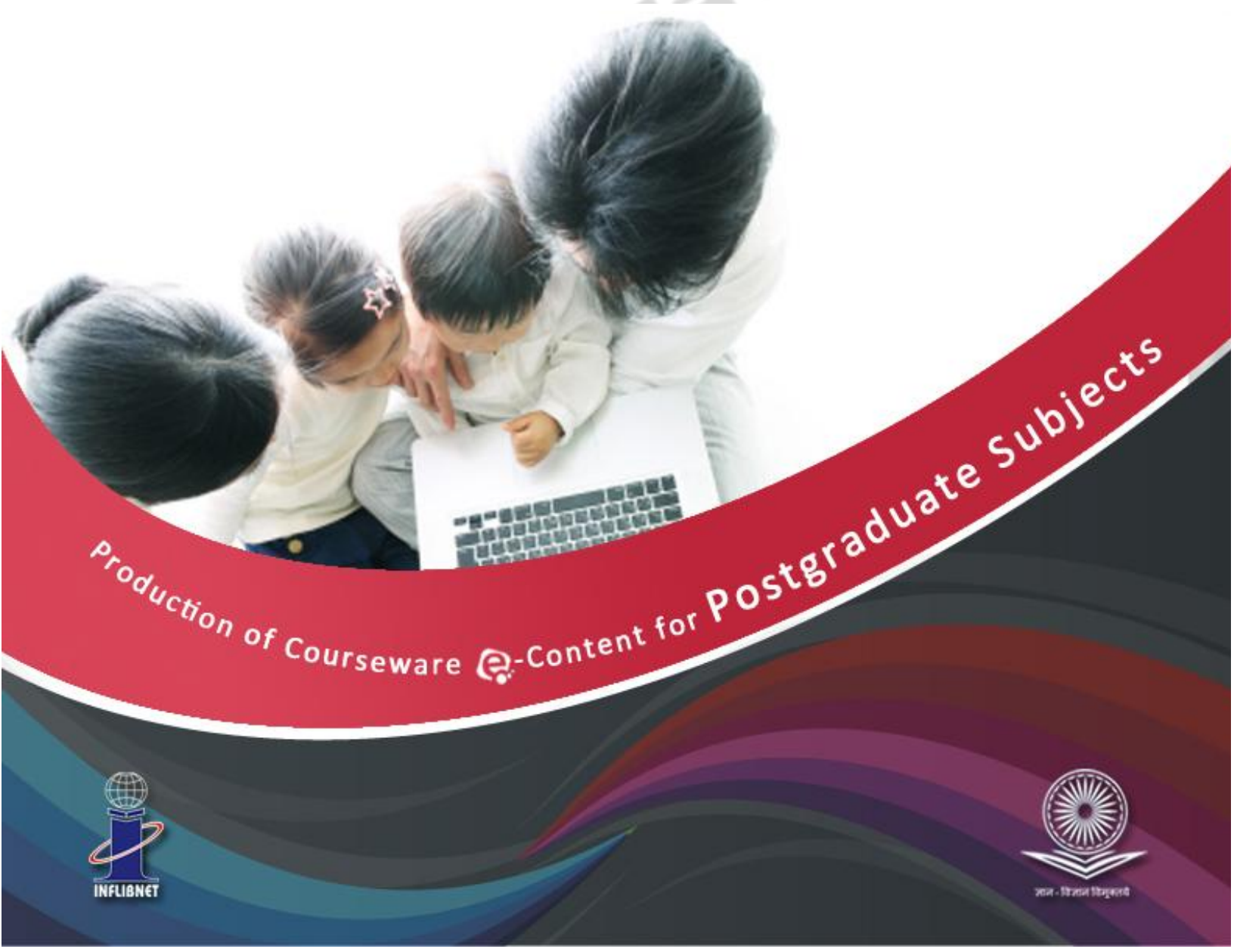
Input Template for Content Writers

(e-Text and Learn More)



Module Detail	
Subject Name	<Botany>
Paper Name	<Ecology>
Module Name/Title	<Succession>
Module Id	<Module Id>
Pre-requisites	<Basic knowledge about Succession >
Objectives	<To make students aware about Succession >
Keywords	<Succession >, <Pioneer Community >, <Sere>, <Seral stages>, Climax

