level and differ in their color, size, shape, aroma and nutrient content of the grain. This is the genetic diversity of rice.

# SPECIES DIVERSITY

This is the variability found within the population of a species or between different species of a community. It represents broadly the species richness and their abundance in a community.

There are two popular indices of measuring species diversity known as Shannon-Wiener index and Simpson index. What is the number of species on this biosphere?

## SPECIES DIVERSITY

The estimates of actual number vary widely due to incomplete and indirect data. The current estimates given by Wilson in 1992 put the total number of living species in a range of 10 million to 50 million.

Till now only about 1.5 million living and 300,000 fossil species have been actually described and given scientific names. It is quite likely that a large fraction of these species may become extinct even before they are discovered and en-listed.

# **ECOSYSTEM DIVERSITY**

• This is the diversity of ecological complexity showing variations in ecological niches, trophic structure, food-webs, nutrient cycling etc. The ecosystems also show variations with respect to physical parameters like moisture, temperature, altitude, precipitation etc.

• Thus, there occurs tremendous diversity within the ecosystems, along these gradients. We may consider diversity in forest ecosystem, which is supposed to have mainly a

dominance of trees.

• But, while considering a tropical rainforest, a tropical deciduous forest, a temperate deciduous forest and a boreal forest, the variations observed are just too many and they are mainly due to variations in the above mentioned physical factors.

# **ECOSYSTEM DIVERSITY**

The ecosystem diversity is of great value that must be kept intact. This diversity has developed over millions of years of evolution. If we destroy this diversity, it would disrupt the ecological balance. We cannot even replace the diversity of one ecosystem by that of another.

Coniferous trees of boreal forests cannot take up the function of the trees of tropical deciduous forest lands and vice versa, because ecosystem diversity has evolved with respect to the prevailing environmental conditions with well-regulated ecological balance.

#### THREATS TO BIODIVERSITY

#### Natural causes:

- ➤ Narrow geographical area
- >Low population
- >Low breeding rate
- ➤ Natural disasters

#### Anthropogenic causes:

- > Habitat modification
- >Overexploitation of selected species
- >Innovation by exotic species.
- Pollution
- ≽Hunting
- ➤Global warming and climate change
- > Agriculture
- ➤ Domino effect

# VALUES IF BIO-DIVERSITY

- 1.Consumptive use value:Food, Drugs, medicines, Fuel
- 2.Productive use values: animal products like tusks of elephants, musk frommusk deer, silk from silk-worm, wool from sheep, fir of many animals, lac from lac insects etc, all of which are traded in the marketSocial Value
- **3.Ethical value:existence** value. It involves ethical issues like .all life must be preserved.. It is based the concept of .Live and Let Live.
- 4.Aesthetic value-eco-tourism.
- 5. Ecosystem service value

# Value of Indian Bio diversity

- A male lion living upto an age of 7 years can generate upto \$ 515,000 due to its aesthetic value as paid by tourists, whereasif killed for the lion skin a market price upto \$ 1,000 can befetched.
- In its lifetime a Kenyan elephant can earn worth \$1 million astourist revenue.
- The mountain gorillas in Rwanda are fetching \$ 4 million annuallythrough eco-tourism.

# Value of Indian Bio diversity

- Whale watching on Hervey Bay on Queensland.s coast earns\$12 million annually.
- Tourism to Great Barrier Reef in Australia earns \$ 2 billion eachyear.
- A typical tree provides \$ 196,2150 worth of ecological services as oxygen, clean air, fertile soil, erosion control, water recycling, wildlife habitat, toxic gas moderation etc. Whereas its worth is only about \$ 590 if sold in the market as timber.

#### BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

- 1. Trans-Himalayan Upper Regions 186200
- 2. Himalayan North-West Himalayas 6900 West Himalayas 720000 Central Himalayas 123000 East Himalayas 83000
- 3. Desert Kutch 45000 Thar 180000 Ladakh NA
- 4. Semi-Arid Central India 107600 Gujarat-Rajwara 400400

# BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

- 5. Western Ghats Malabar Coast 59700 Western Ghat Mountains 99300
- 6. Deccan Peninsula Deccan Plateau South 378000 Central Plateau 341000 Eastern Plateau 198000 Chhota Nagpur 217000 Central Highlands 287000

7. Gangetic Plain Upper Gangetic Plain 206400 Lower Gangetic Plain 153000

#### BIOGEOGRAPHICAL CLASSIFICATION OF INDIA

- 8. North-East India Brahmaputra Valley 65200 North-Eastern Hills 106200
- 9. Islands Andaman Islands 6397 Nicobar Islands 1930 Lakshadweep Islands 180
- 10. Coasts West Coast 6500 East Coast 6500

Source: iConserving our Biological Wealthi, WWF for Nature-India and Zoological Survey of India.

