Biological Diversity

Introduction | Importance | Threats | Conservation

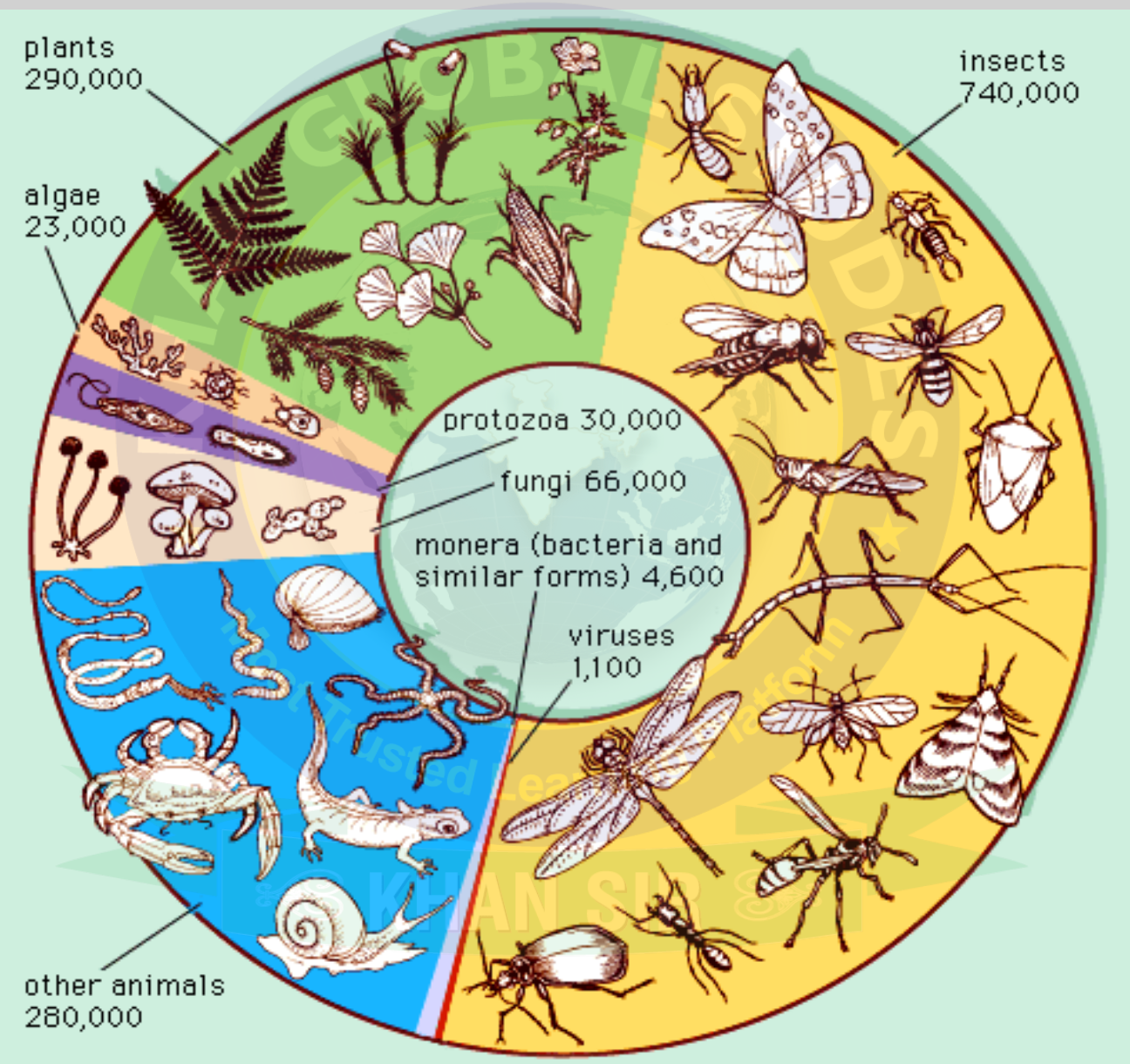
The Basics

Definition, Components, Extent, Value and Major Threats

What?

- It is the variety and variability of life forms and the ecosystems which shelter and support them.
- The totality of genes, species, and ecosystems of a region. It has three components.
    1. **Genetic diversity**: The diversity of genes within a species. There is a genetic variability among the populations and the individuals of the same species
    2. **Species diversity**: The diversity among species
    3. **Ecosystem diversity**: The diversity of the ecological complexes of which the species are part.

