

## LEVELS OF BIODIVERSITY

1. Genetic diversity
2. Species diversity- =

$$\frac{\text{POPULATION OF ONE SPECIES}}{\text{TOTAL POPULATION OF ALL SPECIES IN GIVEN BIOME}}$$

3. ecosystem diversity- diff types of habitat

## MEASURE OF BIODIVERSITY

1. Species richness- number of species found in community
  - Alpha- in Particular area/ ecosystem
  - Beta- between ecosystem
  - Gamma- overall diversity of different ecosystems
2. Species evenness- proportion of species at given site (low= few species dominate the site)

## MODES OF CONSERVATION

1. Ex-situ: conservation outside natural habitat (also includes **REINTRODUCTION** of species into habitat from where it has become extinct)
2. In-situ

ZOO- exhibition of captive animals + Also includes circus and rescue centers (But NOT establishment of licensed dealer in captive animals)

## RED DATA BOOK

Categories:

Extinct>>Extinct in wildlife>>Critically Endangered>>Endangered>>Vulnerable>>Near threat>>Least Concern

Criteria:

- Population reduction
- Restricted geographic range
- Small population size and decline

- Very small or restricted population
- Quantitative analysis

CRITERIA	REDUCTION IN POPULATION	POPULATION SIZE	PROBABILITY OF EXTINCTION IN WILD
Critically Endangered	>90% over last 10 year	<50 mature indi	50% in their 10 years
Endangered	>70% over last 10 year	<250 mature indi	20% within 20 years
Vulnerable	>50% over last 10 year	<10,000 mature indi	10% within 100 years

## INDIAN BIODIVERSITY

1. Realms- Large spatial region in which ecosystems share broadly same biota

- Himalayan region- PALEARCTIC realm
- Subcontinent- MALAYAN realm

2. Biomes- main grp of plants and animals living in areas of certain climate patterns

- Tropical Humid Forest
- Tropical Dry or Deciduous Forest
- Warm Desert and semi-desert
- Coniferous forest
- Alpine meadow

3. Bio-geographic Zones-

- Trans Himalayan
- Himalayan
- Desert
- Semi arid
- Western Ghats
- Deccan peninsula
- Gangetic plains
- Coasts (INCLUDES LAKSHADWEEP)
- North east
- Islands

FAUNA AND FLORA DIVERSITY (refer Shankar Page 125-128)

➤ Fauna:

Invertebrates: **MAAPE** (Mollusk, Annelids, Anthropods (CIA), Protozoa, Echinoderms)

Annelids	1. Body divided in segments    2. Well developed internal organs
Mollusk	1. Soft organs covered in hard shell
Echinoderms	1. Arms and spines that radiates from centre
Anthropods	1. Exoskeleton- hard
	Crustaceans- 1. hard, external shell    2. Mostly in water    (e.g.- crab, lobster)
	Insects- 1. 3 body parts, 6 legs and a antennae
	Arachnids- 1. NO antennae    2. 2 body parts and 4 pairs of legs    (e.g.- Spider, scorpions, Ticks, mites)

## DIVERSITY IN HIMALAYAN REGION

Himalayn Foothills	Monsoon evergreen or semi-evergreen forest Sal, silk-cotton trees, giant bamboo, tall grassy meadow
Western Himalaya (high altitude)	Monsoon evergreen or semi-evergreen forest Rhododendrons, dwarf hill bamboo, birch mixed with Alpine pastures
Eastern Himalaya	Oaks, magnolias, laurels, birches; coniferous forest- pine, fir, yew, junipers + undergrowth scrubby rhododendrons and dwarf bamboo; lichens, mosses, orchids and other Epiphytes

## PLANT DIVERSITY

7 essential plant nutrient elements – MICRONUTRIENTS

1. B (boron)
2. Zn (Zinc)
3. Mn (Manganese)
4. Fe (Iron)
5. Cu (Copper)
6. Mo (Molybdenum)
7. Cl (Chlorine)

Effect of intensity of light on plant growth

- High intensity- Root growth, thus short stem
- Low intensity- accumulation of CO<sub>2</sub>
- Red light- Elongation of cells,                      Blue light- short plants

Insectivorous plants- D ANUP (Drosera, Aldrovanda, Nepenthes, Utricularia, Pinguicula)

Drosera	aka Sundew plants	Curding milk, dyeing silk
Aldrovanda-	freefloating, rootless, marshy - only in sunderbans in india	
Nepenthes	pitcher plant'	Cholera patients, eye drops

	- Garo, Khasi, Jantai Hills	
Utricularia	Bladderworts	Cough, wounds, urinary disease
Pinguicula	Butterwort	

### Invasive Species

1	Needle Bush	7	Palmyra, Toddy Palm	13	Black Mimosa
2	Black Wattle (regenerate rapidly after fire)	8	Ipomoea/ pink morning glory	14	Lantana camara, wild sage
3	Goat weed	9	Water Hyacinth	15	Sleeping grass (touch-me not)
4	Alternanthera Paronychioides	10	Calotropis/ Madar, Swallow Wort	16	4 o'clock plant
5	Prickly Poppy	11	Datura, Mad plant, thorn Apple	17	Parthenium/ congress grass
6	Blumea eriantha	12	Impatiens, Balsam	18	Prosopis Juliflora / Mesquite
				19	Townsend grass