- \*Illegal trade of wildlife products by killing prohibited endangered animals i.e. poaching is another threat to wildlife.
- \*Despite international ban on trade in products from endangered species, smuggling of wildlife items like furs, hides, horns, tusks, live specimens and herbal products worth millions of dollars per year continues.
- \*The developing nations in Asia, Latin America and Africa are the richest source of biodiversity and have enormous wealth of wildlife

- \*The rich countries in Europe and North America and some affluent countries in Asia like Japan, Taiwan and Hong Kong are the major importers of the wild life products or wild life itself.
- \*The trading of such wild life products is highly profit making for the poachers who just hunt these prohibited wild life and smuggle it to other countries mediated through a mafia.

- \*The cost of elephant tusks can go upto \$ 100 per kg;
- \*The leopard fur coat is sold at \$ 100,000 in Japan while bird catchers can fetch upto \$ 10,000 for a rare hyacinth macaw, a beautiful coloured bird, from Brazil.
- \* The worse part of the story is that for every live animal that actually gets into the market, about 50 additional animals are caught and killed..

If you are fond of rare plants, fish or birds, please make sure that you are not going for the endangered species or the wild-caught species. Doing so will help in checking further decline of these species.

Also do not purchase furcoat, purse or bag, or items made of crocodile skin or python skin. You will certainly help in preserving biodiversity by doing so

### MAN-WILDLIFE CONFLICTS

- \*In Sambalpur, Orissa 195 humans were killed in the last 5 years by elephants. In retaliation the villagers killed 98 elephants and badly injured 30 elephants. Several instances of killing of elephants in the border regions of Kote-Chamarajanagar belt in Mysore have been reported recently.
- \*The man-elephant conflict in this region has arisen because of the massive damage done by the elephants to the farmeris cotton and sugarcane crops.

## MAN-WILDLIFE CONFLICTS

- \*The agonized villagers electrocute the elephants and sometimes hide explosives in the sugarcane fields, which explode as the elephants intrude into their fields. In fact, more killings are done by locals than by poachers.
- \*Recently, in early 2004, a man-eating tiger was reported to kill 16 **Nepalese people** and one 4-year old child inside the Royal ChitwanNational Park, 240 Km South-west of Kathmandu

# MAN-WILDLIFE CONFLICTS- The root causes

- (i) Dwindling habitats of tigers, elephants, rhinos and bears due to shrinking forest cover compels them to move outside the forest and attack the field or sometimes even humans. Human encroachment into the forest areas raises a conflict between man and the wildlife, perhaps because it is an issue of survival of both.
- (ii) Usually the ill, weak and injured animals have a tendency to attack man. Also, the female tigress attacks the human if she feels that her newborn cubs are in danger. But the biggest problem is that if human-flesh is tasted once then the tiger does not eat any other animal. At the same time, it is very difficult to trace and cull the man-eating tiger and in the process many innocent tigers are also killed

#### MAN-WILDLIFE CONFLICTS- The root causes

- Earlier, forest departments used to cultivate paddy, sugarcane etc. within the sanctuaries when the favourite staple food of elephants i.e. bamboo leaves were not available.
- Now due to lack of such practices the animals move out of the forest in search of food. It may be noted that,
- One adult elephant needs 2 quintals of green fodder and 150 kg of clean water daily and if it is not available, the animal strays out.
- (iv) Very often the villagers put **electric wiring around their ripe** crop fields. The elephants get injured, suffer in pain and turn violent

#### MAN-WILDLIFE CONFLICTS

#### Remedial Measures to Curb the Conflict

- (i) Tiger Conservation Project (TCP) has made provisions for making available vehicles, tranquillizer guns, binoculars and radio sets etc. to tactfully deal with any imminent danger.
- (ii) Adequate crop compensation and cattle compensation scheme must be started, along with substantial cash compensation for loss of human life.
- (iii) Solar powered fencing should be provided along with electric current proof trenches to prevent the animals from straying into fields.
- (iv) Cropping pattern should be changed near the forest borders and adequate fodder, fruit and water should be made available for the elephants within forest zones..

