# SUCCESSION

Plant Succession

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**Succession** is a directional non-seasonal cumulative change in the types of **plant species** that occupy a given area through time. It involves the processes of colonization, establishment, and extinction which act on the participating plant species. Most successions contain a number of stages that can be recognized by the collection of species that dominate at that point in the succession. Succession begin when an area is made partially or completely devoid of vegetation because of a **disturbance**. Some common mechanisms of disturbance are fires, wind storms, volcanic eruptions, logging, climate change, severe flooding, disease, and pest infestation. Succession stops when species composition changes no longer occur with time, and this community is said to be a **climax community**.

# PLANT SUCCESSION

The concept of a climax community assumes that the plants colonizing and establishing themselves in a given region can achieve **stable equilibrium**. The idea that succession ends in the development of a climax community has had a long history in the fields of biogeography and ecology. One of the earliest proponents of this idea was Frederic Clements who studied succession at the beginning of the 20th century. However, beginning in the 1920s scientists began refuting the notion of a climax state. By 1950, many scientists began viewing succession as a phenomenon that rarely attains equilibrium. The reason why equilibrium is not reached is related to the nature of **disturbance**. Disturbance acts on communities at a variety of spatial and temporal scales. Further, the effect of disturbance is not always 100 %. Many disturbances remove only a part of the previous plant community. As a result of these new ideas, plant communities are now generally seen as being composed of numerous patches of various sizes at different stages of successional development.

# PLANT SUCCESION

**Pioneer species to climax communities**

- **Pioneer species:** These are the first species to occupy a new habitat, starting new communities. They have rapid reproductive strategies, enabling them to quickly occupy an uninhabited area. Many have an asexual stage to their reproduction.
- **Seres:** These are the various stages that follow on from the pioneer species.
- **Climax community:** This is the stable community that is reached, beyond which, no further succession occurs.

# Types of Succession

***Primary succession***

- This occurs when the starting point is a bare ecosystem, (e. g, following a volcanic eruption or a landslide). The pioneer species are usually lichen, moss or algae. They are able to penetrate the bare surface, trap organic material and begin to form humus.
- Over several generations soil begins to form. The soil can be used by a more diverse range of plants with deeper root systems. Gradually larger and larger plants occupy the ecosystem along with a diversity of animals.
- Finally a climax community is reached and the species present do not change unless the environment changes in some way.

# Primary Succession

**An example of primary succession forming woodland (forest):**

- Bare rock is colonised by mosses and lichen.
- Small plants, ferns and grasses take over.
- Larger plants with deeper roots appear.
- Bushes and shrubs replace non-woody plants.
- Fast growing trees form a dense, low wood.
- Larger, slow growing trees create a woodland leading to forest formation.

