Introduction to Environmental Studies

B. Tech 3rd Semester

Ecological succession

Ecosystem

Department: Chemistry
Subject: IES (CHM2041)

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Definition:

- **Ecological succession**: is defined as an orderly process of changes in the community structure and function with time mediated through modifications in the physical environment (climate) and ultimately culminating in a stabilized ecosystem known as climax.

- The gradual replacement of one plant community by another through natural processes over time

Classification based on different types of areas

- Ecological successions starting on different types of areas or substrata are named differently as follows:
- (i) Hydrarch or Hydrosere: Starting in watery area like pond, swamp, bog
- (ii) Mesarch: starting in an area of adequate moisture.
- (iii) Xerarch or Xerosere: Starting in a dry area with little moisture.
- Lithosere : starting on a bare rock
- Psammosere : starting on sand
- Halosere : starting on saline soil

Process of Succession

- Sequential steps of Ecological succession :
- **(i) Nudation:** Start from bare area/land without any life form.
- The bare area may be caused due to landslides, volcanic eruption , drought, glaciers etc. overgrazing, disease outbreak, agricultural/industrial activities.
- **(ii) Invasion:** It is the successful establishment of one or more species on a bare area due to dispersal of the seeds, spores by wind, water, insects or birds. Then the seeds germinate and grow on the land as pioneer species.



Process of Succession

- **iii) Competition and Co-action:** As the number of individuals grows there is competition for space, water and nutrition. both inter-specific (between different species) and intra-specific (within the same species),
- They influence each other in a number of ways, known as co-action
- **(iv) Reaction:** The living organisms grow, use water and nutrients from the substratum, and in turn, they have a strong influence and modified the environment known as reaction.
- The modifications are very often unsuitable for the existing species and favour some new species.
- **(v) Stabilization:** The succession ultimately culminates in a more or less stable community called climax

The climax community is characterized by maximum biomass and symbiotic relationship

There are two main types of Ecological Succession

Primary Succession: The process of creating life in an area where no life previously existed.
Volcano, Rock, Desert, drought, glaciers

Secondary Succession:
The process of re-stabilization/ re-growth after a disturbance in an area with existing soil where life has formed again an ecosystem.
Example Corn field

Primary Succession

- **The development of an ecosystem in an area in which a community has never lived before, would be a new lava or rock from a volcano that makes a new island.**

No soil, there is no Nutrient and community

Primary Succession

Lichens begin growing on the rocks. Over many years lichens produce acid and break down rock into sand.
Weathering and erosion break down rock into sand.

Lichens that do not need soil and grow in dry condition to survive
Called **PIONEER SPECIES**

Primary Succession

Lichens grow larger. And death decompose of lichen increases the organic content of the sand with organic content. Nitrogen cycle begins. Eventually enough nutrients enter the sand and it becomes soil.

Seeds are blown in by the wind or carried in by animals.
Simple plants like **mosses** can grow in the new soil The plants grow and the soil gets enriched as plants die.

Primary Succession

Mosses and fern
can grow on new soil

- Fern, Herbs and weeds can grow in the thicker, enriched soil

The herbs and weeds plants die, adding more organic material. The soil layer thickens, and grasses, wildflowers, and other plants begin to take over

Primary Succession

- Insects and small birds make this their habitat.

- The vegetation grows closer together, reducing the amount of space available for growing.
- Competition between lichen and shrubs for the same space.

Eventually one species (lichen) will die out (or move) and the other species will survive (shrubs).

Primary Succession

- These plants die, and they add more nutrients to the soil
- Shrubs and tress can survive now

Mammals have begun to move in
What was once bare rock now supports a variety of life

