

Environment Class 06

1st March, 2024 at 1:00 PM

THE CLASS STARTED WITH DISCUSSIONS OF PRELIMS PYQS AT: (01:10 PM):

BIODIVERSITY: (01:20 PM):

- Biodiversity is the total of all the variety and variability of animals, plants, fungi, and even microorganisms that make up our natural world.
- **Biodiversity is considered at 3 levels:**
- **i) Genetic Diversity:** A single species might show high diversity at the genetic levels over its distributional range.
- For example, India has 1000 strains of rice and 100 mangoes, if a species has more genetic variation it can adapt better to the changing environmental conditions.
- Our agricultural practices focus on genetic varieties, such as homogeneity can be desirable from the perspective of uniformity in grain and productivity.
- But it also restricts the adaptability of any species to environmental stress.
- **ii) Species Diversity:** They are the biological classification and hence species diversity is the most commonly used in biodiversity.
- Worldwide about 1.75 million different species have been identified
- **It can be measured in 2 ways:**
- **a) Species Richness:** It refers to several different species present in a particular area.
- **b) Species Evenness:** It measures the relative abundance of different species in a given area.
- ***Note:** Evenness is often considered a better indicator compared to only relying on the species richness.
- Species evenness often signifies a resilient community where the communities are not overly dependent on a single species.
- If something were to happen to the dominant species, the entire ecosystem might undergo significant changes.
- **iii) Ecological Diversity:**
- It refers to the presence of different types of ecosystems.

DOMINANT SPECIES & KEYSTONE SPECIES: (01:54 PM):

- **a) Dominant Species:**
- A species pre-dominates the ecosystem and exerts influence on overall community structure because high biomass is known as the Dominant Species.
- For example, Oaks in the Temperate Forest, Pines in the Coniferous forest, Mangroves tree in the Mangrove ecosystem, Bison in the Prairies regions, etc.
- **b) Keystone Species:**
- A species that has a disproportionately large impact on its environment, relative to its abundance is called Keystone Species.
- Such keystone species play a critical role in maintaining the structure and diversity & functions of an ecosystem.
- For example, top (apex) predators, elephants in the Savanna, and Sea otters in the Kelp forest (Kelp forests are underwater areas with a high density of Kelp that covers a large part of the world's coastline, it is a habitat of many marine species, Sea Urchin a spikey organism is eaten by otters preventing their overpopulation).
- **c) Indicator Species:**
- They are such organisms whose presence, absence, or abundance in an environment can reveal health, quality, and pollution in a particular ecosystem.
- These species are sensitive to changes in the environmental conditions & provide early warning signs of environmental disturbances.
- **Examples of Indicator Species:**
- i) Lichens are an indicator for Sulphur di Oxide.
- ii) Mosses respond to air pollution by changing shape, density, or disappearing.
- iii) Amphibians such as frogs, and salamanders have permeable skin making them highly sensitive to changes in the water quality.
- iv) Certain birds indicate habitat quality like the Great Indian Bustard is an indicator of the Dry Grassland ecosystem.
- v) Corals are indicators of the Coral Reef ecosystem.
- vi) Oysters and Other Feeder Filters, are sensitive to even small amounts of pollutants in water.
- vii) Tubifex Worms, indicate oxygen-poor stagnant water and unfit to drink.

FLAGSHIP SPECIES AND UMBRELLA SPECIES: (02:22 PM):

- **d) Flagship Species:**
- They serve as popular Mascots for conservation issues.
- They are chosen for their vulnerability, and attractiveness to generate support from the public at large.
- For example, Giant Panda is a Flagship Species for Captive Breeding.
- **e) Umbrella Species:**
- Species with habitat requirements are so large that their conservation helps many other species together.
- They are not chosen because of popularity but because of habitat requirements.
- **f) Foundation Species:**
- They play a major role in creating or maintaining a habitat, such as Corals in Coral Reefs and Kelp in Kelp forests.
- **Other methods to measure biodiversity:**
- **Alpha, Beta, and Gamma Diversity:**
- Alpha Diversity: It represents Species richness within the habitat unit.
- Beta Diversity: It is an expression of diversity between the habitat.
- Gamma Diversity: It is the diversity of habitat within a larger landscape.

DIVERSITY INDEX: (02:55 PM):

- **Types of Diversity Index:**

- **a) Simpson Index:**

- It measures the probability that two individuals selected randomly from a sample will belong to the same species.

- Thus, a higher Simpson Index means less diversity.

- 1-Simpson Index is the Simpson Index of Diversity.

