Biodiversity

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- The term biodiversity was first coined by Walter and Rosen in 1985

- BIODIVERSITY originates from the Greek word **BIOS = LIFE** and Latin word **DIVERSITAS = VARIETY** or **DIFFERENCE.** • The whole word **BIO DIVERSITY** generally therefore means: **VARIETY OF LIFE**

- Biodiversity refers to the variety of living species on Earth, including plants, animals, bacteria, and fungi.

- Organisms that have evolved to be so different from one another that they can no longer reproduce with each other are considered different **species**. All organisms that can reproduce with each other fall into one species.

Biodiversity

- While Earth's biodiversity is so rich that many species have yet to be discovered, many species are being threatened with extinction due to human activities, putting the Earth's magnificent biodiversity at risk.
- Without biodiversity, there is no future for humanity."

- It can be used more specifically to refer to all of the species in one region or ecosystem.
- Scientists have estimated that there are around **8.7 million** species of plants and animals in existence.
- only around **1.2 million** species have been identified and described so far, most of which are insects.
- millions of other organisms remain a complete mystery.

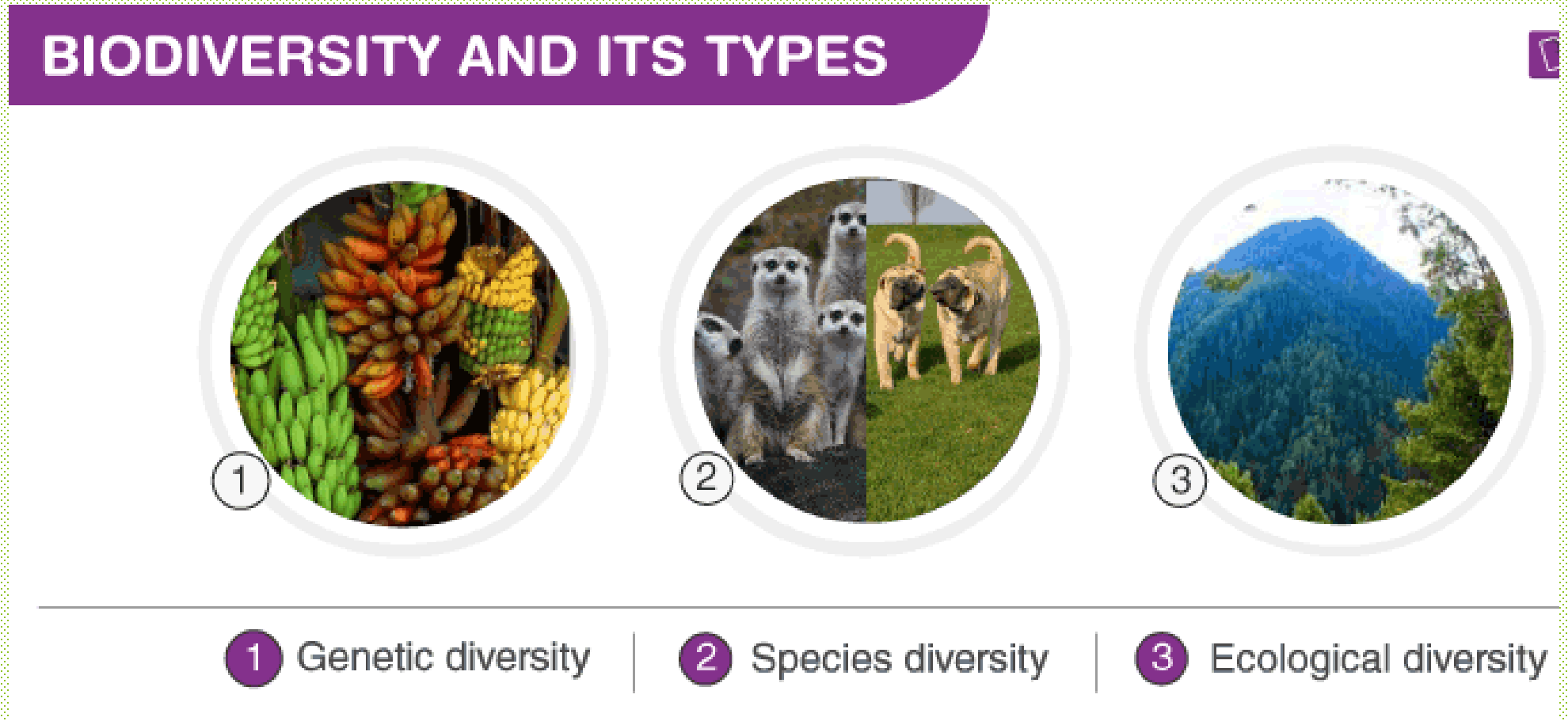
- Biodiversity Hotspots

Mexico, South Africa, Brazil, the southwestern United States, and Madagascar, have more biodiversity than others. Areas with extremely high levels of biodiversity are called hotspots.

