

CUET (UG) Biology Notes: Biodiversity and Conservation (Plain Text Format)

Here are your strictly NCERT-based notes for Biodiversity and Conservation. They are formatted in plain text, making them incredibly easy to copy and paste directly into your Google Docs for rapid CUET revision.

1. Biodiversity: Concept and Levels

Biodiversity refers to the combined diversity at all the levels of biological organization. The term was popularized by the sociobiologist Edward Wilson.

- **Genetic Diversity:** A single species might show high diversity at the genetic level over its distributional range.
 - Example: The medicinal plant *Rauwolfia vomitoria* growing in Himalayan ranges shows variation in the potency and concentration of the active chemical (reserpine) it produces.
 - Fact: India has more than 50,000 genetically different strains of rice and 1,000 varieties of mango.
- **Species Diversity:** The diversity at the species level.
 - Example: The Western Ghats have a greater amphibian species diversity than the Eastern Ghats.
- **Ecological Diversity:** At the ecosystem level.
 - Example: India, with its deserts, rain forests, mangroves, coral reefs, wetlands, estuaries, and alpine meadows, has greater ecological diversity than a Scandinavian country like Norway.

Global and Indian Numbers (IUCN 2004)

- Total number of plant and animal species described is slightly more than 1.5 million.
- Robert May's scientifically sound global estimate places the global species diversity at about 7 million.
- India has only 2.4% of the world's land area, but its share of global species diversity is an impressive 8.1%, making it one of the 12 mega diversity countries of the world.

2. Patterns of Biodiversity

A. Latitudinal Gradients

Species diversity decreases as we move away from the equator towards the poles. Tropics (latitudinal range of 23.5 N to 23.5 S) harbor more species than temperate or polar areas.

- Example: Colombia (near the equator) has nearly 1,400 species of birds; New York (41 N) has 105; Greenland (71 N) has only 56. India has over 1,200 species.
- Why are tropics richer? 1. Tropical latitudes have remained relatively undisturbed for millions of years (no frequent glaciations like temperate regions).
2. Tropical environments are less seasonal, relatively more constant, and predictable.
3. More solar energy is available in the tropics, contributing to higher productivity.

B. Species-Area Relationships

Observed by German naturalist and geographer Alexander von Humboldt in the South American jungles. He observed that within a region, species richness increased with explored area, but only up to a limit.

- The relationship is a rectangular hyperbola.
 - Equation: $S = C \times A^Z$
 - Logarithmic scale: $\log S = \log C + Z \log A$ (Where S = Species richness, A = Area, Z = slope of the line or regression coefficient, C = Y-intercept).
- The Z-value: For normal areas, Z lies between 0.1 and 0.2. But if you analyze a very large area like an entire continent, the Z value is much steeper, ranging from 0.6 to 1.2.
 - CUET Fact: For frugivorous (fruit-eating) birds and mammals in tropical forests of different continents, the slope is 1.15.

3. Importance of Biodiversity

- David Tilman's Ecology Plots: Showed that plots with more species showed less year-to-year variation in total biomass. He also showed that increased diversity contributed to higher productivity.

- The Rivet Popper Hypothesis (Paul Ehrlich): Compares an ecosystem to an airplane and species to rivets holding it together.
 - If every passenger pops a rivet to take home (causing a species to become extinct), it may not affect flight safety initially.
 - However, as more rivets are removed, the plane becomes dangerously weak.
 - Removing a rivet from the wing (a keystone species that drives major ecosystem functions) is a far more serious threat than losing a rivet from a seat inside.

4. Causes of Biodiversity Loss (The "Evil Quartet")

Human activities are causing species extinctions at an alarming rate. The four major causes are known as the Evil Quartet:

Cause	Key Details & NCERT Examples
1. Habitat Loss and Fragmentation	The most important cause driving animals and plants to extinction. The most dramatic examples come from tropical rain forests. The Amazon rain forest (called the "lungs of the planet") is being cut and cleared for cultivating soya beans or for conversion to grasslands for raising beef cattle. When large habitats are broken into small fragments, mammals and birds requiring large territories are badly affected.
2. Over-exploitation	When "need" turns to "greed", it leads to over-exploitation of natural resources. Examples of recent extinctions: Steller's sea cow, Passenger pigeon.