# Secondary Succession

***Secondary succession***

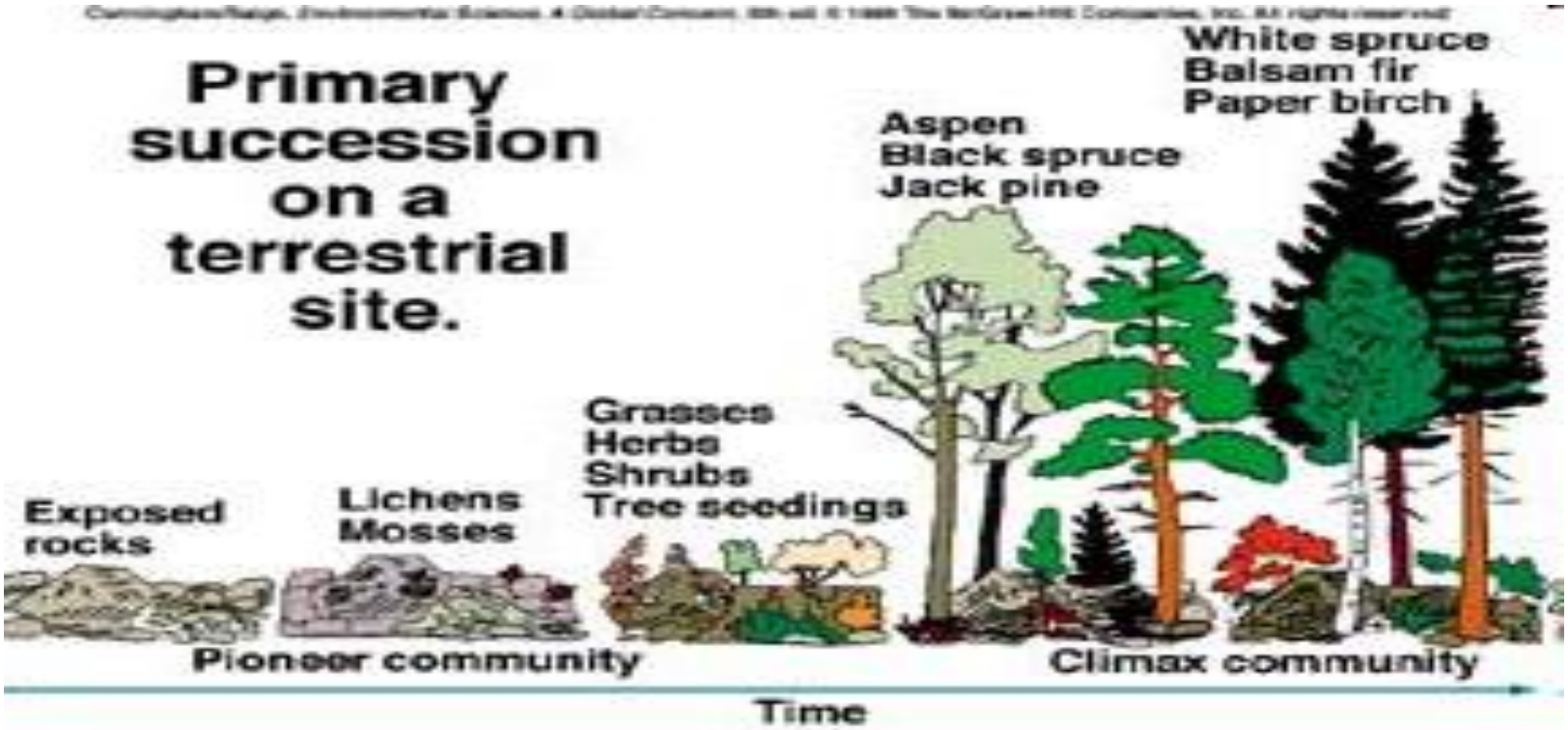
This occurs when the starting point is bare, existing soil, previously vegetated (e. g., following a fire, flood or human intervention). This type of succession proceeds in the same way as primary succession except that the pioneer species tend to be grasses and fast growing plants.

# Secondary Succession

**An example of secondary succession forming forest:**

- Bare soil is colonised by grasses and pioneer plants.
- Grasses begin to predominate with time.
- Shrubs replace the grasses.
- Fast growing trees appear.
- Slow growing trees appear to create the climax community (forest).