- **Endemic species** (native to a specific geographic space.)—species that are only found in one particular location—are also found in hotspots.

Levels of Diversity

1. Species diversity
2. Genetic diversity
3. Ecosystem or Habitat diversity



1. Species diversity (different kinds of organisms, relationships among species) –

- Species diversity refers to the variety of different types of species found in a particular area. It is the biodiversity at the most basic level. It includes all the species ranging from plants to different microorganisms.
- No two individuals of the same species are exactly similar. For example, humans show a lot of diversity among themselves.

2. Genetic diversity- (different genes & combinations of genes within populations)-

- It is a level of biodiversity that refers to the total number of genetic characteristics in the genetic makeup of a species.
- It is distinguished from genetic variability, which describes the tendency of genetic characteristics to vary.
- It refers to the variations among the genetic resources of the organisms. Every individual of a particular species differs from each other in their genetic constitution.
- That is why every human looks different from each other. Similarly, there are different varieties in the same species of rice, wheat, maize, barley, etc.

3. Ecosystem or Habitat diversity- (different habitats, niches, species interactions)-

Ecosystem diversity refers to the diversity of a place at the level of ecosystems. This has 3 perspectives:

1. **Alpha Diversity**: Within community diversity. Alpha diversity refers to the diversity of organisms sharing the same Community / Habitat.

2. **Beta Diversity**: Between community diversity. It refers to the diversity of organisms sharing two habitat.

3. **Gamma Diversity**: Diversity of the habitat over the total landscape or geographical area is called gamma diversity

Ecosystem or Habitat diversity-

- An ecosystem is a collection of living and non-living organisms and their interaction with each other.
- Ecological biodiversity refers to the variations in the plant and animal species living together and connected by food chains and food webs.
- It is the diversity observed among the different ecosystems in a region. Diversity in different ecosystems like deserts, rainforests, mangroves, etc., include ecological diversity.

Classification of Dravya

According to origin/ Yonibhed

A. Audbhida-drugs derived from plant origin

Vanaspati- in which we don't see flowers, direct fruits can be seen Eg- Vata, Audumbar etc

Vanaspatya- fruits appears after flowering. Eg- aamra, Jambu, Bilva, Kapittha

Oshadhi- which get destroyed after maturation , after fruiting Eg- Godhum, Durva, Yava