Extent


plants
290,000
algae
23,000
protozoa 30,000
fungi 66,000
monera (bacteria and
similar forms) 4,600
viruses
1,100
insects
740,000
other animals
280,000

Extent

- Expected number of species: 8.7 million to 10 million
- Described species: ~1.8 m
- Animals: ~1.3 m
  - Insects: ~8.2 L
  - Other animals: 4.8 L
- Plants: ~3L
- Algae: ~40K
- Fungi: ~80K
- Protists and other microbes: ~80K

Value

1. **Ecological Services** (such as Purification of air and water, Stabilization and moderation of the Earth's climate, Moderation of floods, droughts, temperature extremes and the forces of wind, Detoxification and decomposition of wastes, Generation and renewal of soil fertility, including nutrient cycling, Pollination of crops etc.)
2. **Provision of food**
3. **Provision of industrial raw materials and building materials**
4. **Medical value** as source of drugs, genes, vaccines, testing systems etc.
5. **Maintenance of genetic resources** as key inputs to crop varieties and livestock breeds, medicines, and other products
6. **Cultural and aesthetic value**

Factors threatening Biodiversity

1. Destruction of natural habitats of species for making land available for human settlements, urban centres, industries and mines, agriculture etc.
2. Ecosystem fragmentation and degradation due to various types of pollution
3. Overharvesting of biological resources and targeted elimination in some cases
4. Introduction of exotic and invasive species in various ecosystems
5. Disturbances in ecosystem dynamics due to climate change
6. Co-extinction

The Hotspots

Definition, Global Hotspots, Hotspots in India, The special Case of Western Ghats

Concept

- There are places on Earth that are both:
  - biologically rich
  - deeply threatened
- Concept given by Norman Myers in 1988
- To qualify as a biodiversity hotspot, a region must **meet two strict criteria:**
  1. It must have **at least 1,500 vascular plants as endemics** — a high percentage of plant life found nowhere else on the planet. A hotspot, in other words, is **irreplaceable**.
  2. It must have **30% or less of its original natural vegetation**. In other words, it must be **threatened**.

Mapping

- Around the world, **36 areas** qualify as hotspots.
- Their intact habitats represent just **2.5% of Earth's land surface**, but they support **more than half of the world's plant species as endemics** — i.e., species found no place else — and **nearly 43% of bird, mammal, reptile and amphibian** species as endemics.
- Mapping is done by **Conservation International**, an American Organization

Importance

- Hotspots are **crucial for biodiversity conservation**, as they contain a high concentration of diverse species that are under threat.
- Biodiversity is **essential for human survival**, as it provides crucial ecosystem services such as air, food, and water.
- Hotspots play a significant role in **supporting vulnerable human populations** who depend on nature for their livelihoods.
- Though hotspots only make up 2.5% of Earth's land surface, they **account for 35% of the ecosystem services** that vulnerable populations rely on.
- By protecting hotspots, we are **safeguarding both unique ecosystems and the well-being of local communities**.

Global Hotspots

- There are currently 36 biodiversity hotspots worldwide, supporting nearly 60% of the world's plant, bird, mammal, reptile, and amphibian species.
- These hotspots cover only 2.4% of the Earth's surface but are home to a significant portion of the world's terrestrial life.
- Hotspot distribution is not uniform across the globe, with certain regions like the Tropical Andes, Philippines, Mesoamerica, and Sundaland experiencing a higher concentration of hotspots.
- Most biodiversity hotspots are located within the tropics, with 15 of them classified as old, climatically-buffered, infertile landscapes (OCBILs).

OCBILs

- Old, climatically-buffered, infertile landscapes (OCBILs) are a unique category of biodiversity with the following features:
- **Old**: OCBILs are ancient landscapes, often with a geological history spanning millions of years. This long time span has allowed for the evolution of unique species and ecosystems that have adapted to these specific environments.
- **Climatically-buffered**: These landscapes have experienced relatively stable climatic conditions over long periods. This stability has allowed species to evolve and persist without having to adapt to major climate fluctuations. As a result, OCBILs often harbor high levels of endemism, with species that are not found anywhere else.
- **Infertile**: OCBILs typically have nutrient-poor soils, which limit the growth of vegetation and productivity. This low fertility has led to the evolution of specialized plant species that can tolerate or even thrive in these nutrient-poor conditions.

OCBILs

- Examples of OCBILs include:
    1. Southwest Australia: This region is known for its remarkable biodiversity, including many endemic plant species, and is characterized by ancient, sandy soils.
    2. Brazilian Cerrado: A vast savannah with nutrient-poor soils, the Cerrado is home to a unique array of plant and animal species found nowhere else on Earth.
    3. Cape Floristic Region, South Africa: Renowned for its wildflowers, this region features ancient, nutrient-poor soils and supports a high level of plant endemism.

Threats to Global Hotspots

- The distribution of hotspots can change over time due to a combination of factors, including human activities, natural disasters, and the introduction of invasive species.
- Island ecosystems, such as the Caribbean Islands, are particularly vulnerable to habitat loss and are home to several hotspots with high levels of endemism.
- Climate change can potentially alter the distribution of hotspots, as species may be forced to migrate or adapt to changing conditions, which could lead to the emergence of new hotspots or the loss of existing ones.