NOTE- **Achatina fulica** (African Apple snail)- most invasive species in India>> first found in A&N

### MARINE ORGANISMS

#### Plankton

- Organisms floating on surface waters
- High growth rate, productivity and diversity in **TROPICAL** WATERS (especially Mangrove waters)

#### PHYTOPLANKTON

- Plant organism lives in aquatic envs (salty as well as fresh)
- Produces **60%** of total O<sub>2</sub> produced from all plants
- **ALL** phytoplankton do **PHOTOSYNTHESIS**>> Thus CO<sub>2</sub> from atm to ocean (some also consumes other organisms)
- Major nutrients required- Nitrogen and Phosphorus + IRON
- Highest concentration- **HIGHER LATITUDES** (but **NOT in upwelling** areas)
- Foundation of aquatic food chain
- 'Biological carbon Pump'

#### ZOOPLANKTON

- More abundant in **Mangrove waterways** than coastal waters
- Determines quantum of fish stock

## SEA GRASS

- Marine **flowering plants** (thus well differentiated tissues)>>grow in Shallow waters with sandy or muddy bottoms + calm areas
- Only group of higher plants adopted to life in salt water
- India- S.E.coast of TN, Lakshadweep, A&N
- Widespread in **lagoons**>>>thus high fish and migratory bird popu
- IUCN- High priority status
- Food for DUGONG

## SEAWEED

- No tissue differentiation
- **Attached to rocks, corals**
- **Shallow** coastal waters
- Indicators of POLLUTION (particularly HEAVY METAL POLLUTION)

## PROTECTED AREA NETWORK

1. Wildlife Sanctuary- WPA, 1972>>> by STATE govt if area of ecological, geomorphological and natural significance (Central govt also BUT under certain condition)

State govt is assisted by **State Board for Wild Life** for selection of Protected area

WILDLIFE SANCTUARY	NATIONAL PARK
	Greater degree of protection
Grazing allowed	Grazing prohibited
Can be for PARTICULAR SPECIES	NOT focused on peculiar species

National Parks	Wildlife Sanctuaries	Biosphere Reserves
It is associated with the habitat of <b>wild animal</b> species like rhino, tiger, lion, etc.	It is <b>species oriented</b> as pitcher plant, Great Indian Bustard.	It takes into consideration the <b>entire ecosystem</b> .
Its boundaries are marked by <b>legislation</b> .	Its boundaries are not sacrosanct.	Boundaries of its <b>core area</b> are marked by <b>legislation</b> .
Disturbance only limited to the buffer zone.	Limited disturbance.	Disturbance only limited to the buffer zone.
Tourism is allowed.	Tourism is allowed.	Tourism is generally <b>not</b> allowed.
Scientific management is <b>lacking</b> .	Scientific management is <b>lacking</b> .	Scientifically management.
No attention is paid to gene pool conservation.	No attention is paid to gene pool conservation.	

2. National Park-

- Boundaries: by **state** govt in consult and approval of **NBWL**

- Alteration of boundaries- Resolution passed by Legislature (No need of Act)  
(alteration requires recomm by National Board for Wild Life (NBWL))

3. Conservation and Community reserves- under **Wildlife Protection Act, 1972** (amend in 2003) (**Not** Environment Protection Act)

- Conservation reserves- IUCN Category **V**
  1. Act as Buffer zones to or connectors and migration corridors between NP, WS>> **COMPLETELY Uninhabited** and **owned by Govt only**
  2. by **state govt** via consulting **local community**
  3. Tiruppadaimarathur (TN)- 1<sup>st</sup> CS
  4. Considered **at par** with Pas like National Parks and Wildlife sanctuaries
  5. NOTE- Northeast- **NO conservation reserves**  
**Jammu and Kashmir- Highest** no. of CRs
- Community reserves- IUCN Category **VI**
  1. on any community or Private land with consent of members of community
  2. **Keshopur chamb, Gurdaspur (PN)- 1<sup>st</sup> Community reserve**
  3. Highest: **Meghalaya (41)>>> Punjab(2)>> KR(1) and Kerala (1)**

## GLOBAL INITIATIVES

### 1. MAN AND BIOSPHERE (MAB)

- By UNESCO in 1972
- **Intergovernmental** scientific programme
- World Network on Biosphere Reserves (WNBR of UNESCO)- highest no. of biosphere>>Europe and N. America>>Asai and pacific>>Latin ame>>Africa>>arab

#### Biosphere Reserve

- Representative part of terrestrial or coastal/marine ecosystem or combo of both
- Declared by **State OR Central**
- **Dept of Envi**- Nodal agency for BR programme
- Management of BR- responsibility of STATE financial assistance- CENTRE
- Indian Biosphere reserves- Protection not only to flora and fauna, but also to human communities who inhabit these region and their ways of life
- Criterias for selection of BRs
  1. Primary criteria- Effectively protected and minimally disturbed core area
  2. Core area: typical of biogeographical unit and large enough to sustain viable popu representing all trophic levels
  3. involvement of local community
  4. Areas potential to preserve traditional tribal or rural modes of living
- Existing protected area may become part of BR **WITHOUT** change in its legal status

