

RIZVI COLLEGE OF ARTS SCIENCE AND COMMERCE

PLANT SUCCESSION

USBO503

PAPER 3

SEM V

Dr NITESH JOSHI

DEPT OF BOTANY

HYDROSERE

- A plant succession which occurs in a freshwater lake.
- In time, an area of open freshwater will naturally dry out, ultimately becoming woodland.
- Thus, it is gradual conversion of ponds and lakes to forest ecosystems.
- With time ponds and lakes are gradually filled with eroded sediments.
- The sediments moves in the shorelines and eventually fills in the lake.
- The plant sequence is as follows: lake plants, reeds, grasses, shrubs, & trees.

- **Phytoplankton stage**

Unicellular floating algal plants such as diatoms are pioneer species of a bare water body, such as a pond. Their spores are carried by air to the pond. The phytoplankton are followed by zooplankton. They settle down to the bottom of the pond after death, and decay into humus that mixes with silt and clay particles brought into the basin by run off water and wave action and form soil. As soil build up, the pond becomes shallower and further environmental changes follow.

- **Submerged stage**

As the water body becomes shallower, more submerged rooted species are able to become established due to increasing light penetration in the shallower water. This is suitable for growth of rooted submerged species such as *Myriophyllum*, *Vallisneria*, *Elodea*, *Hydrilla*, and *Ceratophyllum*. These plants root themselves in mud. Once submerged species colonize the successional changes are more rapid and are mainly autogenic as organic matter accumulates. Inorganic sediment is still entering the lake and is trapped more quickly by the net of plant roots and rhizomes growing on the pond floor. The pond becomes sufficiently shallow (2-5 ft) for floating species and less suitable for rooted submerged plants.

- **Floating stage**

-

The floating plants are rooted in the mud, but some or all their leaves float on the surface of the water. These include species like *Nymphaea*, *Nelumbo* and *Potamogeton*. Some free-floating species also become associated with root plants. The large and broad leaves of floating plants shade the water surface and conditions become unsuitable for growth of submerged species which start disappearing. The plants decay to form organic mud which makes the pond more shallow yet (1-3 ft).

- **Reed swamp stage**

The pond is now invaded by emergent plants such as *Phragmites* (reed-grasses), *Typha* (cattail), and *Zizania* (wild rice) to form a reed-swamp (in North American usage, this habitat is called a marsh). These plants have creeping rhizomes which knit the mud together to produce large quantities of leaf litter. This litter is resistant to decay and reed peat builds up, accelerating the autogenic change. The surface of the pond is converted into water-saturated marshy land.

- **Sedge-meadow stage**

Successive decreases in water level and changes in substratum help members of Cyperaceae and Graminae such as *Carex*, *Juncus* to establish themselves. They form a mat of vegetation extending towards the centre of the pond. Their rhizomes knit the soil further. The above water leaves transpire water to lower the water level further and add additional leaf litter to the soil. Eventually the sedge peat accumulates above the water level and soil is no longer totally waterlogged. The habitat becomes suitable for invasion of herbs (secondary species) such as *Mentha*, *Caltha*, *Iris*, and *Galium* which grow luxuriantly and bring further changes to the environment. Mesic conditions develop and marshy vegetation begins to disappear.

- **Woodland stage**

The soil now remains drier for most of the year and becomes suitable for development of wet woodland. It is invaded by shrubs and trees such as *Salix* (willow), *Alnus* (alders), and *Populus*. These plants react upon the habitat by producing shade, lower the water table still further by transpiration, build up the soil, and lead to the accumulation of humus with associated microorganisms. This type of wet woodland is also known as carr.

- **Climax stage**

Finally a self perpetuating climax community develops. It may be a forest (if the climate is humid), grassland (if sub-humid environment), or a desert in arid and semi-arid conditions.

A forest is characterized by presence of herbs, shrubs, mosses, shade-loving plants and trees including decomposers.

The overall changes taking place during development of successional communities are building up of substratum, shallowing of water, addition of humus and minerals, soil building and aeration of soil.

As the water body fills in with sediment, the area of open water decreases and the vegetation types moves inwards as the water becomes shallower. Many of the above mentioned communities can be seen growing together in a water body. The center is occupied by floating and submerged plants with reeds nearer the shores, followed by sedges and rushes growing at the edges. Still further are shrubs and trees occupying the dry land.