# MAN-WILDLIFE CONFLICTS Remedial Measures to Curb the Conflict

- (v) Wild life corridors should be provided for mass migration of big animals during unfavorable periods. About 300 km2 area is required for elephant corridors for their seasonal migration.
- (vi) In Similipal Sanctuary, Orissa there is a ritual of wild animal hunting during the months of April-May for which forest is burnt to flush out the animals. Due to massive hunting by people, there is a decline in prey of tigers and they start coming out of the forest in search of prey.
- WWF-TCP initiative to curb this ritual of iAkhand Shikarî in Orissa

# In-situ conservation

• In-situ conservation is the on-site conservation or the conservation of genetic resources in natural populations of plant or animal species, such as forest genetic resources in natural populations of Teagan species



### **Biodiversity Conservation**

IN-SITU

- Protected Areas
  - National Parks
  - Sanctuaries
  - Biosphere Reserves
- 2. Sacred Forests and Lakes

EX-SITU

- Seed Banks, Gene Banks
- 2. Long Term Captive Breeding
- 3. Animal Translocations
- 4. Tissue Culture Banks
- Cryopreservation of Gametes and Embryos
- 6. Botanical Gardens
- Zoological Gardens or Zoos.

### **Bio-sphere Reserves-insitu**

- The Biosphere Reserves conserve some representative ecosystems
- as a whole for long-term in situ conservation.
- NandaDevi (U.P.),
- Nokrek (Meghalaya),
- Manas (Assam),
- Sunderbans (WestBengal),
- Gulf of Mannar (Tamil Nadu),
- Nilgiri (Karnataka, Kerala, Tamil Nadu),
- Great Nicobars and Similipal (Orrisa) biosphere Reserves.

Within the Biosphere reserves we may have one or more National Parks. For example, Nilgiri Biosphere Reserve has two National Parks viz. Bandipur and Nagarhole National Park.

### Ex situ Conservation-Gene Banks

i) National Bureau of Plant Genetic Resources (NBPGR) is located in New Delhi. Here agricultural and horticultural crops and their wild relatives are preserved by cryo-preservation of seeds, pollen etc. by using liquid nitrogen at a temperature as low as -196°C.

Varieties of rice, pearl millet, Brassica, turnip, radish, tomato, onion, carrot, chilli, tobacco, poppy etc. have been preserved successfully in liquid nitrogen for several years without losing seed viability.

### Ex situ Conservation-Gene Banks



### Ex situ Conservation-Gene Banks

- (ii) National Bureau of Animal Genetic Resources (NBAGR) located at Karnal, Haryana. It preserves the semen of domesticated bovine animals.
- (iii) National Facility for Plant Tissue Culture Repository (NFPTCR) for the development of a facility of conservation of varieties of crop plants/trees by tissue culture. This facility has been created within the NBPGR. The G-15 countries have also resolved to set up a network of gene banks to facilitate the conservation of various varieties of aromatic and medicinal plants for which India is the networking co-ordinator country.

### Wildlife sanctuaries-in situ

- Wildlife sanctuaries are also protected areas where killing, hunting, shooting or capturing of wildlife is prohibited except under the control of highest authority.
- However, private ownership rights are permissible and forestry operations are also permitted to an extent that they do not affect the wildlife adversely

### Wildlife Sanctuaries of India

*Ghana Bird Sanctuary	<b>State</b> Rajasthan	Major Wild Life 300 species of birds (including
migratory) *Hazaribagh Sanctuary	Bihar	Tiger, Leopard
*Sultanpur Bird Sanctuary birds	Haryana	Migratory
*Nal Sarovar Bird Sanctuary Abohar	Gujarat	Water birds
*Wildlife Sanctuary	Puniab	Black buck

### Wildlife Sanctuaries of India

#### Name of Sanctuary State

Major Wild Life

\* Mudamalai Wildlife Sanctuary Tamil Nadu

Tiger, elephant, Leopard

\*Vedanthangal Bird Sanctuary Tamil Nadu

Water birds

\* Jaldapara Wild Life Sanctuary W. Bengal elephant, Tiger

Rhinoceros,

\* Wild Ass Sanctuary chinkara

Gujarat

Wild ass, wolf, nilgai,

### **HOT SPOTS OF BIODIVERSITY**

- Areas which exhibit high species richness as well as high species endemism are termed as hot spots of biodiversity
- The term was introduced by Myers (1988). There are 25 such hot spots of biodiversity on a globallevel out of which two are present in India, namely the Eastern Himalayasand Western Ghats
- An area is designated as a hotspot when it contains at least 0.5% of the plant species as endemics

### **National Parks-insitu**

- A National Park is an area dedicated for the conservation ofwild life along with its environment.
- It is also meant for enjoyment through tourism but without impairing the environment.
- Grazing of domestic animals, all private rights and forestry activities are prohibited with in a National Park.
- Each National Park usually aims atconservation specifically of some particular species of wildlife alongwith others.