Virudh- climbers, twinners, Shrubs Eg- Prasarini, Guduchi

B. Jangam

Jarayuja- Human, Cow

Andaja- Birds, Snakes, Fish

Swedaj- Worms, Insects, Ants

Udbhija- Frog

C. Parthiva

Murcury

Gold

Mica

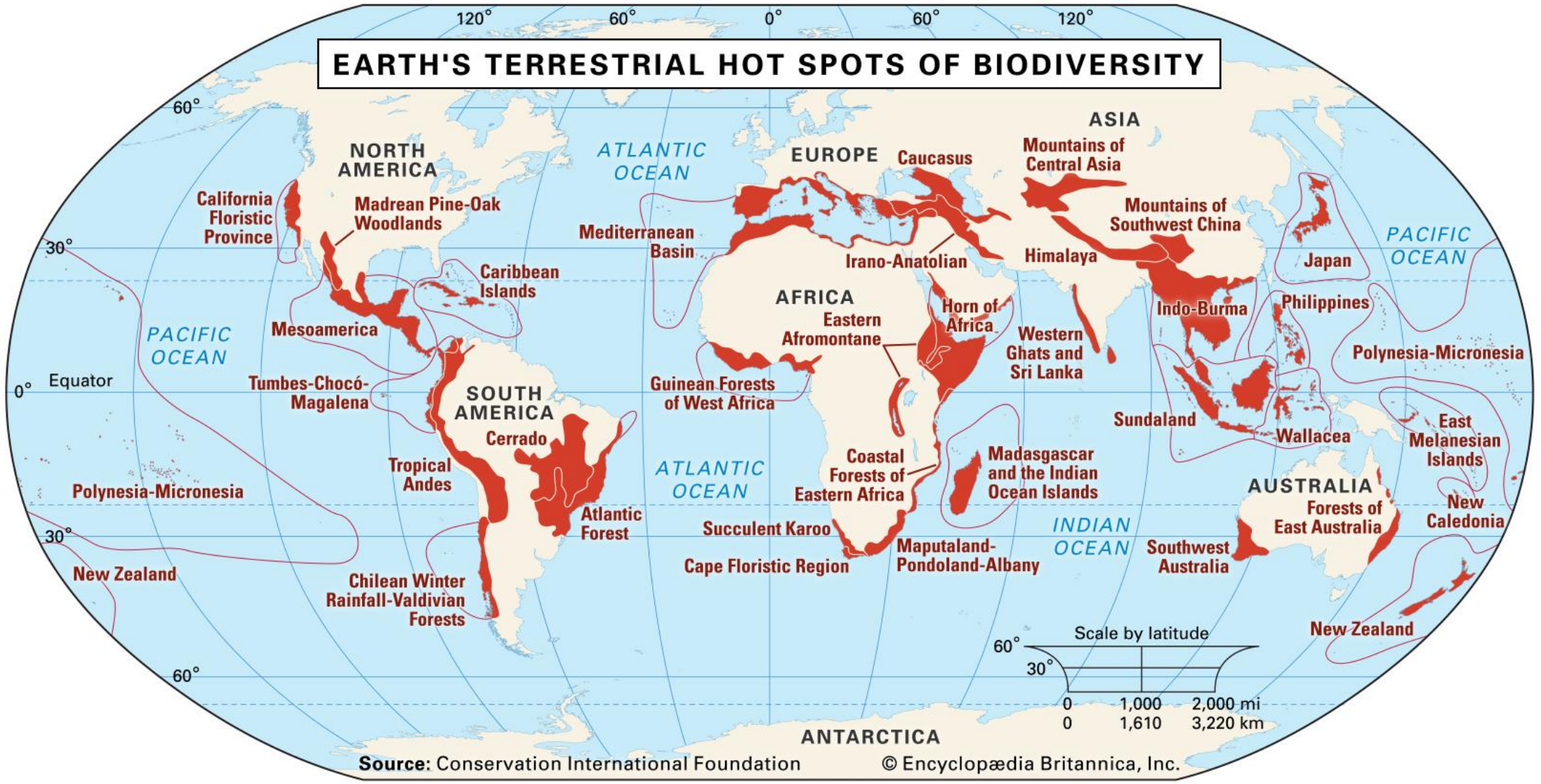
Silver

Hot spots of biodiversity

- There are **25** such **hotspots of biodiversity** on a global level, out of which two are present in India.
  1. Indo-Burma (earlier The Eastern Himalayas)
  2. The western Ghats & SriLanka.

- Eastern Himalayas is recognized as the "Cradle (place of origin)of Speciation" due to rich diversity of primitive flowering plants.

Earth's terrestrial Hot spots of Biodiversity



Biodiversity in India

- India is one of the most diverse nations in the world. It ranks ninth in terms of plant species richness.
- It is the origin of important crop species such as pigeon pea, eggplant, cucumber, cotton and sesame. India is also a centre of various domesticated species such as millets, cereals, legumes, vegetables, medicinal and aromatic crops, etc.
- India is equally diverse in its faunal wealth. There are about 91000 animal species found here.

Criteria for determining hot-spots

- No. of Endemic Species i.e. the species which are found no where else.
- Degree of threat, which is measured in terms of Habitat loss.

Biodiversity in and around India

- **Indo-Burma (Eastern Himalayas) Hotspot**:

Cambodia, Vietnam & Laos, Thailand, Myanmar

Bhutan Nepal, eastern India southern China.

In addition, it covers several off shore Island including south China Sea and Andaman & Nicobar Islands

Indo Burma is one of the most threatened biodiversity hotspots, due to the rate of resource exploitation and habitat loss.

Western Ghats and Sri Lanka:, also known as the "Sahyadri Hills" encompasses the montane forests in the south western parts of India and on the neighboring Islands of SriLanka.

The entire extent of hotspot was originally about 1,82,500 square kms, but due to tremendous population pressure, now only 12,445 square Km or 6.8% is in pristine condition. ▫ The important populations include Asian elephant, Indian tigers and the endangered lion tailed macaque.

Importance of Biodiversity

- Ecosystems with a lot of biodiversity are generally stronger and more resistant to disaster than those with fewer species.
- All species are interconnected. They depend on one another.

Imp. Of Biodiversity

- Forests provide homes for animals.
- Animals eat plants.
- The plants need healthy soil to grow.
- Fungi help decompose organisms to fertilize the soil.
- Bees and other insects carry pollen from one plant to another, which enables the plants to reproduce.
- With less biodiversity, these connections weaken and sometimes break, harming all the species in the ecosystem.

Imp. Of Biodiversity

- Biodiversity is important to people in many ways.
- Plants, for instance, help humans by giving off oxygen.
- They also provide food, shade, construction material, medicines, and fiber for clothing and paper.
- The root system of plants helps prevent flooding.

Imp. Of Biodiversity

- Hundreds of industries rely on plant biodiversity. Agriculture, construction, medical and pharmaceutical, fashion, tourism, and hospitality all depend on plants for their success.

- When the biodiversity of an ecosystem is interrupted or destroyed, the economic impact on the local community could be enormous.