# Primary Succession



# Plant Succession

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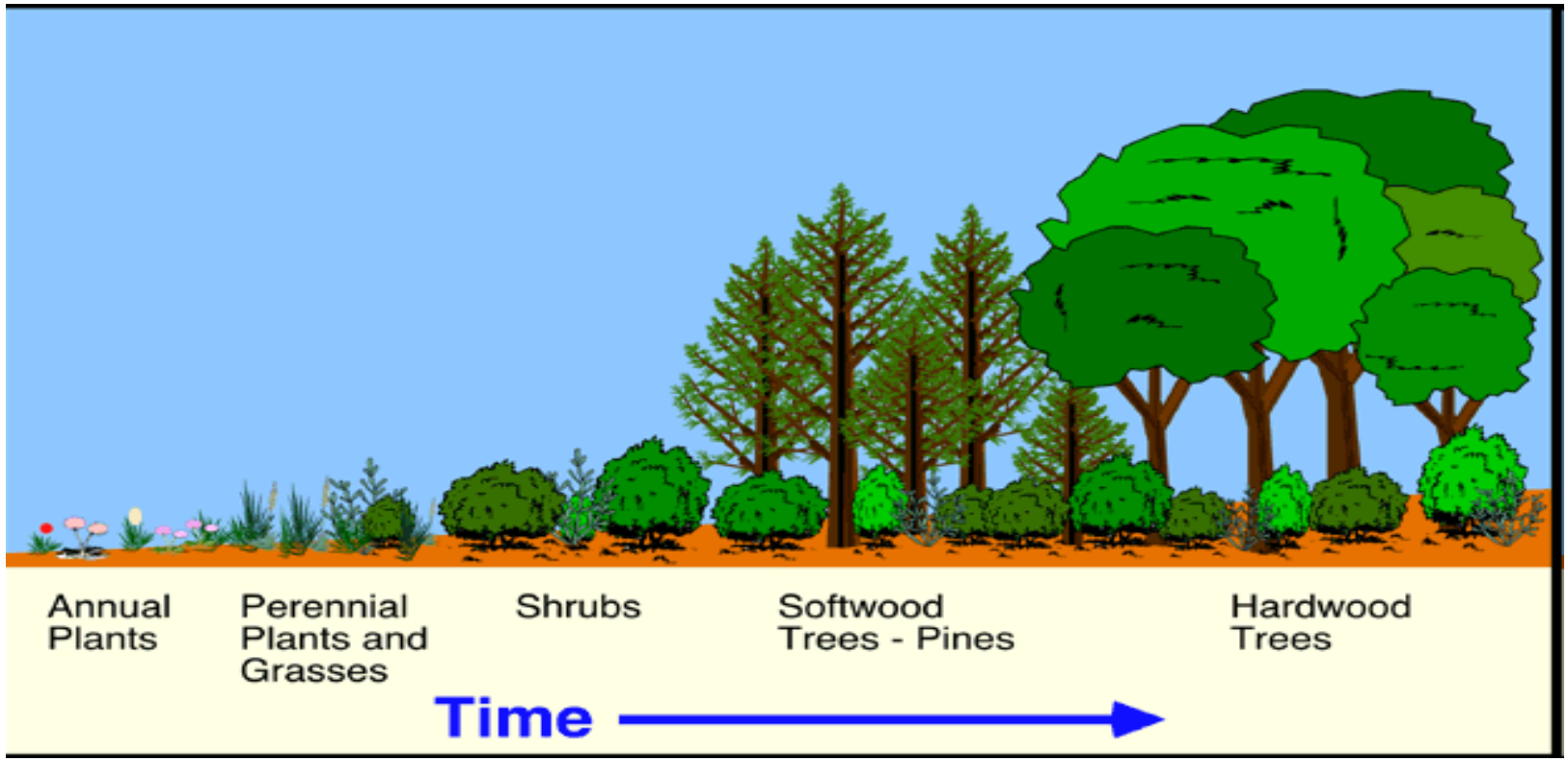
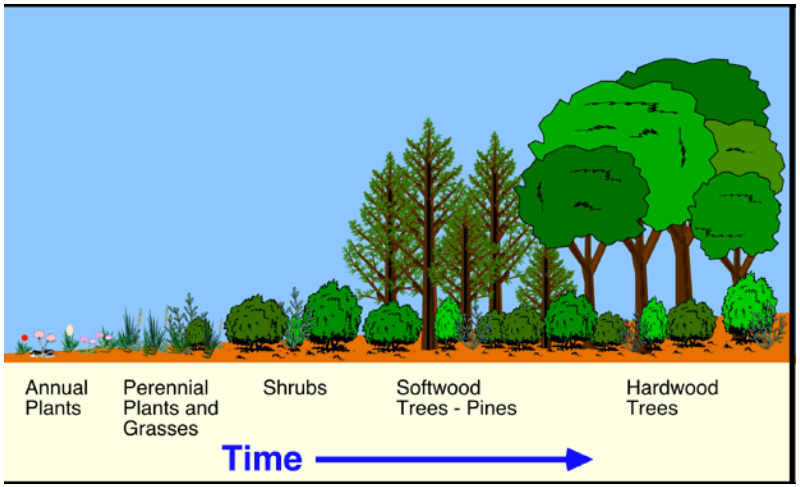