- Indian National Man and Biosphere Committee (**INMBC**)- new sites, advice on policy and program, guidelines
- Parts:
  1. CORE- only **scientific research** of exceptional value allowed
  2. BUFFER ZONE- **Human settlements can continue**, limited recreation, tourism, fishing, grazing
  3. TRANSITION- **Zone of Coop**- settlements, Crop lands, managed forests, intensive recreation

Biodiversity Hotspot:

Two criteria

1. Species **endemism**- **1,500** species of vascular PLANTS (>**0.5%** of world's total) as endemic
  2. Degree of **threat**- lost **70%** of original habitat
- Indian- 1. Himalaya 2. Indo-Burma 3. W.ghat 4. Sundaland

Hottest hotspot- 5 criteria: Endemic- plants, Vertebrates, plants/area ratio, vertebrate/area, primary vegetation as % of original extent

8 hottest hotspot: MP BCE SIW (Madagascar, Philippines, Brazil atlantic coast, Caribbean, Eastern arc and coastal forest of Tanzania/Kenya, Sundaland, Indo-burma, W.ghat)

Biodiversity Coldspots

- Low bio-diversity but high rate of habitat loss

CONSERVATION EFFORTS

1. Project Tiger

- 1973 in Jim Corbett
  - Aim- protection of tigers + harmonizing rights of tribal living around TR
  - **Tiger protection force**- to combat poachers
  - 2018 tiger census- **MP-highest** **Tiger Reserve: Pench (MP)**
  - 2018- census with tech like M-STripes
  - 2018 census: designed by **WII**
  - Project administered by- **NTCA**
  - **Tiger reserve**- **Notified by STATE** govt on recomm of NTCA  
Alteration in boundary + Denotification of TR-**On recom of NTCA** + approval of NBWL
- A. Core zone- by STATE in consultation with expert committee + not to violate ST's rights
- B. Buffer zone- consult Gram Sabha and Expert Committee

## PROJECT ELEPHANT

- 1992
- Also implementing MIKE (Monitoring of Illegal Killing of Elephants) programme of **CITES**

Hathi Mere Saathi- by MoEFCC + WTI

- Launched at E-8 ministerial meeting

NOTE- Elephant= India's National Heritage Animal

## INDIA RHINO VISION 2020

- By dept of envi & forest(Assam) + Bodo autonomous council + WWF India + Indian Rhino Foundation (IRF)
- Aim- popu from 2000>>>3000 by 2020 , distri of this popu over 7 PAs of Assam (translocation of rhinos e.g. from Kaziranga and Pabitora>>>Manas, dibru, Laokhowa-Bura chapori WLS)

## PROJECT SNOW LEOPARD

- In J&K, HP, UK, Sikkim, Arunachal

## SEA TURTLE PROJECT

- 1999
- In collaboration with UNDP
- Implementing agency- Wildlife Insti of India (**WII**)

## DOLPHIN CONSERVATION PROGRAMME

- **WWF-India:** Ganga Mohotsav as part of LIVING GANGA PROGRAMME

## CHEETAH REINTRODUCTION

- Possible site- 1. Kuno-Palpur WS (MP) 2.Nauradehi WS (MP) 3.Narayan Sarovar WS- Kuchh

## EXTINCT ANIMALS IN INDIA

1. Pink headed duck
2. Indian cheetah
3. Sunderban dwarf rhinoceros
4. Indian auroch



5. Gigantopithecus
6. Sivatherium
7. Bharatherium

#### Important Bird Areas (IBA)

- By **BirdLife International**
- Criteria: Globally threatened species, Restricted range species, Biome restricted species,

#### Important Coastal and Marine Biodiversity Areas (ICMBA)

- Identified by **WII**
- **Only in Coastal States** (**No UT** have any ICMBA)
- Total 106

#### Key Biodiversity Areas (KBA)

- By **IUCN**
- On basis of 5 broad categories: threatned biodiversity, geographically restricted biodiversity, ecological integrity, biological process, irreplaceability

#### Monitoring of Illegal Killing of Elephants (**MIKE**)

- By **CITES** in 10<sup>th</sup> COP in 1997
- Currently **28 sites** over **13 countries**
  - India-10 sites (**Highest**)
  - 2 Sites: Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar and Thailand,
  - 1 Sites: Bangladesh, Bhutan, China, Nepal, Sri Lanka and Viet Nam.
- Indian Sites:

Arunachal	Deomali
Assam	Chirang Ripu, Dhang Patki
Meghalaya	Garo hills
WB	Eastern Dooars
Orissa	Mayurbhanj
Tamil Nadu	Nilgiri
Kerala	Wayanand
Karnataka	Mysore
Uttarakhand	Shivalik