Imp. Of Biodiversity

- Biodiversity is especially important to the medical and pharmaceutical industries. Scientists have discovered many chemicals in rain forest plants that are now used in helpful drugs. One of the most popular and safe pain relievers, aspirin, was originally made from the bark of willow trees.
- Greater genetic diversity in species can make plants and animals more resistant to diseases. Genetic diversity also allows species to better adapt to a changing environment.

Imp. Of Biodiversity

- The pores and cracks found in between soil particles act as natural filters purifying water as it drips through the forest ecosystem.
- This not only helps in protection and conservation fertile topsoil, but also maintains ground water.
- Plants absorb water from soil or water reservoirs and add it to the air as vapor by transpiration.
- Animal and plants also lose water in vapor form by respiration. Water vapor formed by transpiration and respiration form clouds and enter global water cycle (hydrological cycle).

Imp. Of Biodiversity

- Soil microbes (decomposers) and soil animals like earthworms help in efficient breakdown of organic matter into inorganic nutrients, thus enriching the soil fertility.
- Biodiversity plays in helping people recover from illness, it also makes a significant contribution in preventing disease and illness, since well-functioning ecosystems can help protect human health.

Imp. Of Biodiversity

- It is known that the poor suffer most from scarce or polluted water and air, and from diseases associated with disrupted ecosystems.
- One critically important service is the role ecosystems play in controlling the emergence and spread of infectious diseases by maintaining equilibria among predators and prey, and among hosts, vectors and parasites in plants, animals and humans.

Causes of a change in biodiversity

- Drivers are natural or human-induced factors that directly or indirectly cause a change in biodiversity
- Direct drivers that explicitly influence ecosystem processes include land use change, climate change invasive species, over exploitation and pollution
- Indirect drivers such as changes in human population incomes or life style operate more diffusely by altering one or more direct drivers

Causes of a change in biodiversity

- Drivers affecting biodiversity range from local to global and from immediate to long term .
- Changes in biodiversity are driven by combinations of drivers that work overtime, on different scales, and that tend to amplify each other.
- For example, population and income growth combined with technological advances, can lead to climate change

Causes of a change in biodiversity

The most important direct drivers of change in different ecosystems are

- In terrestrial ecosystem: Land cover change, mainly by conversion to crop land.
- Only areas unsuited to crop plants such as deserts, boreal forests and tundra, remain relatively intact.

Specific direct drivers

1. **HABITAT DESTRUCTION/ LOSS**

- it is the primary reason for loss of biodiversity and results from the increase of human population and human activities.
- it occurs in mostly on islands.
- Habitat is lost by cutting down trees, filling wetlands, ploughing grasslands, burning forests, cattle ranching, plantation, dam construction

1. HABITAT DESTRUCTION/LOSS

- In marine ecosystem: Fishing is the major direct human pressure affecting the structure, function and biodiversity of the oceans.

- In fresh water ecosystem: Water regime changes, such as those following the construction of large dams; invasive species, which can lead to species extinction and pollution ,such as high levels of nutrients

2. HABITAT DEGRADATION AND POLLUTION –

- Weakening of habitat by physical or chemical change.
- Man made disturbance differ from natural disturbances in intensity, rate and spatial extent .
- Environmental pollution in the form of industrial chemicals, emissions, pesticides, sediment deposits etc. changes habitat quality.
- pollution may reduce and eliminate populations of sensitive species.
- Global climate change—the latest rise in the average temperature around the globe, linked to human activity—is also a factor. Warmer ocean temperatures damage fragile ecosystems such as coral reefs. A single coral reef can shelter 3,000 species of fish and other sea creatures such as clams and sea stars.

3. INVASIVE ALIEN SPECIES / EXOTIC SPECIES –

- They rank second as a major cause of biodiversity loss.
- Exotic/Alien species are the new species entering a geographical range.
- Chief factors responsible for their introduction are: European colonization, horticulture and agriculture and accidental transport.
- They may be natural chance immigrants, escaped ornamentals or escaped domestic animals.
- They may cause of disappearance of native species through changed biotic interactions as they have no natural predators

4. OVER EXPLOITATION-

- It remains a serious threat to many species, such as marine fish and invertebrates, trees, and animals hunted for meat.
- Over exploitation results in either complete extinction of the species or reduction in the population size beyond critical density.
- Most industrial fisheries are either fully or over exploited, while destructive fishing technique harm estuaries and wet lands.
- The overexploitation of bush meat is in a similar situation, where sustainable levels of exploitation are poorly understood, and the catches difficult to manage effectively

5. GLOBAL CLIMATE CHANGE –

- Global warming, depletion of ozone layer and acid rain are responsible for the loss of biodiversity across the globe.
- They have affected species distributions, population sizes and the timing of reproduction or migration events, as well as the frequency of pest and disease outbreaks.
- Projected changes in climate by 2050 could lead to the extinction of many species living in certain limited geographical regions.
- By the end of the century, climate change and its impacts may become the main direct driver of overall biodiversity loss