# Plant Succession




Succession of plant species on abandoned fields. **Pioneer species** consist of a variety of annual plants. This successional stage is then followed by communities of perennials and grasses, shrubs, softwood trees and shrubs, and finally hardwood trees and shrubs. This succession takes about 120 years to go from the **pioneer** stage to the **climax** community

# Primary Succession

**Primary Succession:** These photos show **primary succession**, the development of a community where none was before. Here, you can see a whole **sere** in one view; first to appear on the bare rock are **lichens and algae**. These secrete acids which begin to extract nutrients from the rock and which form tiny cracks which are widened by freezing and thawing. As the cracks widen they trap enough organic material and moisture for **mosses** to take hold. Larger cracks have enough soil to support **grasses** and **small shrubs**. The largest cracks come together to form small basins where **trees** can take root, although the tree in the photo below didn't make it too long; perhaps a drought exhausted the water in the small basin. However, in the background the **climax coniferous forest** is visible where enough soil has accumulated to support the trees.

# Primary Succession

Larger cracks have enough soil to support **grasses** and **small shrubs**. The largest cracks come together to form small basins where **trees** can take root, although the tree in the photo below didn't make it too long; perhaps a drought exhausted the water in the small basin. However, in the background the **climax coniferous forest** is visible where enough soil has accumulated to support the trees.

# Primary Succession

Another view of primary ecological succession at work. Note the sparse amount of soil available for these trees. First lichen, then moss, then other hardy plants, then trees. Based on other trees on this rock that have fallen over, the root system of these trees is probably about a foot or less in depth (two or three decimeters).

# Primary Succession

- Plant succession, starting from bare rocks.
- Can you identify and of the plant types in the photo?

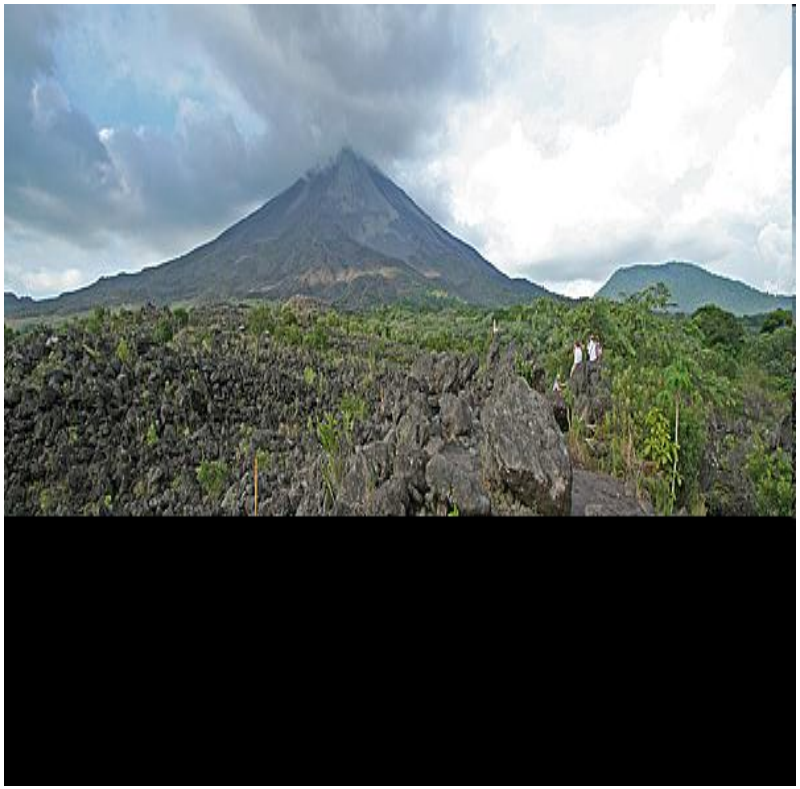
# Primary Succession

Describe what you can observe in the photo

# Primary Succession

What stage of primary succession is shown in the photo?