#### Some important National parks in India-80

N	lame	of N	National	Park
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#### State

#### Important Wildlife

Kaziranga
Gir National Park
Dachigam
Bandipur
Periyar
Kanha
Corbett
Dudwa
Ranthambore

Sariska

Assam
Gujarat
J & K
Karnataka
Kerala
M.P.
U.P.
U.P.
Rajasthan
Rajasthan

One horned Rhino
Indian Lion
Hangul
Elephant
Elephant, Tiger

# Endemic/Endangered/Extinct/Rare species

- The International Union for Conservation of Nature and NaturalResources (IUCN) publishes the Red Data Book which includes thelist of endangered species of plants and animals.
- In India, nearly 450 plant species have been identified in thecategories of endangered, threatened or rare.
- Existence of about 150mammals and 150 species of birds is estimated to be threatened
- while an unknown number of species of insects are endangered.
- (a) Reptiles: Gharial, green sea turtle, tortoise, python
- (b)Birds: Great Indian bustard, Peacock, Pelican, Great Indian Hornbill, Siberian WhiteCrane

# Endemic/Endangered/Extinct/Rare species

- A species is said to be extinct when it is not seen in the wildfor 50 years at a stretch e.g. Dodo, passenger pigeon.
- A species is said to be endangered when its number has been reduced to a critical level or whose habitats, have been drastically reduced and if such a species is not protected and conserved, it is in immediate danger of extinction.
- A species is said to be in vulnerable category if its population is facing continuous decline due to over exploitation or habitat destruction.

# Endemic/Endangered/Extinct /Rare species

- Such a species is still abundant, but under aserious threat of becoming endangered if causal factors are not checked.
- Species which are not endangered or vulnerable at present, but are at a risk are categorized as rare species. These taxa are usually localized within restricted areas i.e. they are usually endemic. Sometimes they are thinly scattered over a more extensive area.

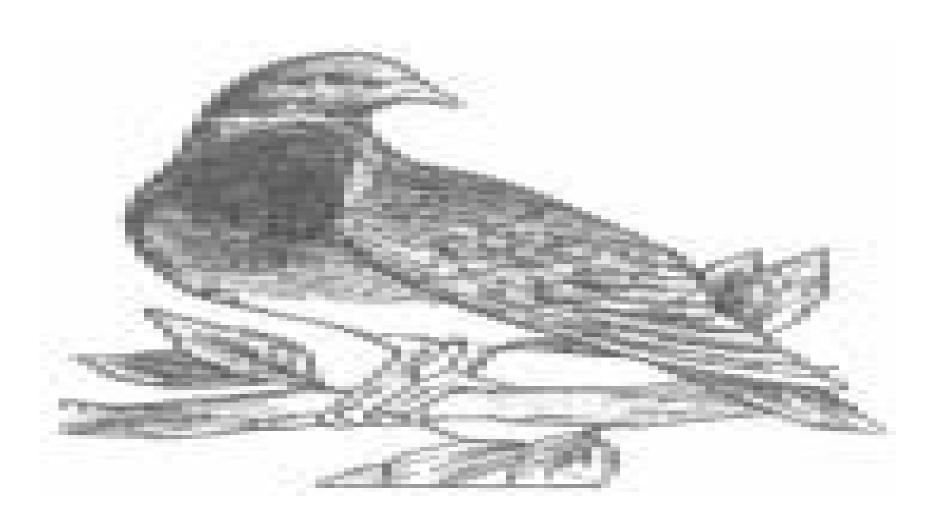
# Endemic/Endangered/Extinct /Rare species

- (C)Carnivorous Mammals: Indian wolf, red fox, Sloth bear, red panda, tiger, leopard, striped hyena, Indian lion, golden cat, desert cat, dugong
- (d)Primates:Hoolock gibbon, lion-tailed macaque,Nilgiri langur, Capped monkey, golden monkey
- (e)Plants: A large number of species of orchids, Rhododendrons, medicinal plants likeRauvolfia serpentina, the sandal wood treeSantalum, Cycas beddonei etc.

