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.

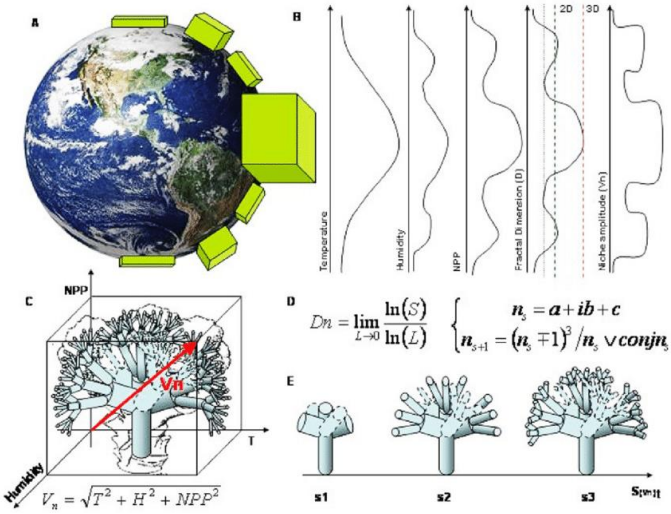
DOMINANT SPECIES & KEYSTONE SPECIES: (01:54 PM):

- **a) Dominant Species:**
- A species ~~pre-dominates the~~ that pre-dominates in an ecosystem and exerts major 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 Savvanna, 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 ~~Warms~~ Worms, indicate oxygen-poor stagnant water and unfit to drink.

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

- **d) Flaghsip 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~~ habitats.
- 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:**
- 

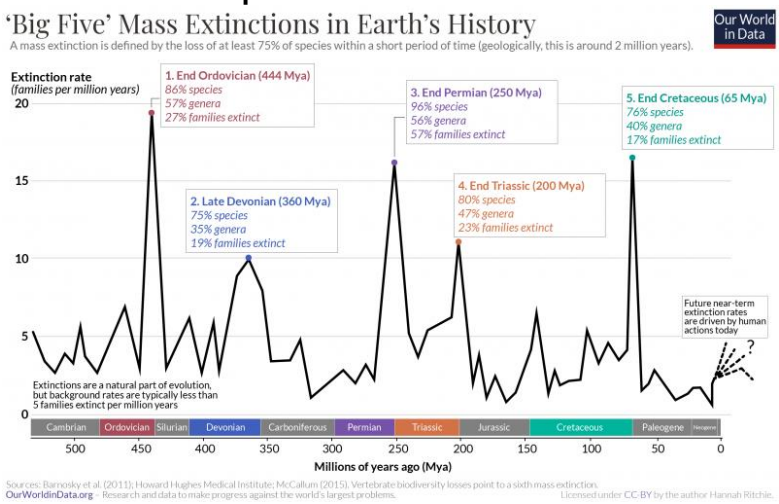
- **1) Latitudinal Gradient:**
- In general, species diversity decreases as we move away from the equator to the pole with a few exceptions.
- **This is mainly because of:**
- 1. a) More availability of solar energy in the equatorial regions, hence higher productivity.
- 1. b) Tropical environments are relatively more ~~constant~~ stable and predictable.
- 1. c) Temperate and polar regions have witnessed frequent glaciations.
- **2) Altitudinal Gradient:**
- Generally, species richness tends to ~~increase~~ decrease with increasing altitude due to harsher environmental conditions, reduced oxygen.
- Mountain areas often contain a high amount of endemic species. resulting into speciation as isolated population adapt
- 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 hypothesis ? 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?

only

This may be because of mix of habitats, moderate climate, transitional zones.

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. (because of high trophic level less energy will pass)
- e) High endemism.
- **Mass Extinction Episodes:**



- 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.

↓

Infact,

- **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 Overexplotation 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.