# Primary Succession



15 years later….

# Primary Succession

The **valley** you see in the photo was created by a retreating **glacier**. Initially, the steep slopes are subject to slides, and not much will be able to grow there. As the land stabilizes, however, succession will begin to take hold and, if the climate does not cool and allow the glacier to grow again, the forests will cover the slopes.

# Secondary Succession

**Clear cutting:** When forests are clear-cut, **secondary succession** begins on the deforested plots. To speed the process, and to ensure that the resulting forest will be the same age and easy to harvest, timber companies usually replant the forest. This, however, results in a forest of trees which are often **genetically very similar**, and of course, of the **same age**. This creates a **patchwork landscape**. Because these forests do not retain any of the **old trees** which provide food and nest sites for many animals, they are not very diverse in terms of wildlife either. Wildlife depends on a diversity of trees which themselves vary in age from saplings to mature and even dead trees.

# Secondary Succession

# Secondary Succession

**Old-field Succession:** The **abandoned pasture** to the left is slowly reverting to forest. **Grasses** are gradually replaced by other perennials such as **milkweeds**, **goldenrod**, and **shrubs**. Next come small **trees** adapted to this habitat. These would include **sassafras**, **hawthorns** and the like. Larger trees such as **oaks**, **maples**, **hickories** and eventually **beeches** will begin to come into the picture, and eventually a mature forest such as the old-growth forest shown in the remaining pictures will come into being after hundreds of years. Note the diversity of tree sizes in the mature forest.

# Fire and Succession

Fire plays a complex role in succession. Usually, a fire stops the progression of succession and sets the stage for new, secondary succession as plants take root and grow in the soil enriched by the mineral ashes of their predecessors. In some cases, however, fire plays an even more important role. It maintains the climax community by removing competitors that would otherwise move the climax to a different type of community.

