Hello students.

Programme: Bachelor of Science, Third year

Subject: Botany Semester six

Course code: BOC 110.

Course title: Plant ecology and Phytogeography.

Unit Title: Plant communities

Module name: Process of succession, Climax concepts.

I am Conceicao De Souza, Associate professor, St. Xavier's College, Mapusa - Goa

The outline of the module is

Definition

Process of succession.

Climax concepts

Learning Outcomes.

This module

Defines the term succession,

Describes the process of succession,

Explains the term climax,

Understands the climax concepts,

Succession: Occurrence of relatively definite sequence of communities over a period of time in the same area.

Factors causing succession

Initiating or Initial causes:

Climatic: Erosion and deposits, wind, fire etc. caused by lightning or volcanic activity.

Biotic: Various activities of organisms. These results in destruction of existing populations in an area and results in formation of barren land.

Ecesis or continuing causes: Processes such as migration, ecesis, aggregation, competition, reaction etc. cause successive waves of population as a result of changes, chiefly edaphic features.

Stabilising causes: Cause the stabilisation of the community.

Basic types of succession:

Primary succession: Starts from a primitive substratum, where there was no previously any sort of living matter.

The first group of organisms establishing are called pioneers or primary community or primary colonisers.

Secondary succession: Starts on previous built substrata with already existing living matter.

Autogenic succession: replacement with a new community as a result of reactions of existing community with the environment which results in modification of its own environment.

Allogenic succession: replacement with a new community as a result of any other external condition and not by the existing organisms.

Autotrophic succession: Characterised by dominance of autotrophic organisms like green plants.

There is gradual increase in the organic matter content supported by energy flow.

Heterotrophic succession: Characterised by heterotrophs such as bacteria, actinomycetes, fungi etc.

There is a progressive decline in the energy content.

The process of succession consists of five steps: Nudation, Invasion, Competition and coactions, Stabilization and before that you have reaction

Nudation: Development of barren land without any form of life.

There are different causes for nudation.

Topographic causes: soil erosion by gravity, water or wind, deposition of sand, landslide, volcanic activity.

Climatic causes: dry period, storm, frost, fire, glaciers.

Biotic causes: activities of human for development, industry, housing. There is epidemics by fungi and viruses.

Invasion: Successful establishment of a species in the barren area.

It involves three stages: Migration, Ecesis, Aggregation.

Migration: Seeds, Spores and Propagules brought by air, water, human etc to barren area.

Ecesis (Establishment): Establishment of species as a result of adjustment with conditions prevailing there is known as Ecesis.

After migration, seeds or propagules germinate, grow as seedling, mature as adults and reproduce.

Only few capable of doing this under the primitive harsh conditions. As a result of establishment individual species become established in the area.

Aggregation: Due to reproduction individuals species increases in number and come closer to each other.

Competition & Co-action:

Due to aggregation develops competition, Inter and intra specific for space and nutrition.

Individuals of species affect each other's life in various ways and this is called Co-action.

If unable to compete with other species present, they get discarded.

To withstand competition, reproductive capacity and wide ecological amplitude is important

Reaction:

Most Important stage in succession.

Mechanism of modification of environment through influence of living organisms on it is known as reaction.

Reactions result in change in soil, water, light conditions, temperature etc. As a result of which the environment modified, becomes unsuitable for existing community and sooner or later replaced by another community.

Whole sequence of communities that replaces one another in given area – sere

Various communities constituting the sere – seral communities / seral stages / developmental stages.

a barren land is occupied by a series of communities like a,b,c,d,e,f,g,h,i etc.

Out of all these the last terminal community tends to remain over there undisturbed for a long time and is designated as a climax community

Stabilization or Climax:

Finally a stage occurs in the process wherein the final terminal community becomes more or less established for a longer period of time .It can maintain itself in equilibrium with climate of area for a longer time. Final community is not replaced for a long time and is known as Climax community and the stage

CLIMAX CONCEPTS

CLIMAX

Final terminal and more or less established community in succession which is able to establish some sort of equilibrium with the environmental conditions of that area is called Climax according to Clements in the

year 1916

According to Clements

Climax has 3 principle characteristics:

1. Unity: Climax is a unit, index of climate of area. Life/Growth forms of plants indicate the climate type.

Unless all species are not taken as an organised unit, climax would not indicate the climate.

2. Stability:

More or less stable with the climate. Can be replaced through competition by any other group of species.

Climax communities have a few characteristic dominant species.

3. Origin & phylogenetic relations:

Should be treated equivalent to an organism. The way organism takes birth, grows, develops and

matures. Designated as super organism in organismic – concept of climax community.

It undergoes changes with changing climate similar to development of organism.

Phylogenetic relations may be established between different climax communities of the world.

Climax concept in ecology.

There are three popular theories to describe the climax concept in ecology.

Monoclimax theory

Polyclimax theory

Climax – pattern hypothesis

Monoclimax theory (Climatic – climax concept of Clements)

Within a given region all land surfaces eventually tend to be occupied by a single stable climax

community which is determined solely by regional stable climate according to Clements

Equilibrium state is never reached and succession is infact a variable approaching a variable rather than a constant, according to Cowles.

Cowles disagreed with the idea of stability.

Cooper considered climax state as stage of minimum change, rather than finally changed state of succession.

Climax may not be taken equivalent to an organism, from which it differs in several respects.

Therefore community may not be considered as a unit.

Commonly observed that in same climate climax communities are different because depending upon their primary stages and habitat characteristics their successional stages are also different.

Concept that climax is infact controlled solely by one factor i.e. climate cannot be accepted.

Polyclimax theory

Monoclimax theory opposed by many ecologists.

Tansley in 1935 came with a concept which said climax controlled by many factors and not one factor i.e. Climate.

Accordingly Tansley's concept became popularly known as Polyclimax theory.

Clements agreed with Tansley but he thought that these communities would soon or later develop into climatic – climax types.

Clements introduced a number of terms to accommodate these stages in his own hypothesis

Sub climax – stage just preceding the climatic-climax.

Sere climax – established due to microclimate or effects of factors like soil, fire etc.

Dis climax or Disturbed – Disturbance of man or other biotic factors which prevents establishment of

climatic-climax.

Pre climax – life forms lower than those in expected climatic-climax may be due to drier habitat.

Post climax – higher forms those in expected climatic-climax may be due to moist or colder habitat.

Types depending upon the nature of factor in stabilisation

Edaphic climax is developed on underdeveloped soil, develops due to edaphic effects.

Biotic climax due to biotic disturbances e.g. man, animals, grazing effect etc.

Topographic climax due to differences in topographic factors like mountains, hills etc.

Fire climax due to repeated effects of fire.

Acc to polyclimax theory the climax stage may be controlled by any factor of environment and not only by climate

Climax – pattern hypothesis proposed by R.H.Whittaker in 1953.

On the basis of community gradient analysis, the communities at a particular place are in accordance with all the factors of environment.

In this area vegetation can be divided into smaller basic units.

According to the hypothesis there is only one community that changes according to soil, slope and other habitat factors.

References.

Thank you.