Structure of Module / Syllabus of a module (Define Topic / Sub-topic of module)	
<Succession>	<Introduction>,< Terms used in ecological succession >, <Steps in succession>, <Types of succession >

I. Introduction

Ecological succession or ecosystem development involves the changes in the structure and function of community over time. Succession may also be described as the gradual change which occurs in vegetation of a given area of the earth's surface on which one population succeed the other over a period of time. It can also be defined as a continuous, unidirectional and sequential change in the species composition of the natural community. Seasonal changes are not usually included in the definition of succession, e.g. variation in the grassland vegetation with season. Ecological succession is a normal natural process. Long term changes of thousands or millions of years which include climate change or evolutionary change are usually not included in the definition of succession. Changes occurring in a time span of 1 – 500 years are generally considered as changes due to succession. Ecological succession result in a change in the relative abundance of dominant species or a complete change in species composition from unstable communities to more stable, mature and relatively self-maintaining communities over a period of time. Thus, the ecological succession may be described on the basis of following three important events: (i) It is an orderly process of development of community involving changes in species composition and various processes of community with time, it is reasonably directional and hence predictable. (ii) Course of succession is determined by the changes in the physical environment by the community i.e. community –modified changes in physical environment, and (iii) change terminates in a stable community which perpetuate itself till the climate remains same.

II. Terms used in ecological succession

Bare area: Habitat without any vegetation from where succession starts. Wholly independent of the structural, nutritional aspects of their soil, bare areas may be classified into following three categories according to their characteristic water relations:

(a) Wet or hydric (e.g. pond bottom)

(b) Dry or xeric (e.g. rock surface exposed to the sun)

(c) Intermediate or mesic

Pioneer Community: Succession starts with a community by establishing first in any bare area.

Climax community: Succession ends with a community in which the species perpetuate themselves through reproduction till the climate remain the same.

Successional or Seral community: The relatively transitory communities or developmental stages which develop during the course of succession and exhibit some directional, cumulative, non-random change in a period of 1 – 500 years, until a climax community is achieved.

Sere: Whole sequence of communities that replace one another in a given area i.e. the entire progression of seral stages from the first one to occupy bare area to the climax community.

The seres that begin on wet, dry or intermediate bare areas are known as hydrosere or hydrarch, xerosere or xerarch and mesosere or mesarch respectively.

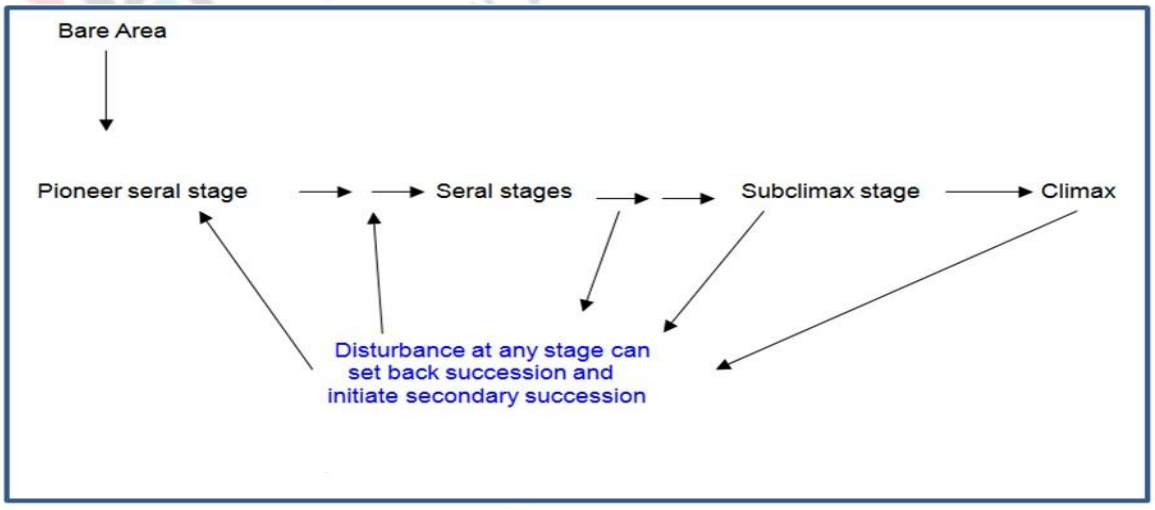


Fig.1. Schematic representation of process of succession

III. Steps in succession

Clements (1916) divided whole succession process in three phase and six steps:

Phase I – Initiation: Involves three following steps:

Step 1: Nudation – Exposure of new substrate

Step 2: Migration – Arrival of disseminates (i.e. seeds, spores or vegetative propagules)

Step 3: Ecesis – Refers to germination, establishment, growth and reproduction of propagules

Phase II – Continuation/Natural selection: Involves following two steps:

Step 4: Competition – It may result in species replacement

Step 5: Reaction – It involves a habitat change through the species

Competition and reaction occurs simultaneously.

Phase III – Termination: Involves only one step

Step 6: Stabilization –Refers to the stabilization of climax community i.e. Homeostasis

From migration to reaction, four steps are mechanically repeated several times in a cyclic fashion. Each turn of the cycle gives a new seral community.

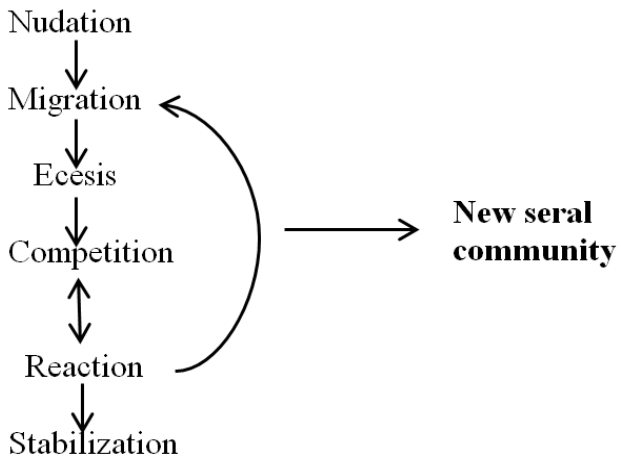


Fig.2. Flow chart showing steps in succession

IV. Major types of succession or major Successional patterns

1. Primary succession and Secondary succession

Primary succession: Refers to the establishment of vegetation on area not previously vegetated. It may be hydrarch primary succession, if the pioneer community becomes established on a wet substrate (e.g. pond, lake, etc) or xerarch primary succession, if the pioneer community becomes established on a dry substrate (e.g. sand dunes, rocks, etc)

Fig.3. Diagrammatic representation of an example of 'Primary Succession'

Secondary succession: It is the establishment of vegetation in an area that has been previously vegetated, but the pre-existing vegetation having been destroyed by some disturbances caused either by human activities (e.g. logging, cultivation, etc.) or natural catastrophe (e.g. flood, landslide, hurricane, etc.) The barren surface is not as severe as the surface in primary succession. Since the soil remains there (may not be fertile), many plant propagules (seeds,

rhizomes etc.) may remain in the soil. Secondary succession is generally faster than primary succession. Secondary succession on abandoned cropland is known as 'old field succession'.