# Fire and Succession

# Fire and Succession

- n areas not adapted to fire (below), fire resets the successional clock.  The area on the right in this image burned, killing all the shrubs and tree saplings.  The grass will sprout back quickly in the spring, but that side of the small creek will end up reaching the last stages of succession -here a deciduous forest - perhaps 5-10 years later than the unburned area.  Of course, since it will take about 100 years or more to have fairly mature trees on either side, the 5-10 year difference may not be apparent a century from now.
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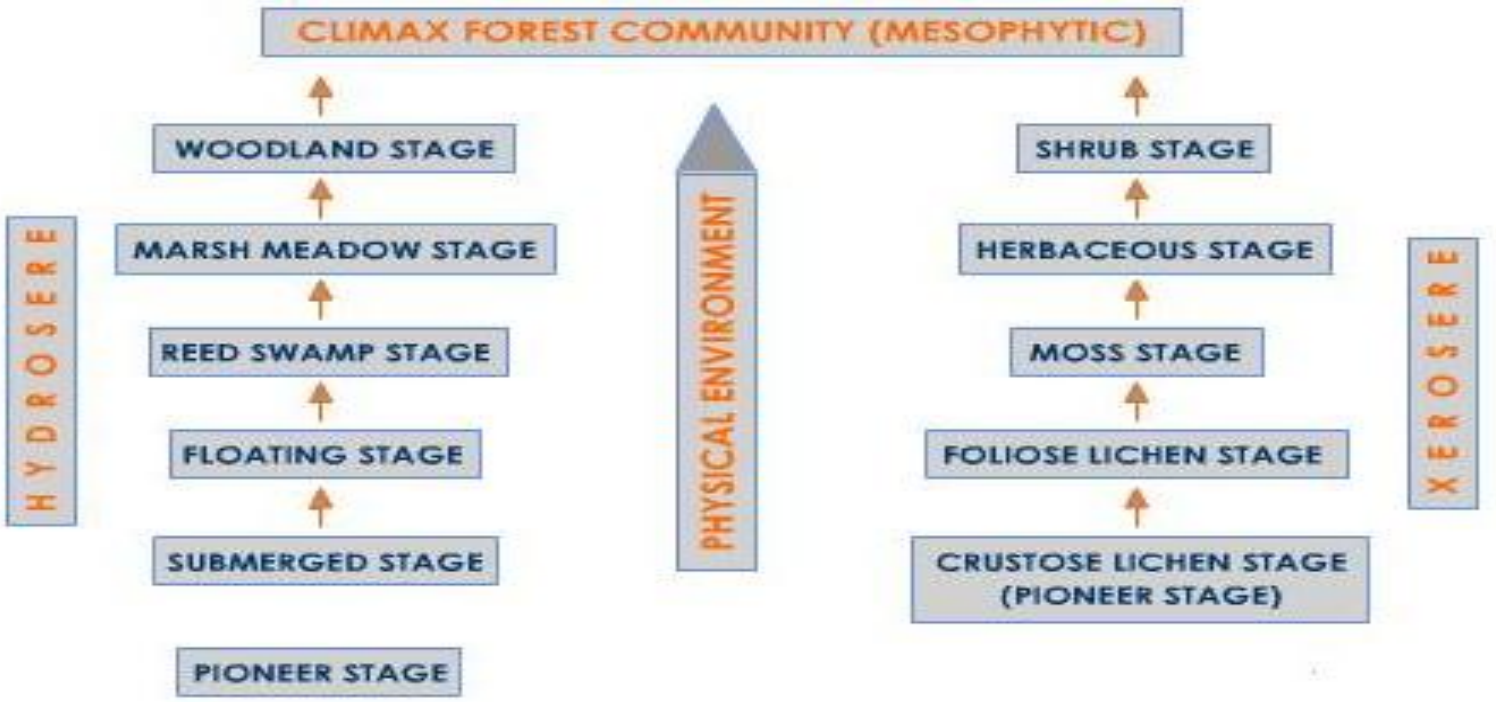
# XEROSERE and HYDROSERE




A diagrammatic respresentation of the developmental stages of plant succession during hydrosere and xerosere(lithosere) leading to the formation of mesophytic climax forest community

# Hydrosere

Hydrosere, also called hydrarch involves the ecological succession in the newly formed pond or lake.

# Secondary Succession

# Hydrosere

**Stages in Hydrosere**

a) Plankton stage

Germination of encysted spores in the newly formed water body forms the pioneer community, Spores could have reached the water body through wind or animals. Planktonic stage includes minute autotrophic diatoms, phytoflagellates, cyanobacteria etc. Population of phytoplankton is regulated by zooplanktons. Their dead and decomposed organic matter mixes with silt and forms soft mud at the bottom of the pond.

# Hydrosere

b) Rooted submerged stage

Rooted submerged hydrophytes like *Hydrilla*, *Vallisneria*, *Utricularia*, etc. grow on the soft mud. Due to death and decay of these plants and deposition of sand and silt, leads to a slow rise in the bottom level (soil layer) of the pond. Buried older plants form good humus for next seral stage.

# Hydrosere

c) Rooted floating stage

Area is now invaded by species of floating, leaved, anchored plants like *Nymphea*, *Trapa*, *Monochoria*, *Nelumbo* etc, which help the water become rich in mineral and organic matter. Later free floating species like *Azolla*, *Lemna*, *Pistia*, *Eichhornia*, etc. appear. This rapid growth of plants builds up the pond bottom and makes the water shallower.

