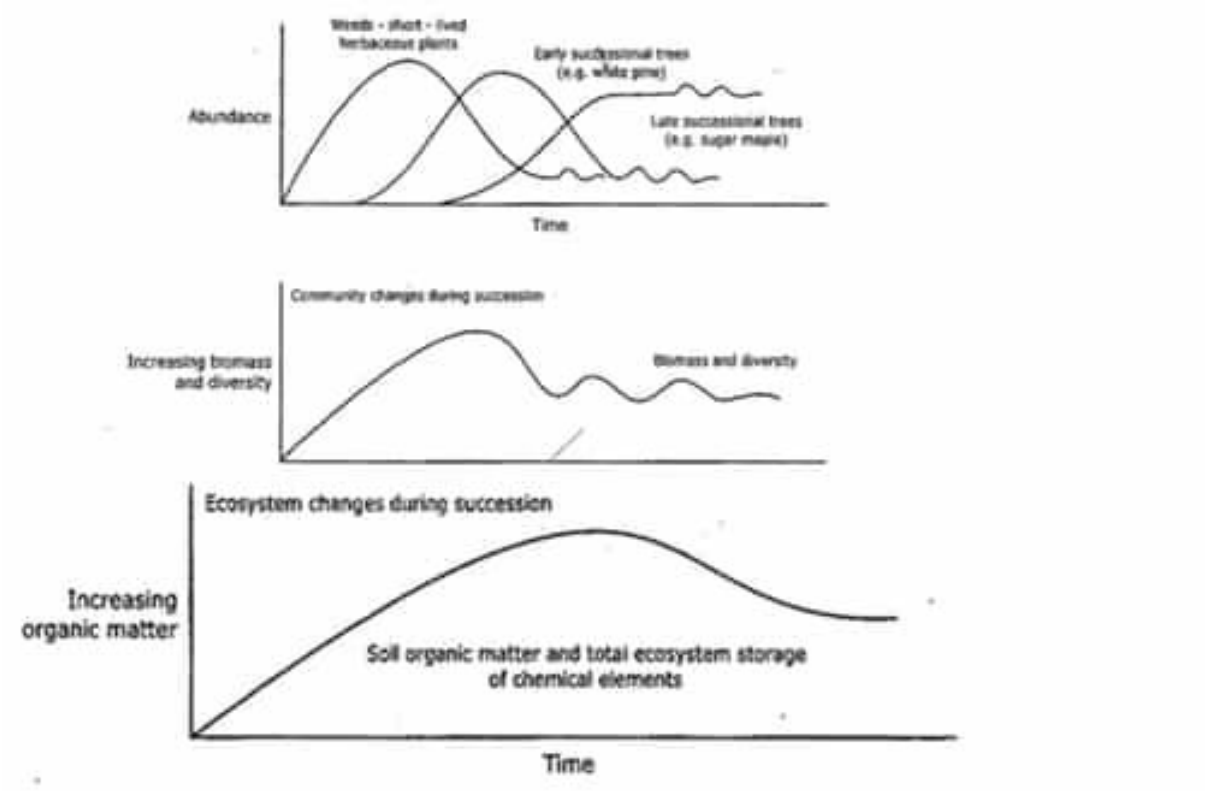
CSIR NET Life Science Unit 10

Ecological Succession

- Succession is a universal process of directional change. In community composition, on an ecological timescale.
- Succession is a unidirectional progressive series of changes that leads to the establishment of a relatively stable climax community.
- Climax community marks the endpoint of succession. Each **temporary stage** in the successional process is called a **seral stage**.
- Each seral stage is a snapshot of a continuum that is changing over time, but each has its characteristic species composition.
- Eventually succession slows as the community reaches a steady equilibrium with the environment.