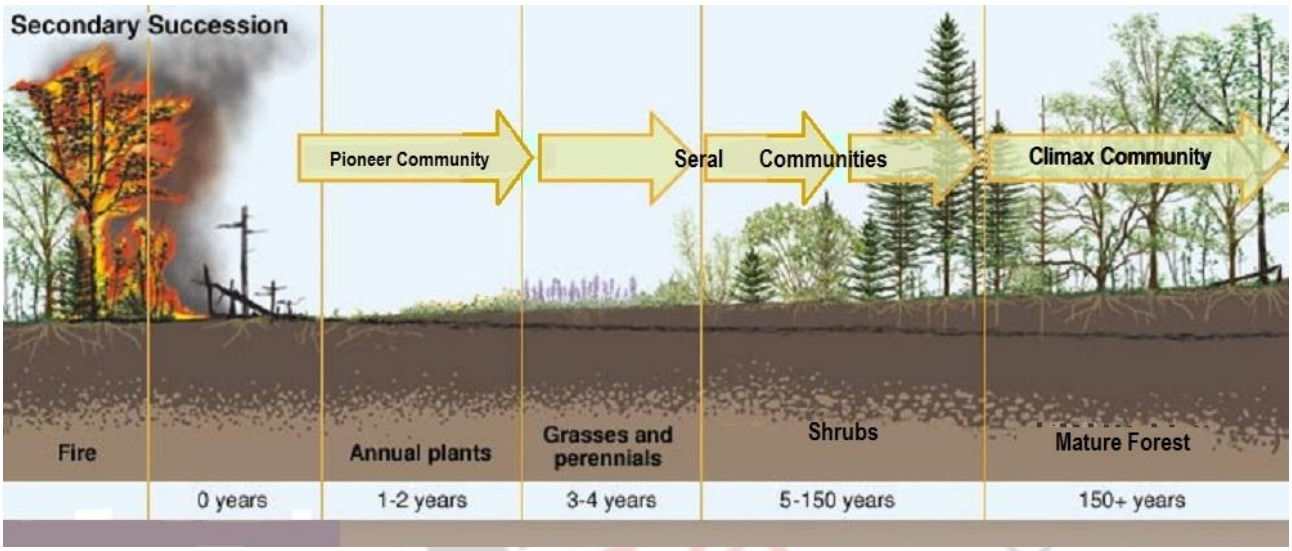


Fig.4. Diagrammatic representation of an example of 'Secondary Succession'

2. **Autogenic succession and Allogenic succession**

Autogenic succession (Auto=self; genic=generated)

When course of succession is largely driven or determined by internal coactions then such type of succession is known as Autogenic Succession i.e. the change in both the environment and the community is brought about by the activities of organisms themselves. Change in environment for example is brought about by plant shade or litter input to soil which in turn will result into change in structure and properties of soil leading to change in species composition with time.

Allogenic Succession- (externally generated)

When course of succession is controlled by some external driving forces, i.e. the forces beyond the control of the indigenous organisms or the changes in the environment are caused by some external factor unaffected by the organism (e.g. storms, fire etc.), such type of succession is known as allogenic succession.

3. Progressive Succession and Retrogressive Succession

Progressive Succession: Refers to the succession which leads to community with more complexity and biomass and to habitats that are progressively more and more mesic (moist).

Retrogressive succession- leads in the opposite direction i.e. loss of species and decrease in structural complexity as a result of site destruction, towards either a more hydric (wet) or a more xeric (dry) habitat.

Retrogressive successions may either be allogenic e.g. introduction of cattle or weedy annuals or Autogenic.