3. Alien Species Invasions	<p>When alien species are introduced unintentionally or deliberately, some turn invasive and cause the decline or extinction of indigenous species.</p> <ul style="list-style-type: none"> • Nile perch introduced into Lake Victoria (East Africa) led to the extinction of >200 species of cichlid fish. • Invasive weeds: Carrot grass (Parthenium), Lantana, and Water hyacinth (Eichhornia). • Illegal introduction: The African catfish (Clarias gariepinus) poses a threat to indigenous catfishes in our rivers.
4. Co-extinctions	<p>When a species becomes extinct, the plant and animal species associated with it in an obligatory way also become extinct.</p> <ul style="list-style-type: none"> • Examples: Host fish and its unique assembly of parasites; plant-pollinator mutualism (like the Fig and Wasp).



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5. Biodiversity Conservation Approaches

Why should we conserve biodiversity? The reasons are grouped into three categories:

1. **Narrowly Utilitarian (Economic):** Humans derive countless direct economic benefits from nature. Food (cereals, pulses, fruits), firewood, fiber, construction material, industrial products (tannins, lubricants, dyes, resins, perfumes), and products of medicinal importance. Over 25% of drugs are derived from plants. Exploring molecular, genetic, and species-level diversity for products of economic importance is called bioprospecting.
2. **Broadly Utilitarian (Ecosystem Services):** Nature provides services that cannot be priced. The Amazon forest is estimated to produce 20% of the total oxygen in the earth's atmosphere. Pollination is another crucial service provided by bees, bumblebees, birds, and bats. It also includes the aesthetic pleasure of walking through thick woods.
3. **Ethical:** We share this planet with millions of plant, animal, and microbe species. Philosophically or spiritually, we need to realize that every species has an intrinsic value. We have a moral duty to care for their well-being and pass on our biological legacy in good order to future generations.

the entire forest to save the tiger). This is in situ (on-site) conservation. However, when a situation demands urgent measures to save an endangered species, it is ex situ (off-site) conservation.

A. In Situ Conservation (On-Site)

- **Biodiversity Hotspots:** Regions with very high levels of species richness and high degree of endemism (species confined to that region and not found anywhere else).
 - Initially 25 hotspots were identified, now the total is 34.
 - These hotspots cover less than 2% of the earth's land area but can reduce mass extinctions by almost 30%.
 - **India's Hotspots:** Western Ghats and Sri Lanka, Indo-Burma, and Himalaya.
- **Protected Areas in India:** India has 14 Biosphere Reserves, 90 National Parks, and 448 Wildlife Sanctuaries.
- **Sacred Groves:** Tracts of forest set aside, and all the trees and wildlife within are venerated and given total protection due to religious and cultural beliefs.
 - Khasi and Jaintia Hills in Meghalaya (the last refuges for a large number of rare and threatened plants).
 - Aravalli Hills of Rajasthan.
 - Western Ghats regions of Karnataka and Maharashtra.
 - Sarguja, Chanda, and Bastar areas of Madhya Pradesh.

B. Ex Situ Conservation (Off-Site)

- **Threatened animals and plants** are taken out from their natural habitat and placed in special settings where they can be protected and given special care.
- **Traditional Methods:** Zoological parks, botanical gardens, and wildlife safari parks.
- **Advanced Methods:**
 - * **Cryopreservation:** Preserving gametes of threatened species in viable and fertile condition for long periods using liquid nitrogen (-196°C).
 - **Tissue Culture:** Propagating plants in vitro.
 - **Seed Banks:** Storing seeds of different genetic strains of commercially important plants for long periods.



6. Methods of Biodiversity Conservation

When we conserve and protect the whole ecosystem, its biodiversity at all levels is protected (e.g., saving