Xerosere

- **Xerosere** is a plant succession which is limited by water availability.
- It includes the different stages in a *xerarch succession*.
- Xerarch succession of ecological communities originated in extremely dry situation such as sand deserts, sand dunes, salt deserts, rock deserts etc.
- A xerosere may include lithosere (on rock) and psammosere (on sand).

- **Crustose lichen stage**

- A bare rock consists of solid surface; no place for rooting plants to colonize.
- The thalli of crustose lichens can adhere to the surface of rock and absorb moisture from atmosphere; & colonize the bare surfaces of rocks first.
- The propagules of these lichens are brought by air from the surrounding areas.
- These lichens produce acids which corrode the rock and their thalli collect wind blown soil particles among them that help in formation of a thin film of soil.
- When these lichens die their thalli are decomposed to add humus. This promotes soil building and the environment becomes suitable for growth of foliose and fruticose type of lichens.

Foliose and fruticose lichen stage

- *Foliose* lichens have leaf-like thalli, while the *fruticose* lichens are like small bushes.
- They are attached to the substratum at one point only, therefore, do not cover the soil completely.
- They can absorb and retain more water and are able to accumulate more dust particles.
- Their dead remains are decomposed to humus which mixes with soil particles and help building substratum and improving soil moisture contents further.
- The shallow depressions in the rocks and crevices become filled with soil and topsoil layer increases further. These autogenic changes favor growth and establishment of mosses.

Moss stage

- The spores of xerophytic mosses, such as *Polytrichum*, *Tortula* and *Grimmia* are brought to the rock where they succeed lichens.
- Their rhizoids penetrate soil among the crevices, secrete acids and corrode the rocks.
- The bodies of mosses are rich in organic and inorganic compounds. When these die they add these compounds to the soil, increasing the fertility of the soil.
- As mosses develop in patches they catch soil particles from the air and help increase the amount of substratum.
- The changing environment leads to migration of lichens and helps invasion of herbaceous vegetation that can out-compete mosses.

Herb stage

- Herbaceous weeds, mostly annuals such as asters, evening primroses and milk weeds, invade the rock.
- Their roots penetrate deep down, secrete acids and enhance the process of weathering.
- Leaf litter and death of herbs add humus to the soil.
- Shading of soil results in decrease in evaporation and there is a slight increase in temperature.
- Xeric conditions begin to change and biennial and perennial herbs and xeric grasses such as *Aristida*, *Festuca*, and *Poa*, begin to inhabit.
- These climatic conditions favor growth of bacterial and fungal populations, resulting in increase in decomposition activity.

Shrub stage

- The herb and grass mixture is invaded by shrub species, such as *Rhus* and *Phytocarpus*.
- Shrub consists of densely packed bushes with growth stunted by want of water and high transpiration rate.
- Early invasion of shrub is slow, but once a few bushes have become established, birds invade the area and help disperse scrub seeds.
- This results in dense scrub growth shading the soil and making conditions unfavorable for the growth of herbs, which then begin to migrate.
- The soil formation continues and its moisture content increases. The environment becomes mesic (moderately moist).

Climax community

- Change in environment favors tree saplings to grow.
- The kind of tree species inhabiting the area depends upon the nature of the soil.
- In poorly drained soils Oaks establish themselves. The trees form canopy and shade the area.
- Shade-loving scrubs continue to grow as secondary vegetation.
- Leaf litter and decaying roots weather the soil further and add humus to it making the habitat more favorable for growth to trees.
- Mosses and ferns make their appearance and fungi population grows abundantly.

Climax stage

- The succession culminates in a climax community, the forest. Many intermediate tree stages develop prior to establishment of a climax community. The forest type depends upon climatic conditions. The climax forest may be:
- Oak-Hickory Climax Forest In dry habitat oaks and hickories are climax vegetation. There is only one tree stage and forests are characterized by presence of scrubs, herbs, ferns, and mosses.
- Beech-Hemlock Climax Forest These climax forests develop in mesic climates. The dominant vegetation is Beech and Hemlock. There are many intermediate tree stages. The other vegetation types include herbs, ferns, and mosses.
- American Beech-sugar Maple climax forest These climax forests develop in mesic climates in the Northeastern United States. The dominant vegetation is American Beech and sugar-maple.
- Spruce-Alpine Fir Climax Forest At high altitudes in Rocky Mountains the climax forest is dominated by spruces and alpine firs.