# Hydrosere

d) Reed swamp stage

Also called amphibious stage and plants like *Typha*, *Sagittaria*, *Scripus*, etc., replace the floating plants. These plants produce abundant amount of organic wastes and lose huge amounts of water by transpiration. Addition of organic matter raises the substratum of the pond and becomes unsuitable for growth of amphibious plants.

# Hydrosere

e) Sedge meadow stage

Also called marsh meadow stage where the area is now made up of plant species like *Carex* (Sedge), *Juncus*, *Diochanthium* and herbs like *Polygonum*, etc. They form a mat like vegetation with their much branched rhizomatous system. Finally the marshy vegetation disappears due to the development of mesic conditions.

# Hydrosere

f) Wood land stage

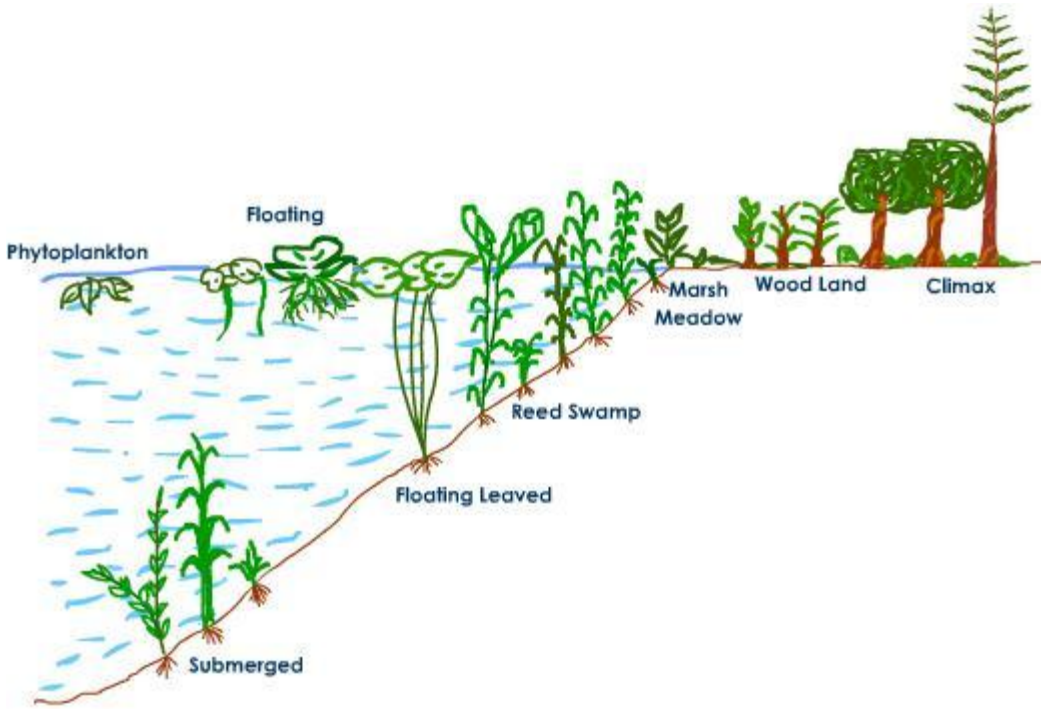
First the peripheral part of the area is invaded by some shrubby plants, which can tolerate bright sunlight and water logged conditions. Plants that grow are Cornus (Bogwood), Cephlanthus (Button brush), etc. The next to invade trees are Populus (Cottonwood), Almus (Alder), etc. Further fall in the water table, along with mineralisation and soil buildup favours the arrival of plants for next seral community.

# Hydrosere

g) Forest stage

It is the formation of climax community, which depends upon the climatic conditions. For e.g., tropical deciduous or monsoon forests are formed in regions of moderate rainfall, tropical rain forests in areas with heavy rainfall, mixed forests in temperate regions.

# Stages of Plant Succession in a Lake or Pond (Hyrosere)



# Importance of Ecological Succession

Ecological succession is of great importance as

- i) It provides information, which help to have control on the growth rate of one or more species in a given geographical area.
- ii) It helps in reforestation and forest management programmes.