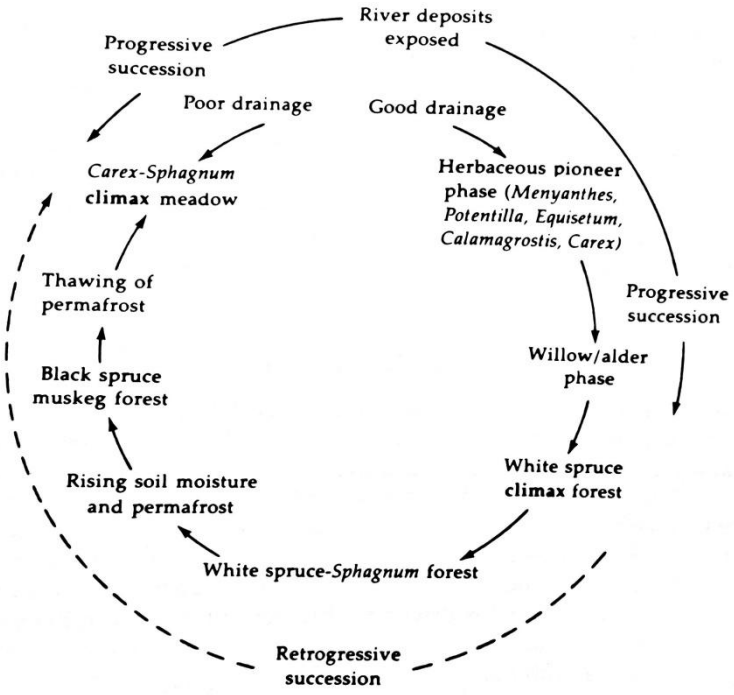


Fig.5. Schematic representation of an example of progressive and retrogressive succession on Alaskan flood plains. Succession in Alaskan flood plain may at first be progressive, leading from a sedge meadow to a white spruce forest with low shrubs of cranberry and blueberry. The dense shade, however, encourages the growth of a dense moss carpet and the encroachment of a shallow layer of frozen soil and water (permafrost) layer. As the soil moisture rises, sphagnum

moss invades, white spruce is replaced by black spruce, and ultimately retrogression to a sedge meadow result.

4. **Directional succession and Cyclic succession**

Directional Succession: Characterized by an accumulation of changes that lead to community-wide changes.

Cyclic Succession: Characterized by non-directional succession that is cyclic in nature and generally involves a type of local changes.

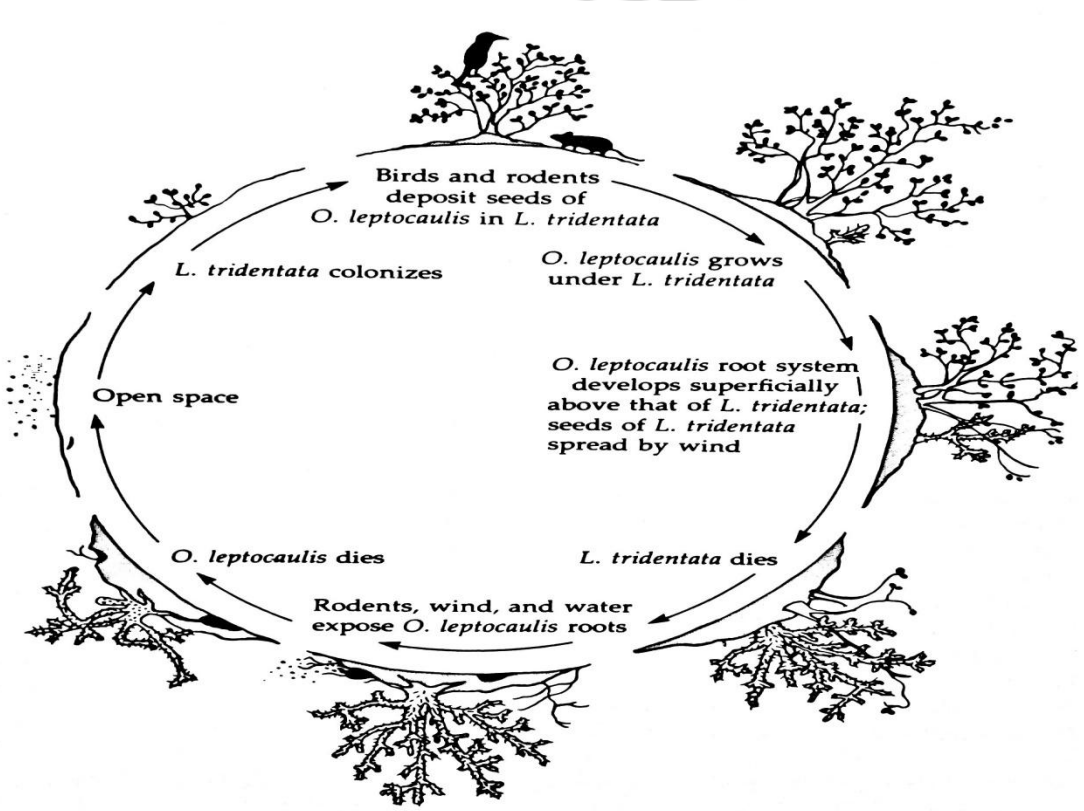


Fig.6. Schematic representation of example of cyclic succession in a desert scrub in Texas, USA. (Opuntia *leptocaulis* and *Larrea tridentate*)