6. CHANGE IN ECONOMIC ACTIVITY –

- Global economic activity is now nearly seven times what it was 50 years ago and it is expected to grow further.
- The many processes of globalization have been removing regional barriers, weakening national connections, and increasing the interdependence among people and between nations

7. POPULATION CHANGE-

- World population has doubled in the past forty years, reaching 7.9 billion in 2021.
- The fact that more and more people live in cities increases the demand for food and energy and thereby pressure on ecosystems

8. CULTURAL AND RELIGIOUS FACTORS

- Culture conditions individuals perceptions' of the world, and their priority setting, for instance in terms of conservation

9. SCIENCE AND TECHONOLOGY –

- The development and diffusion of scientific knowledge and technologies can on the one hand allow for increased efficiency in resource use and on the other hand provide the means to increase exploitation of natural resources

Story of taxol and the Pacific yew

- Biodiversity loss diminishes the supplies of raw materials for drug discovery and biotechnology, causes a loss of medical models, affects the spread of human diseases, and threatens food production and water quality
- The story of taxol and the Pacific yew illustrates how we may be losing new medicines before species have been analyzed for their chemical content.

- Although the wood of Pacific yew has been used for furniture and handicrafts, for many years this species was considered an impediment to the harvest of larger timber trees. Therefore, many stands were indiscriminately cut down.
- More recently an extract of the bark of this species was found to yield a compound Taxol that is a potent drug for the treatment of certain types of cancer.
- Unfortunately, the plants grow slowly and must be some 100 years old before the bark is harvestable. This has led to the destruction of more wild populations but also to a search for related species of the genus *Taxus* that might contain taxol.

Coral reefs

- As coral reefs are increasingly threatened in many parts of the world , the existence of reef-dwelling organisms such as cone snails is similarly threatened.
- peptide compounds in the venom of cone snails, a genus of predatory snails numbering about 500 species that inhabit tropical coral reefs.
- Some of these peptide compounds are used for the prevention of nerve cell death following coronary artery bypass surgery, head injury and stroke, and for the treatment of chronic, intractable pain associated with cancer, AIDS and peripheral neuropathies

RED DATA BOOK

- The list of threatened animals have been listed in a book called “RED DATA BOOK” RDB.
- RDB was first formulated by Sir Peter Scott.
- The major threatened categories under IUCN are **Extinct (Ex), Endangered (En), Vulnerable (VU), Rare (R) & Interminate species.**

What is The IUCN Red List?

- Established in 1964, **The International Union for Conservation of Nature's Red List of Threatened Species** has evolved to become the world's most comprehensive information source on the global conservation status of animal, fungi and plant species.
- The IUCN Red List is a critical indicator of the health of the world's biodiversity. Far more than a list of species and their status, it is a powerful tool to inform and catalyze action for biodiversity conservation and policy change, critical to protecting the natural resources we need to survive. It provides information about range, population size, habitat and ecology, use and/or trade, threats, and conservation actions that will help inform necessary conservation decisions.

IUCN Red List of Threatened Spe

iucnredlist.org

More than 37,400 species are threatened with extinction

That is still 28% of all assessed species.

AMPHIBIANS	MAMMALS	CONIFERS	BIRDS	SHARKS & RAYS	REEF CORALS
41%	26%	34%	14%	36%	33%

SELECTED CRUSTACEANS
28%

feedback

Take action

Help us make The IUCN Red List a more complete barometer of life.

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RARE SPECIES/ VULNERABLE/ ENDANGERED/ CRITICALLY ENDANGERED/ EXTINCT

- **RARE SPECIES**: Species with small population restricted geographically with localized habitats. They are not in immediate danger of extinction e.g.

  Saraca indica (**Asoka**)

- **VULNERABLE:** Species are under threat of or actually declining in number.

  Aegle marmelos (**Bilwa**)

  Baliospermum montanum (**Danti**)

- **ENDANGERED:** Species with low population number that are in considerable danger of becoming extinct

  e.g. Bacopa monnieri (**Brahm**i)

- **CRITICALLY ENDANGERED:** when a species is facing an extremely high risk of extinction in wild in the immediate future e.g.