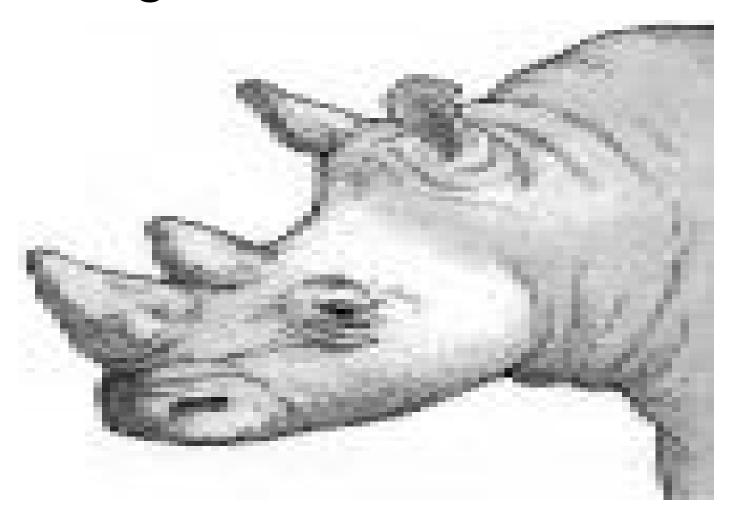
## **Extinct-DODO**



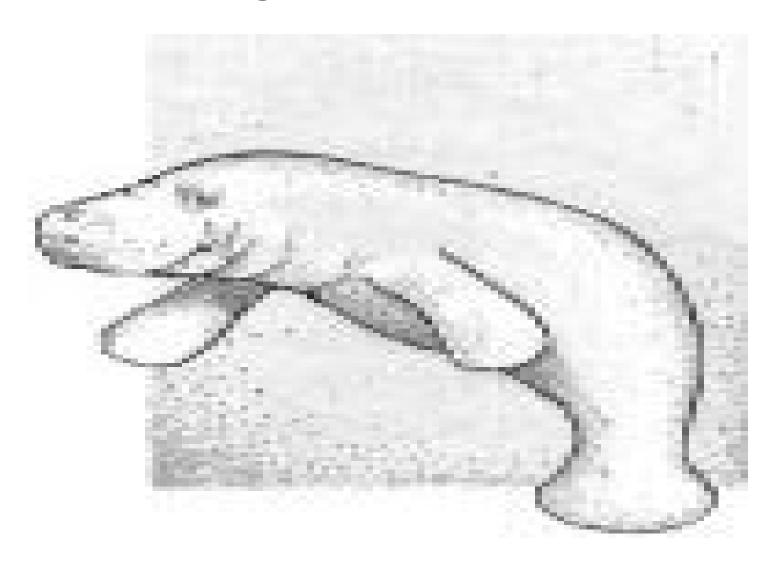
## Passenger Pigeon



## **Endangered-Black Rhino cros**



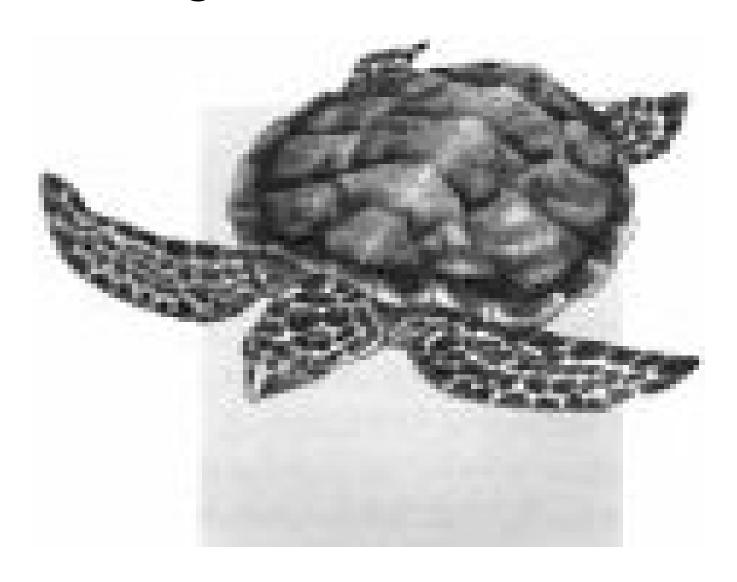
## **Endangered-**DUGONG



## **Endangered-**RED PANDA



## Endangered-Green sea Turtle



## **Endangered**-Tiger



## Endangered-Snow leopard