Trends of changes in ecosystem development

Attribute	Early	Late
Organic matter	Small	Large

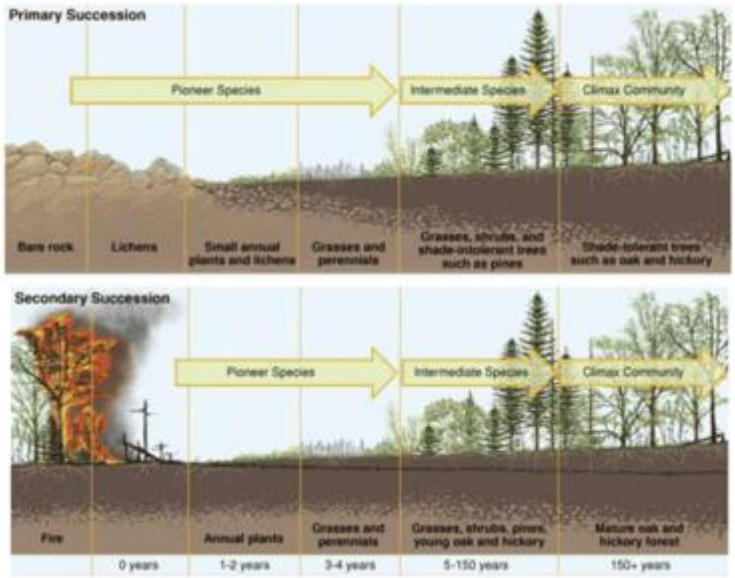
Nutrients	External	Internal
Nutrient cycles	Open	Closed
Role of detritus	Small	Large
Diversity	Low	High
Nutrient conservation	Poor	Good
Niches	Wide	Narrow
Size of organisms	Small	Large

Types of Succession

Primary and secondary succession

Succession occurring in bare areas where no community existed before is called primary succession. In primary succession, an unoccupied terrestrial site is first colonized by a few pioneer species, which are often microbes, lichens, and mosses.

The secondary succession starts on a well-developed soil already formed at the site. Secondary succession is relatively faster as compared to primary succession which may often require hundreds of years. It is a more common type of succession as compared to primary succession.



Autogenic and allogenic succession

Autogenic succession is self-driven, resulting from the interaction between organisms and their environment. In this case, successional changes are brought about by the organisms themselves.

Allogenic succession occurs as a result of the changes brought about in the habitat by external agencies and not by the existing community itself.

Autotrophic and heterotrophic succession

- The succession where initially the green plants are much greater in quantity than the animals, is known as autotrophic succession.
- Such a succession takes place in a medium rich in inorganic substances.
- In heterotrophic succession, the populations of heterotrophic organisms, like bacteria, actinomycetes, and fungi are present in greater quantity in the initial stages. It begins, prominently in the organic environment, and there is a progressive decline in the energy content.

Processes in Succession

Steps or processes are:

1. Nudation

2. Invasion or migration

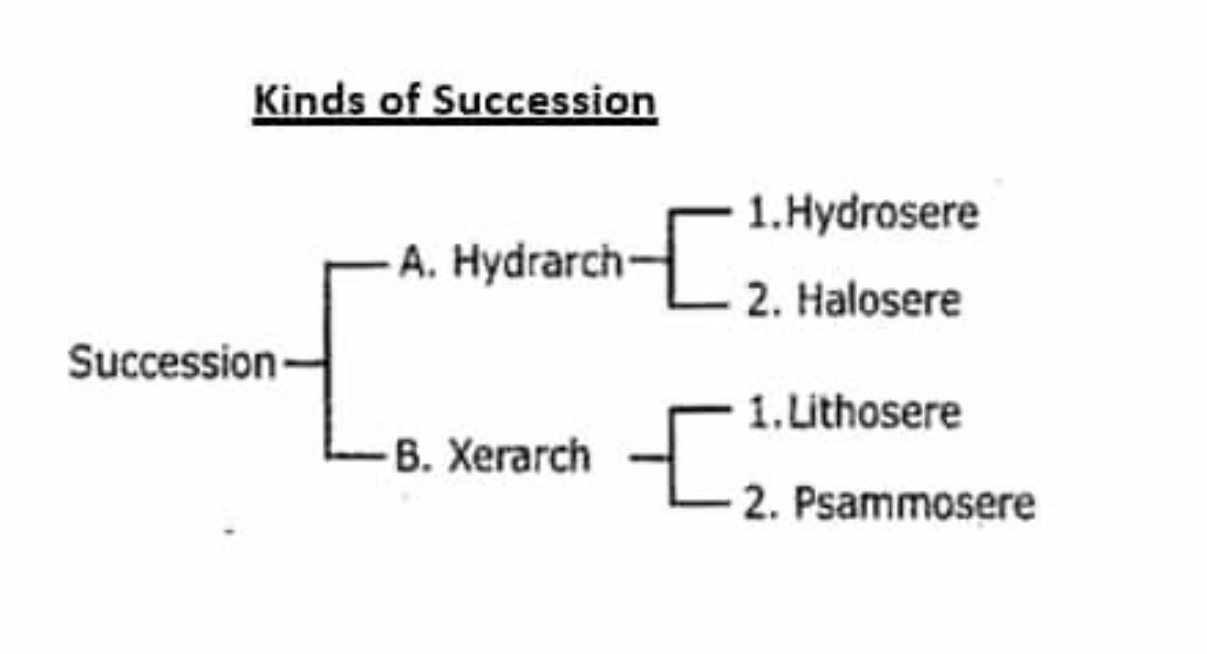
1. **Ecesis**
2. **Aggregation**

5. Competition

1. **Reaction**

7. Stabilization – climax

Kinds of Succession



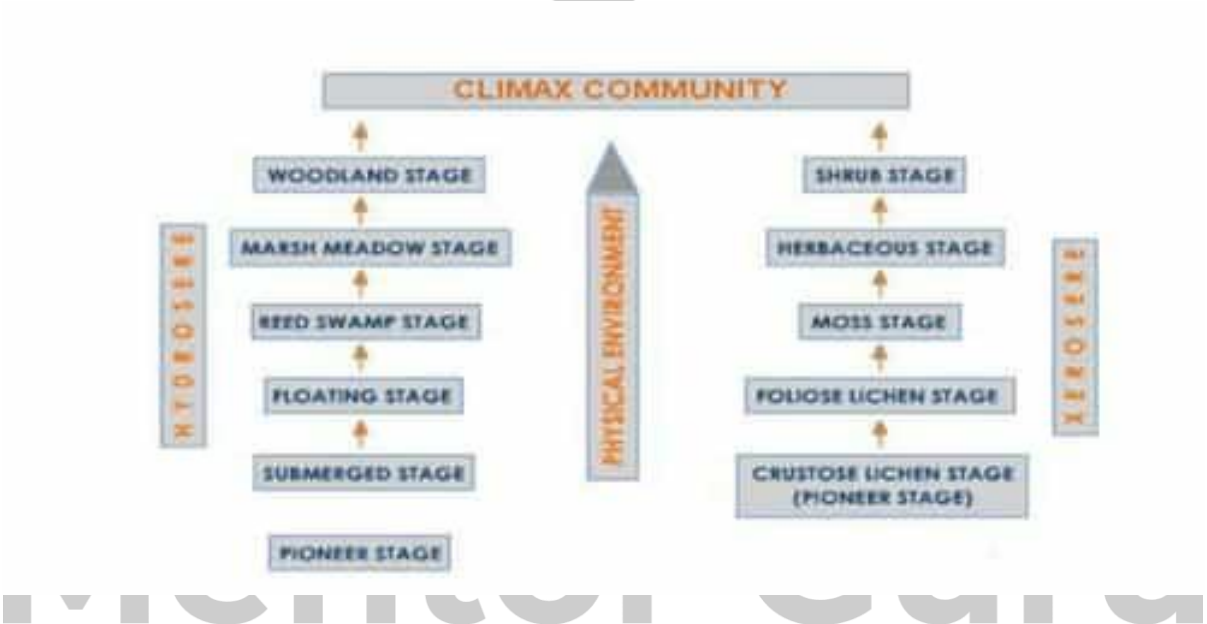
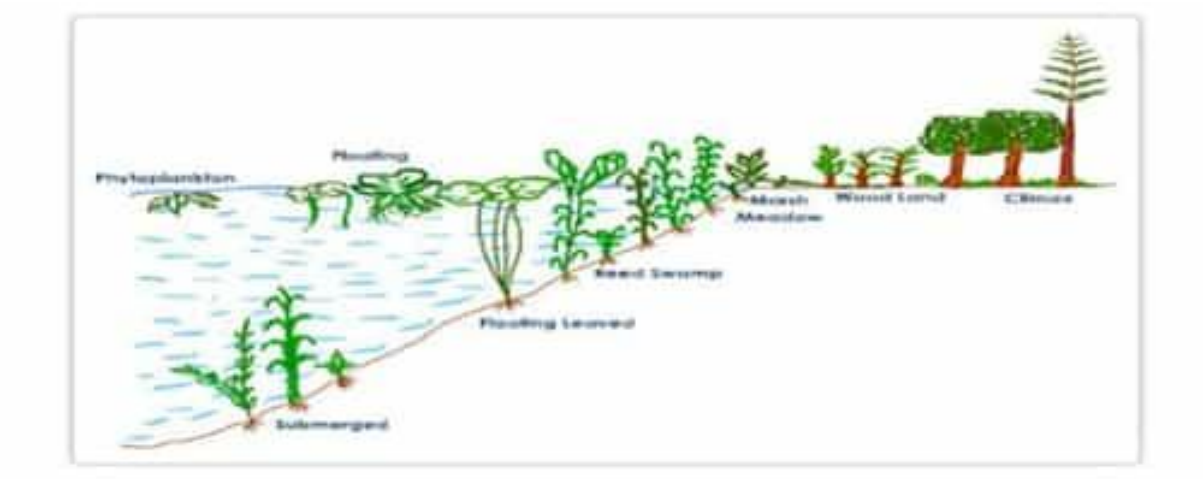