  Inula racemosa (**Puskaramoolam**)

- **EXTINCT**: Species which cannot be found in areas where they recently been inhabited e.g. Drosera indica,

  Aerva wightii (**Pashanbhed**)

  Asparagus rottleri

  Madhuca insignis

Critically endangered animal species of India

- 1. Jenkin's, Andaman & Nicobar shrew (Crocidura jenkensii, C. andamanensis, C. nicobarica)
- 2. Salim Ali's fruit bat (Latidens salimali)
- 3. Wroughton's free-tailed bat (Otomops wroughtoni)
- 4. Leaf-nosed bat (Hipposideros hypophyyllus)
- 5. Lion tailed macaque (Macaca silenus)
- 6. Andaman, Kerala, Palm rat (Rattus stoicus, R.ranjiniae, R.palmarum)
- 7. Kondana soft furred rat (Millardia kondana)
- 8. Nilgiri leaf monkey (Trachypithecus johnii)
- 9. Namdapha flying squirrel (Biswamayopterus biswasi)
- 10. Indian flying squirrel (Ratufa indica)
- 11. Nilgiri tahr (Hemitragus hylocrius)

Important medicinal plants regarding conservation status

- **Medicinal Plants of Himalayas**
- Aconitum ferox (**Vatsnabha**)- Part used : Roots ▫ Uses: Antidote for poison, it relieves body pain and used as ailment for Asthma and diabetes.
- Eupatorium cannabinum -Part used: Flowers ▫ Uses: Diuretic, remedy for purifying blood, juice used to stop bleeding.
- Aconitum heterophyllum (**Ativisha**) -Part used: Underground stem and root ▫ Uses: Antipyretic, anti inflammatory, treatment of piles, vomiting etc
- Rhododendron anthopogon (**Talispatra**)- Part used: Leaves ▫ Uses: Its oil is used in treating cold, obesity , flu and gout.
- Picrorhiza kurrooa (**Katuki**) Roots are used in stomach pain, fever and dyspepsia

- **Medicinal Plants of Deserts**
- Cressa cretica (**Rudravanti/Rudanti**)-Part used: Leaves and Flowers

Uses: Used to treat Asthma, leprosy and also tuberculosis.

- Convolvulus microphyllus (**Shankhapushpi**)-Part used: Leaves

Uses: It is used to reduce cholestrol ,it is also psycho stimulant and to reduce stress.

- Tecomella undulata (**Rohitaka**) - Part used: Bark and seed .

Uses: Blood purifier, used to treat diseases of liver, internal tumours.

- **Medicinal Plants of Deccan Plateaue**
- Rawolfia serpentina (**Sarpaganda)** -Part Used:Roots -Uses: Used to treat snake bites, mental disorders. ▫ Reserpine is extracted from them
- Celastrus paniculatus (**Jyotishmati**)- Parts used: Seeds • Uses: Seed oil is used as tonic for memory loss, used to treat neuro degenerative diseases.
- **Medicinal Plants of Western Ghats**
- Garcinia indica (**Amlavetas**)-Parts used: Fruit • Uses: They contain rich amount of anti- oxidants, treated for fever and also for skin diseases
- Embelia ribes (**Vidanga)** - Parts used: Seeds • Uses: To treat cardiac disease, skin diseases, obesity etc.
- Myristica malabarica (**Ramjathi/ Bandhukpushpa**)- Part used: Bark, seed. • Uses: To treat Ulcers, gangrene, Rheumatism.

- **Medicinal Plants of Coastal Region**
- Acanthus ilicifolius (**Mangrove- Aartagala**)- Parts used: Roots, leaves.

Uses: Treat Asthma and Rheumatism, Skin diseases.

- Avicennia marina –(**Mangrove) -**Part used: Bark.

Uses: Treatment of Scabies ▫ They have Anti- bacterial, Anti- microbial Properties.

- Rhizophora mucronata –(**Mangrove)** -Part used: Leaves, Bark.

Uses: Treatment of Diabetes, Dysentry. ▫ Also used to

Ways to Protect and Conserve Biodiversity

- Government legislation.
- Nature preserves.
- Reducing invasive species.
- Habitat restoration.
- Captive breeding and seed banks.
- Research.
- Reduce climate change.
- Purchase sustainable products.

Conservation and Development measures

- Govt. of India vide its notification No. Z. 18020/19/97- MP Cell dated 24.11.2000 created NMPB, New Delhi for the Development of this sector.
- **There are two schemes namely**
- **Promotional and Contractual farming** are under implementation.
- Under the Promotional Schemes Govt. institutions are involved for the conservation of Medicinal Plants and Projects are sanctioned in the limit of Rs. 30.00 lacs.
- Under the Contractual Farming Scheme of Medicinal Plants, 30% subsidy in the upper limit of Rs. 09.00 lacs is provided. • The Guggul Plantation is kachchh and saurashtra and Asoka Plantation is south Gujarat, Dapoli Maharashtra is being taken up on large scale.

How biodiversity conservation is taken care of in India

- Religious and traditional beliefs, cultural mores, and practices play a crucial role in the conservation of environment and biodiversity.
- Conservation of nature and natural resources has been an important part of cultural ethos, especially in remote rural and indigenous communities in many parts of the world, including India.
- These communities consider themselves connected with their biophysical environment in a web of spiritual relationship. These rural communities consider specific plants, animals, or even rivers and mountains as their ancestors and protect them.

