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What is Plant succession ? 1

- The gradual replacement of one type of community by the other is refered to as plant succession.
- According to **E.P.Odum**, plant succession is an orderly process of community change in an unit area.
- According to **Salisbury**, Plant succession is a competitive drift in which at each phase, until the climax, the constituent species render the habitat more favourable to their successors than to themselves.
- **Clements** defined succession is a natural process by which the same locality become successively colonised by different groups of communities.

Succession

- KINDS OF SUCCESSION- Depending upon the nature of bare area on which it develops Plant succession may be of two kinds-
- **<u>1. Primary succession-</u>** When the succession starts on the extreme bare area on which there was no previous existence of vegetation, it is called primary succession or presere.
- <u>2.Secondary succession</u>. This type of succession starts on the secondary bare area which was once occupied original vegetation but later became completely cleared of vegetation(naked, denuded or bare) by the process denudation. This denudation process is brought about by the destructive agencies, such as fire, cultivation, strong winds and rains. The succession progressing on such area is termed as subsere.
- These primary and secondary successions may be of following types—
- A) Hydrosere The plant succession which starts in the aquatic environment is called hydrarch. A series of changes taking place in vegetation of hydrarch is called hydrosere.

Succession

- B) Halosere- It is special type of sere which begins on a salty soil or in saline water.
- C) Xerosere- When the vegetational succession develops on xeric or dry habitats, it is called xerarch or xerosere. Xerosere may be of two types- Psamosere and Lithosere.
- i) Psamosere- It refers to the vegetational succession that begins on sandy soil. ii) Lithosere- It refers to the succession occurs on rock surface.
- D) Serule- It refers to the miniature succession of microorganisms, such as bacteria and different types of fungi on the fallen logs of decaying wood, tree bark etc.

All types of succession generally lead the plant communities towards the climax stage of **mesic community** (mesophytic or mixed mesophytic forests).

Xerosere(Lithosere) 4



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• It is a vegetational succession develops on **xeric or dry** habitats, called as xerarch or xerosere. Xerosere may be of two types- Psamosere and Lithosere. Here Lithosere will be discussed in detail. Xeric succession commonly occurs on bare rock surfaces resulting from glaciations or from erosion by wind and water. The rocky habitat shows many extreme xeric conditions. As the rock is directly exposed to sun, the temperature of rock surface goes very high. There is no water and nutrient holding device on the exposed smooth surface of rock. In such a xeric habitat only those plants can survive which can resist the extreme drought. Xerosere completes in a series of several orderly steps-

- **1.Pioneer crustose lichen stage on Bare rocks-** Bare rocks are produced when glaciers recede or volcanoes erupt. Erosion of these rocks is brought by rain water and wind loaded with soil particles. The rain water combines with atmospheric carbon dioxide(CO2+H2O= H2CO3 carbonic acid) that corrodes the surface of the rocks and produce crevices. Water enters these crevices, freezes and expands to separate boulders. All these processes lead to formation of a little soil at the surface of these bare rocks. Algal and fungal spores reach these rocks by air from the surrounding areas. These spores grow and form symbiotic association, the <u>Crustose lichen</u>, which act as **pioneer colonisers of bare rocks**. The process of succession starts when autotrophic organisms start living in the rocks, in the form of membranous crust. Example of crustose lichens are **Rhizocarpus, Lacidea etc.** In dry periods, these pioneers appear desicated but remain alive.
- The lichens secret carbonic acid in excess(CO2 liberated in respiration combines with water), that corrodes rocky materials, which with decaying lichens make the first thin layer of soil on the rock surface. Nitrogenous compounds formed from the atmospheric gases during lightening are brought to the soil by rains.
- Now the habitat becomes less fit for the existing plants and these begin to disappear from there.

- 2.Foliose and Fruticose lichen stage- Now the rock surface becomes covered with *Foliose* lichens, which have leaf-like thalli, and the *fruticose* lichens which are like small bushes. Ex- Dermatocarpon, Parmelia, Umbiliceria etc. 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 top soil layer increases further. These autogenic changes favor growth and establishment of mosses.
 - **3. Xerophytic 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. These mosses develop rhizoids which penetrate deep in to rocky soil. The decaying older parts of mosses form a thick mat over the rock surface, which increases the water holding capacity.

• 4.Herb stage- When the soil increases in thickness, 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. As a result, the 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 activities.

- **5.Shrub stage**The herb and grass mixture is invaded by shrub species, such as *Rhus* and *Physocarpus*. 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.
- 6.Tree stage-Change in environment favors colonization of tree species. The tree saplings begin to grow among the scrubs and establish themselves. 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.

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• 7.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:
- <u>Oak-hickory climax forest</u> 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.
- <u>Beech-hemlock climax forest</u> 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.
- Beech-maple climax forest-These climax forests develop in mesic climates in the Northeastern United States. The dominant vegetation is American beech and sugar maple.
- <u>Spruce-alpine fir climax forest</u> -At high altitudes in Rocky Mountains the climax forest is dominated by spruces and alpine firs.





Shrubs & Trees