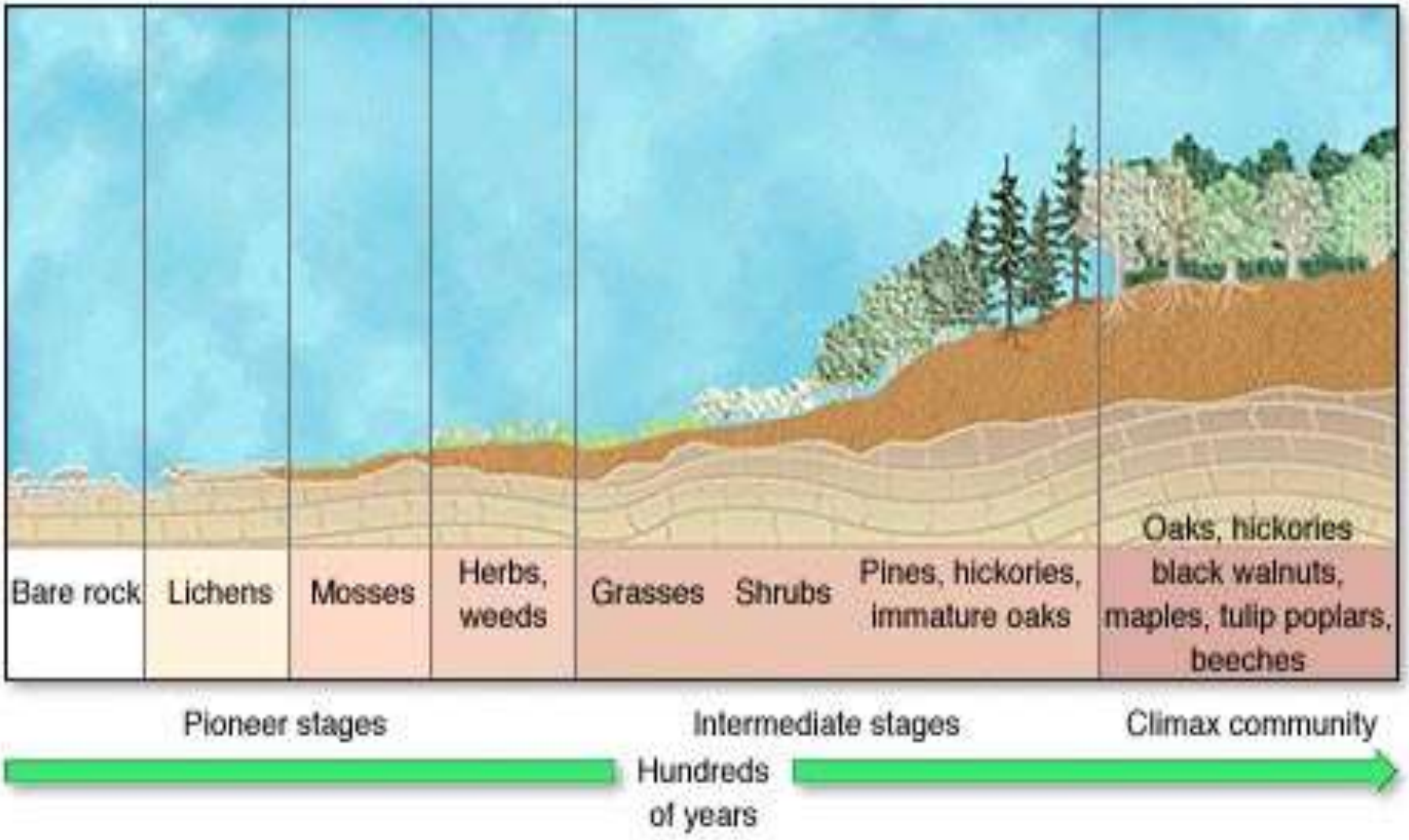
Primary Succession

- These plants die, and they add more nutrients to the soil
- Now larger trees can grow: Beech, Oak, Walnut, Maple…

The Climax Community

A climax community is a mature, stable and best adapted community that is the final stage of ecological succession.

Primary Succession



Secondary Succession

- Organisms are destroyed but the soil is safe.
- The soil already contains the seeds of weeds, grasses, and trees. More seeds are carried to the area by wind and birds.
- Succession begins again but the primary species are different.
- Because soil is present, this succession is faster.

Secondary Succession on an abandoned Cornfield

a.

b.

c.

d.

e.

Figure 24.18 Secondary succession from a cornfield. a. During the first year, only the remains of corn plants are seen. b. During the second year, wild grasses have invaded the area. c. By the fifth year, the grasses look more mature and sedges have joined them. d. During the tenth year, there are goldenrod plants, shrubs (blackberry), and Eastern juniper trees. e. After twenty years, the juniper trees are mature and there are also birch and maple trees in addition to the blackberry shrubs.

Difference between primary and secondary succession

Primary Succession	Secondary Succession
Begins with no life	Follows removal of existing biota
No soil present	Soil already present
New area (e.g. volcanic island)	Old area (e.g. following a bush fire)
Lichen and moss come first	Seeds and roots already present
Biomass is low	Biomass is higher

Physical factors involving in ecological succession

The **factors** involved in **ecological succession** are either biotic or abiotic.

Abiotic factors.

i) Light. Sun Light affects living things in terms of intensity, quality and duration.

ii) Temperature.

iii) Atmospheric Pressure.

iv) Humidity.

v) Rain fall pattern

vi) Soil quality, moisture and organic content, its pH

vii) Wind flow

Humidity affects the rate at which water evaporates from the surface of organisms such as in transpiration or sweating.

Wind. etc.,

Threats to Climax Communities

- Rapid urbanization and roads, railway tract
- Mainlining activities
- Industrial establishment
- Demand of Wild life product and fuel
- Deforestation for agricultural purposes
- Construction of big Dams
- Pest and wide spread diseases
- Flooding and Volcanic eruptions
- Forest Fires
- Anything that destroys the existing community,


Measure consumption of environmental resources
Calculate emissions
Report consumption and emissions externally
Identify reduction
Reduce consumption
Reduce emissions
Environment Sustainability

THANK YOU


MASS EXTINCTION
BUSH FIRES
SEVERE DROUGHT
NEXT 100 YEARS