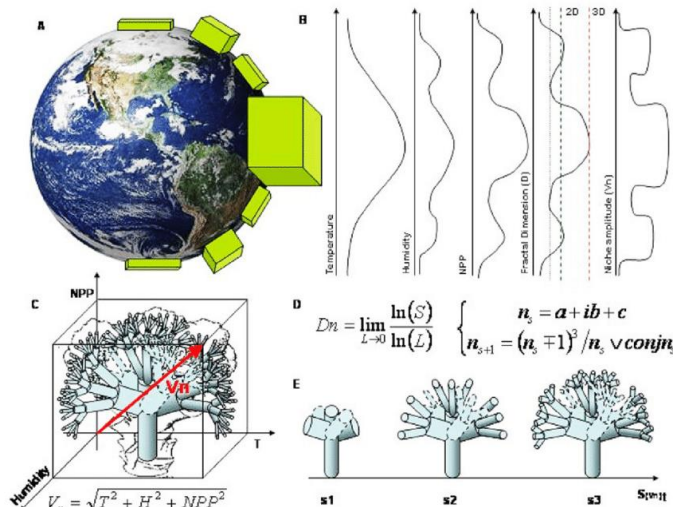
- **b) Shannon Index:**

- It measures the Species Diversity of a community based on the information theory.

- Greater diversity should correspond to greater uncertainty in picking a random individual of a particular species.

- **Patterns Of Bio-Diversity:**

- **Diagram of Patterns Of Bio-Diversity:**



- **1) Latitudinal Gradient:**

- In general, species diversity decreases as we move away from the equator to the pole with a few exceptions.

- **This is mainly because of:**

- 1. a) More availability of solar energy in the equatorial regions, hence higher productivity.
- 1. b) Tropical environments are relatively more constant and predictable.
- 1. c) Temperate and polar regions have witnessed frequent glaciations.

- **2) Altitudinal Gradient:**

- Generally, species richness tends to increase with increasing altitude due to harsher environmental conditions.

- Mountain areas often contain a high amount of endemic species.

- Mountain ranges act as a barrier to gene flow and lead to the isolation of the population adapting to their specific environment.

- Mid-elevation diversity bulge suggests that the highest levels of species diversity are not at the base but at a higher elevation on the mountain slope.

- **Question:** What are the benefits of biodiversity? Are these benefits abstracts in nature or they can be quantified?

EXTINCTION OF SPECIES: (03:36 PM):

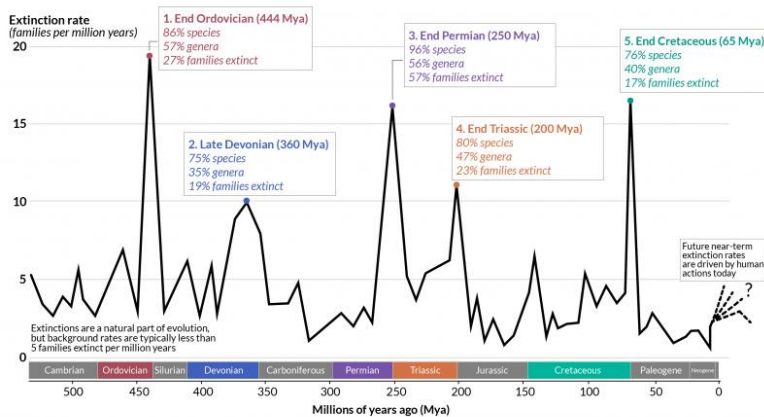
- Extinction is a natural process and an important part of evolution.
- many species that have lived on the planet Earth have become extinct, this is called Background Extinction.
- Not all species are equally vulnerable to extinction,
- **The following characteristics can make them more susceptible:**
- a) Large body size.
- b) Low population size.
- c) low reproductive rate.
- d) High trophic levels.
- e) High endemism.

Mass Extinction Episodes:

'Big Five' Mass Extinctions in Earth's History

A mass extinction is defined by the loss of at least 75% of species within a short period of time (geologically, this is around 2 million years).

Our World
in Data



Sources: Barnosky et al. (2011); Howard Hughes Medical Institute; McCallum (2015). Vertebrate biodiversity losses point to a sixth mass extinction. OurWorldinData.org. Research and data to make progress against the world's largest problems. Licensed under CC BY by the author Hannah Ritchie.

- In the last 450 million years the earth has witnessed 5 Mass Extinctions (mass extinctions are not as same as background extinctions).
- The Extinction Rate for species in recent times has been much higher and many scientists attribute this to anthropogenic activities.
- The term 6th Mass Extinction is used for this particular trend.

- **Main Reasons for Biodiversity Loss:**

- a) Changes in land and sea use including habitat loss due to habitat fragmentation.
- Habitat Loss refers to the modification of the species' living place by complete removal.
- And fragmentation, mostly because of unsustainable agriculture, residential or commercial development, energy production, and mining among others.
- b) Species Overexploitation: There are both direct and indirect forms of overexploitation.
- Direct Overexploitation refers to unsustainable hunting, poaching, etc.
- Indirect overexploitation occurs when non-target species are killed unintentionally.
- c) Pollution: it can directly affect the species making the environment unsuitable for survival e.g. oil spills
- It can also affect the species indirectly by affecting the food availability or affecting the reproducing capabilities.
- d) Invasive Species: These species can compete with the native species for space, food, and other resources and they can also transport new diseases presently not present in the environment.
- e) Climate Change: It can directly affect species and a lot of effects are indirect e.g. temperature changes can trigger seasonal events such as migration and reproduction at the wrong time.
- f) Co-extinction: It refers to the loss of one species as a result of extinction of the species it depends.

TOPICS OF THE NEXT CLASS:IUCN and Preservation of Species, etc.