FIG. Diagrammatic representation of Developmental stages of plant succession during HYDROSERE and XEROSERE(Lithosere) leading to the formation of mesophytic climax forest community

1. **HYDRARCH (Succession in the aquatic environment)**



The succession in a freshwater ecosystem is also referred to as hydrosere.

Stages of Succession in Hydrosere

1. **Phytoplankton stage**

- This is the initial stage, the pond water is poor in nutrients and is devoid of much life.
- At this stage, the water is incapable of supporting larger life forms.
- Phyto-planktons consisting of microscopic algae begin to multiply and they quickly become the pioneer colonizers.
- The Phytoplanktons and the dependent animal population dies, decomposer organism increases in the number and bring about decomposition, which results in the release of minerals and enrichment of aquatic habitats.

1. **Submerged stage**

- **Habitat is now shallower and is richer in nutrients**.
- **Light is available up to a certain depth**
- It becomes suitable for the growth of rooted, submerged hydrophytes
- **Example-- Hydrilla, Potamogeton, Vallisneria, etc.**
- These grow at various depths, mostly rooted in the muddy or sandy bottom depending on the species, and on the clearness or turbidity of water.

1. **Floating stage**

- The pond is now colonized by plant species that are rooted in mud, but their leaves reach the water surface and float.

1. **Reed-Swamp stage**

- This stage is also known as the **amphibious stage**.
- The plants of the community are rooted but most parts of their shoots remain exposed to air.
- **Examples-- Species of Typha, Sagittaria, and Phragmites**
- These plants have well-developed root systems, and they form dense patches of vegetation.

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1. **Sedge-Meadow stage**

- Forms mat-like vegetation with the help of their much-branched rhizomatous system.
- All these reach the habitat by binding water-carried and wind-borne soil.
- There is much rapid loss of water.
- Sooner mud is exposed to air.
- The conditions in the area gradually change from marshy to mesic, and the marshy vegetation shows a decline.
- Up to the end of the sedge-meadow stage, the climate of the region has no control over the succession because the water content of the soil is high, irrespective of rainfall and climate of the region.
- At the end of this stage, the soil becomes dry and its water content will henceforth be dependent upon rainfall and climate of the region.

1. **Woodland stage**

- The lowland has been built up to an extent where the soil is saturated
- In spring Only and early summer, certain species of shrubs and trees may appear.
- Those that can tolerate waterlogged soil around their roots will be the pioneers.

- Various species of Salix, Alnus, Populus, etc. may form dense thickets.
- By this time of succession there is much accumulation of hummus with a rich flora of microorganisms like bacteria, fungi, and others.
- Thus, mineralization of the soil favors the arrival of new tree species in the area leading to the climax stage.

1. **Climax stage**

- A variety of trees invade the woodland community which soon develops into the climax community. The nature of the climax is dependent upon the climate of the region.

1. **B) Xerarch**

Succession initiated with the establishment of pioneer communities in the drier area is termed xerarch succession and the successional stage is called **xerosere**.

It is further subdivided as:

Lithosere:

When it takes place on bare rocks.

MODELS OF SUCCESSION

1. Facilitation:

The organisms at a given successional stage make the environment more suitable for later successional stages.

Examples:

1. 1**. lichens breaking down rock into soil**,

2. **Nitrogen-fixing plants improve the fertility of the soil, nurse plants.**

2. Tolerance:

The organisms of a given successional stage have little impact on later successional stages.

Example: Oldfield succession

1. **Inhibition:**

The organisms at a given stage resist invasion by organisms of later stages Succession proceeds when the individuals of a given stage die.

Example: allelopathy