- In India, nature worship dates back to the pre-Vedic period (5000 B.C.) and is based on the proposition that all creations of nature have to be protected.
- The forefathers of these communities were fully aware of the importance and significance of natural resources and the necessity of their conservation for the sustenance of future generations.
- They lived in harmony with nature and thereby played an important role in conservation of biodiversity

Sacred species

- Traditionally conserved plant and animal species of religious and cultural importance are called sacred species. Ex: Plants like Tulasi, Neem, Ashoka tree and Pipal tree. Animals like Cow, Monkey and Cobra etc.

DEVRAI

- One of the important traditions of nature reverence is to conserve those patches of forest that have been dedicated to a god or goddess or ancestral spirits as *"sacred groves."*
- SGs are the relic forest segments preserved in the name of religion and culture. These groves are mostly associated with temples and are also culturally important. They manifest the spiritual and ecological ethos of rural indigenous communities.
- Around 100000 to 150000 sacred groves have been reported from India

Sacred grooves

- SGs are especially present in the Himalayan region, Western and Eastern Ghats, Coastal Region, Central Indian Plateau, and Western Desert.
- The SGs play an important role in ensuring smooth ecosystem services such as clean environment, that is, air, soil, and water conservation, flora and fauna conservation, carbon sequestration, temperature control, and conservation of traditional knowledge.
- Sacred groves serve as a home for birds and mammals, and hence they indirectly help in the conservation of biodiversity

Banned for export

- The ministry of environment and forests has, notified 29 species which are banned for export and the list contains some popularly used drugs in Ayurvedic formulations like
- ***Sarpagandha*** (*Rauwolfia serpentina* Kurz),
- ***Raktachandana*** (*Pterocarpus santalinus* L.f.),
- ***Aguru*** (*Aquilaria agallocha* Roxb.),
- ***Katuki*** (*Picrorhhiza kurroa* Royle ex Benth.),
- ***Trayamana*** (*Gentiana kurroo* Royle),
- ***Kiratatikta*** (*Swertia chirata* [Roxb. ex Fleming] H. Karst.),
- ***Jatamansi*** (*Nordostachys grandiflora* DC.),
- ***Ativisha*** (*Aconitum heterophyllum* Wall.),
- ***Vatsanabha*** (*Aconitum* species) etc.

Asthavarga

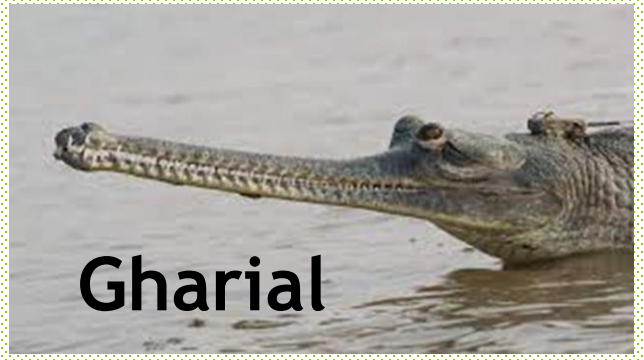
Sr. no	Ashtavarga Dravya	Substitute
1	Kakoli	Ashwagandha
2	Kshirkakoli	Ashwagandha
3	Jivaka	Vidārikanda
4	Rushabhak	Vidārikanda
5	Meda	Shatavari
6	Mahameda	Shatavari
7	Riddhi	Varahikanda
8	Vruddhi	Varahikanda