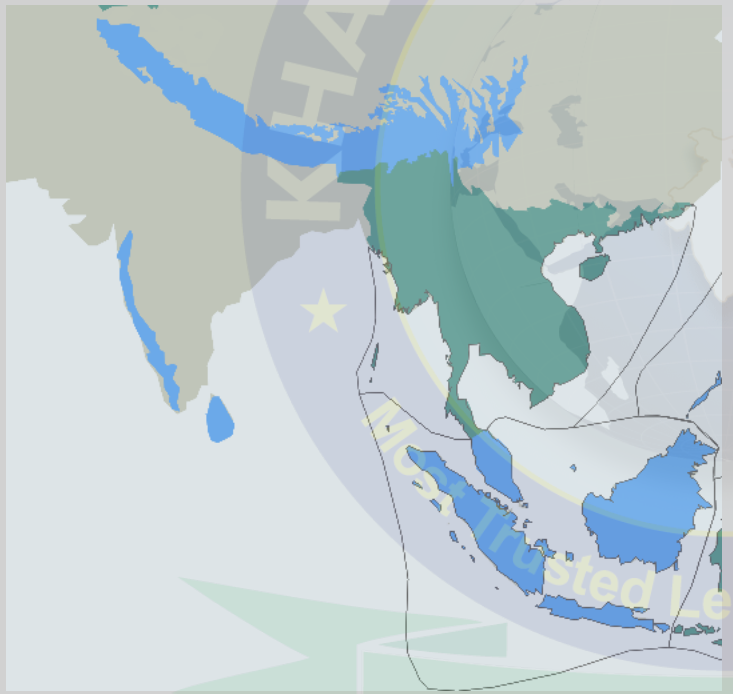
Major conservation initiatives

- Different groups are working together to help save these important places:
- **Critical Ecosystem Partnership Fund** (CEPF): This group gives money and support to help protect areas with lots of different plants and animals.
- **World Wide Fund for Nature**: They made a list of 200 important places called "Global 200 Ecoregions" to focus on saving plants and animals in different habitats.
- **Birdlife International**: They found 218 special areas called "Endemic Bird Areas" where unique bird species live, and they also identified more than 11,000 important bird areas around the world.
- **Plant life International**: This group works to find and take care of important plant areas.
- **Alliance for Zero Extinction**: These scientists and groups work together to save the most threatened animals and plants in the world.
- **National Geographic Society**: They made a map of the hotspots and have more information about the endangered animals in each area.
- **CAMPA**: This group in India helps protect forests from being destroyed.

Indian Hotspots

- Four major biodiversity hotspots in India:
  - The Himalayas
  - Indo-Burma Region
  - The Western Ghats
  - Sundaland
- None of these falls exclusively within Indian territory

Indian Hotspots



The Himalayas

- Location: Includes northeastern Indian states like Arunachal Pradesh, Sikkim, and West Bengal, as well as Bhutan, Nepal, and Tibet.
- Neighboring countries: China, Nepal, and Bhutan.
- Uniqueness: The world's highest mountain range.
- Flora: Over 10,000 plant species, including rhododendrons, orchids, and oaks.
- Unique Flora example: Blue Poppy (Meconopsis grandis)
- Fauna: Diverse wildlife, such as snow leopards, red pandas, and Himalayan tahr.
- Endemic species: 3,160 plant species, Himalayan Yew (Taxus wallichiana)
- Threats: Deforestation, climate change, habitat fragmentation, and poaching.

Indo-Burma

- Location: Includes Indian states of Manipur, Mizoram, Nagaland, and parts of Assam.
- Neighboring countries: Myanmar, Thailand, Laos, Vietnam, and China.
- Uniqueness: One of the most biodiverse regions on Earth.
- Flora: Dense tropical forests with bamboo, teak, and rattan.
- Unique Flora example: Amherstia nobilis (Orchid Tree)
- Fauna: Rich in wildlife, including tigers, elephants, and gibbons - Hoolock Gibbon (Hoolock hoolock)
- Endemic species: Numerous plant and animal species found nowhere else. Endemic species example: Khasi Pine (Pinus kesiya)
- Threats: Deforestation, illegal wildlife trade, and agricultural expansion.

Western Ghats

- Location: Runs parallel to the western coast of India, including states Maharashtra, Goa, Gujarat, Karnataka, Kerala, and Tamil Nadu.
- Neighboring countries: Sri Lanka
- Uniqueness: One of the world's ten "Hottest biodiversity hotspots."
- Flora: Rich vegetation with evergreen and deciduous forests, and unique grasslands called "shola." Flora example: Neelakurinji (Strobilanthes kunthianus)
- Fauna: Home to Indian elephants, Bengal tigers, and lion-tailed macaques. (Macaca silenus)
- Endemic species: High levels of endemism, with many unique species. Endemic species example: Nilgiri Tahr (Nilgiritragus hylocrius)
- Threats: Deforestation, habitat loss, pollution, and climate change.

Sundaland

- Location: Nicobar Islands
- Neighboring countries: Indonesia, Malaysia, and the Philippines.
- Uniqueness: Rich terrestrial and marine ecosystems.
- Flora: High diversity of plant species, including mangroves, palms, and dipterocarps.
- Flora example: Andaman Padauk (Pterocarpus dalbergioides)
- Fauna: Numerous species of birds, mammals, reptiles, and marine life.
- Fauna example: Andaman Day Gecko (Phelsuma andamanensis)
- Endemic species: High levels of endemism, with many species unique to the islands.
- Endemic species example: Andaman Masked Owl

Efforts to conserve Biodiversity