Environment Class 03

24th February, 2024 at 9:00 AM

ECOTONE (09:18 AM)

- An ecotone is a **transition area** between two different ecosystems.
- It's where the edges of two adjacent ecosystems overlap and integrate.
- These areas often exhibit high diversity and unique species composition. It is called as **edge effect.**

ECOLINE

- It represents a **gradual continuous change** in plants along an environmental gradient.
- Thus ecotone represents a transition area that can be properly demarcated.
- Ecoline represents a continuous change where marking a boundary is difficult.

FUNCTIONS OF AN ECOSYSTEM (09:30 AM)

- Primary Production
- Energy flow through the food chain/web
- Nutrient cycle
- Ecological Succession
- Homeostasis of Ecosystem
- Ecosystem Services

PRIMARY PRODUCTION

- It is the storage of energy through the formation of organic matter from inorganic compounds.
- It is done by autotrophic organisms.
- **Gross Primary Productivity:**
- It is defined for an ecosystem as the rate of production of organic matter during photosynthesis.
- It is measured in **Kg m^{-2} yr^{-1}**
- Productivity depends on the availability of water, and sunlight.
- Plants use 400-700nm wavelength of light for photosynthesis.
- This is photosynthetically active radiation.
- A considerable amount of GPP is utilized by plants in respiration.
- **Net Primary Productivity** is defined as gross primary productivity minus respiration losses.
- This is the available biomass for the consumption of heterotrophs.
- **Secondary productivity** is defined as the rate of formation of new organic matter by consumers.

CHEMOSYNTHESIS (10:00 AM)

- Certain microbes can produce energy-rich molecules from chemicals present in their environment typically in the absence of sunlight.
- Deep-sea bacteria use **Hydrogen Sulphide** that rises from deep-sea hydrothermal vents.
- Hydrothermal vents are the result of sea water percolating down in the ocean crust.
- The cold seawater is heated by hot magma and re-emerges to form this vent.
- Chemosynthesis can also occur in **cave ecosystems.**

ENERGY FLOW THROUGH FOOD CHAIN/WEB

- The transfer of food energy from producers/plants through a series of organisms, that consume and are consumed is termed as **food chain.**
- It shows a movement of energy by indicating the path of food from producer to final consumer.
- Based on the source of nutrition, organisms occupy a specific place in the food chain, which is known as the **Trophic Level.**
- Within any ecosystem, there are two major food chains.
- **a. Grazing Food Chain**
- **b. Detritus Food Chain**
- The distinction between these two is the source of energy for primary consumers.
- In the grazing food chain, it is plant biomass. In the detritus food chain, it is dead organic matter.
- The detritus food chain includes detrivores and decomposers.
- Detrivores are organisms that consume Detritus by breaking it into smaller pieces.
- E.g. Earthworm, Millipeds, Woodlice, etc.
- Bacteria and fungi decompose at the molecular level into simple inorganic molecules.
- **Note: In aquatic ecosystems, the grazing food chain is a major conduit for energy flow, and in terrestrial ecosystems, the detritus food chain is a major conduit for energy flow.**
- **Ecological Efficiency:**
- It represents the percentage of energy in the biomass produced by one trophic level that is incorporated into the biomass produced by the next higher trophic level.
- On average, this efficiency is about 10 percent. This is called **Lindeman's rule.**

ECOLOGICAL PYRAMID (10:37 AM)

- Ecological pyramids are graphic representations of trophic levels in an ecosystem.
- The producer makes the base of the pyramid and subsequent tiers represent herbivores, carnivores, and top carnivores.
- We can draw three types of pyramids:
- **i. Pyramid of Number**
- This represents several organisms at each trophic level. Generally, this pyramid is upright but in some cases, it can be inverted.
- There can be inverted pyramids. E.g. Big tree as an ecosystem. We can see many insects and parasites.
- **ii. Pyramid of Biomass**
- This represents biomass at each level.
- It is measured in **kg $m^{-2.}$**
- In most terrestrial ecosystems, it is upright, in an aquatic ecosystem it is inverted.
- **iii. Pyramid of Energy**
- It represents the total amount of energy at each level.
- The energy pyramids are never inverted.

BIOACCUMULATION AND BIOMAGNIFICATION (11:07 AM)

- Bioaccumulation occurs when pollutants build up in a single organism's body over time.
- **E.g. Mercury Poisoning in Fish.**
- Biomagnification occurs when the concentration of toxins increases as these toxins are passed up the food chain.
- E.g. **Poly-Chlorinated biphenyl** can be observed by phytoplankton, zooplankton eats large quantities of phytoplankton, and fish eats large quantities of zooplankton, thus the concentration of PCB further increases up the food chain.
- For biomagnification to occur, pollutants should be long-lived, and soluble in fat, mobile, and biologically active.

NUTRIENT CYCLING (11:29 AM)

- **Gaseous Cycle**: Water, Carbon and Nitrogen
- **Sedimentary Cycle:** Phosphorus and Sulfur

CARBON CYCLE

- Carbon is a vital component of life.
- It is found in all organic molecules.
- The atmosphere contains a significant amount of carbon in the form of **CO_2 and CH_4.**
- Plants and animals store carbon in their tissues.
- Dead organic matter and soil also hold significant amounts of carbon.
- Oceans absorb atmospheric CO_2. Marine organisms utilize carbon to build shells.
- Carbon is also stored in the earth's crust as fossil fuel and sedimentary rock layers such as limestone.
- **Processes in the carbon cycle:**
- **1. Photosynthesis**
- **2. Respiration**
- **3. Decomposition:** It releases CO_2 in the air. In the absence of oxygen, organic matter decomposes into methane.
- **4. Burning of organic matter** or fossil fuels such as coal petroleum natural gas releases CO_2 in the atmosphere.
- Fossil fuel burning is the biggest reason for the recent build-up of CO_2 in the atmosphere.
- **5. Ocean uptake and release:**
- Oceans constantly absorb CO_2 and release it slowly.
- All the places where carbon is stored are called carbon sinks.
- The process by which carbon is stored is called carbon sequestration.
- Marine organisms dissolve CO_2 to form limestone shells, when these organisms die, shells accumulate on the sea floor forming carbon-rich sedimentary rocks.

The topic for the next class: Wetlands, Corals and Mangroves