Indian Pea Fowl


Indian Salamander


Black Necked Crane


White Winged Wood Duck


Gharial


Indian Wolf


Golden monkey


Niligiri Langur


Red Fox


Himalayan Brown Bear

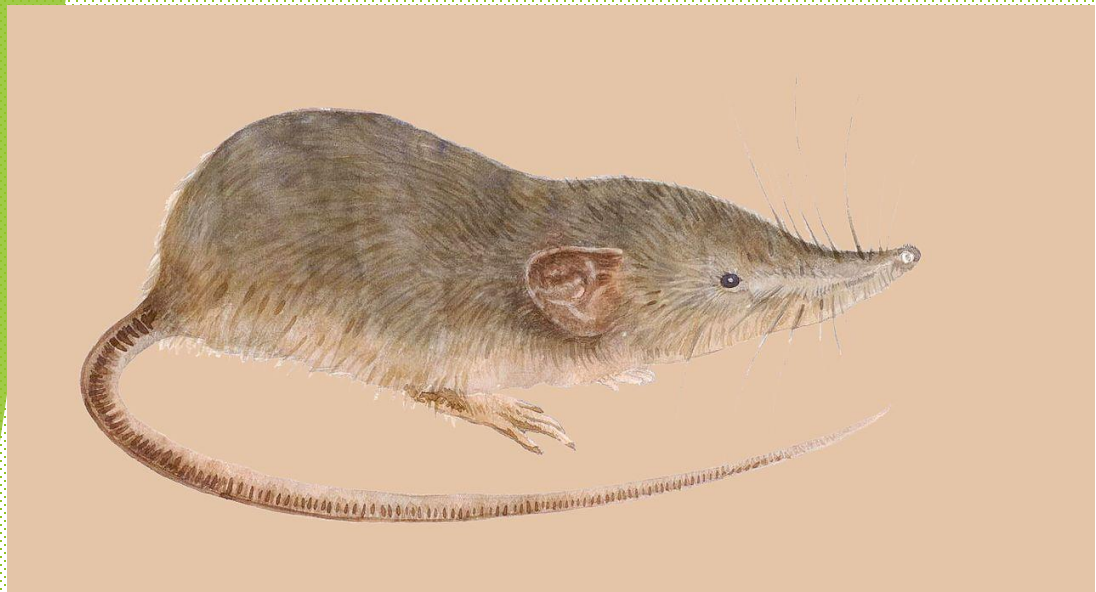

Great Indian One Horned Rhinoceros


Indian egg eating Snake

Conclusion

- Biodiversity is our life.
- If the Biodiversity got lost at this rate then in near future, the survival of human being will be threatened.
- So, it is our moral duty to conserve Biodiversity as well our Environment.
- Long-term maintenance of species and their management requires co-operative efforts across entire landscapes.
- Biodiversity should be dealt with at scale of habitats or ecosystems rather than at species level.

Jenkin’s, Andaman & Nicobar shrew



Salim Ali’s fruit bat

© Sreehari Raman

Salim Ali’s Fruit Bat

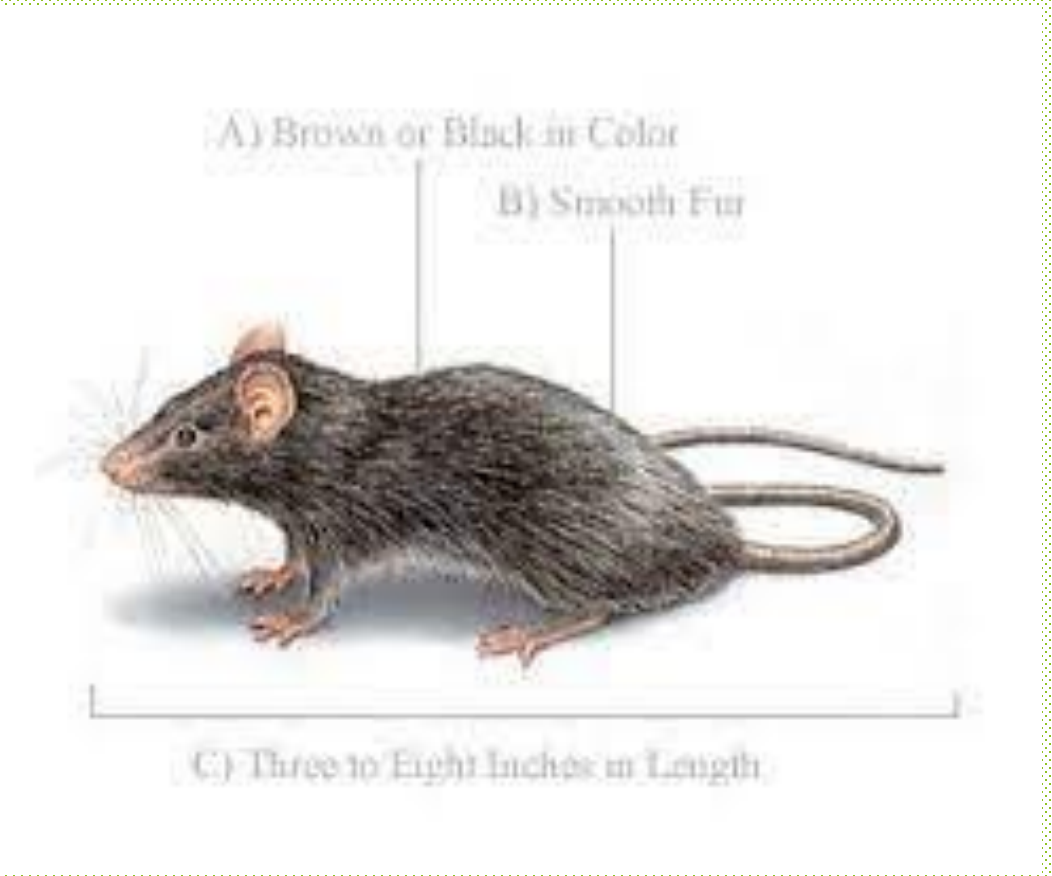
Latidens salimalii

Wroughton’s free-tailed bat

Leaf-nosed bat

Lion tailed macaque

Andaman, Kerala, Palm rat



Kondana soft furred rat

Nilgiri leaf monkey

Namdapha flying squirrel

Indian flying squirrel

Nilgiri tahr

THANK YOU