Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (Third Year)

Subject: Botany

Course Code: BOC 110

Course Title: Plant Ecology and Phytogeography

Unit: 06

Module Name: Process of Succession, Climax concepts

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Notes:

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

Factors causing succession

1. Initial or initiating causes:

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

b) Biotic: Various activities of organisms.

These results in destruction of existing populations in an area and formation of barren land.

2. 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.

3. Stabilising causes:

Cause the stabilisation of the community.

Basic types of succession:

1. **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**.
2. **Secondary succession:** Starts on previous built substrata with already existing living matter.
3. **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.
4. **Allogenic succession:** replacement with a new community as a result of any other external condition and not by the existing organisms.
5. **Autotrophic succession:** Characterised by dominance of autotrophic organisms like green plants.

   There is gradual increase in the organic matter content supported by energy flow.
6. **Heterotrophic succession:** Characterised by heterotrophs such as bacteria, actinomycetes, fungi etc.

   There is a progressive decline in the energy content.

PROCESS OF SUCCESSION

1. **NUDATION**

Development of barren land without any form of life.

TOPOGRAPHIC CAUSES: Soil erosion by gravity, water or wind. Deposition of sand, landslide, volcanic activity.

CLIMATIC CAUSES: Dry period, Hails and storm, Frost, Fire, Glaciers.

BIOTIC CAUSES: Activities of Human for development, Industry, Housing.

Disease epidemics by Fungi and Viruses.

2. 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 and become seedling which in turn grow grow 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 individual species increase in number and come closer to each other.

3. COMPETITION & CO-ACTION

Due to aggregation, there 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 Coaction. If unable to compete with other species present, they get discarded

To withstand competition - reproductive capacity, wide ecological amplitude is important.

4. 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 the environment is modified making it unsuitable for existing community,

thus sooner or later gets 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.**

BARREN LAND → A (10 years) → B (30) → C (32) → D (40) → E (46) → F (60) → G (64) → H (73) → I (120) (CLIMAX).

5. **STABILIZATION (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.

Final community is not replaced for a long time and is known as **CLIMAX COMMUNITY** and the stage **CLIMAX 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.

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 only with a few characteristic dominant species.

3. ORIGIN & PHYLOGENETIC RELATIONS:

Should be treated equivalent to an organism.

Birth..... Grows ... Develops.... Mature.

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

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

3 popular theories

1. MONOCLIMAX THEORY
2. POLYCLIMAX THEORY
3. CLIMAX – PATTERN HYPOTHESIS

1. **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….. **Clements**

   Equilibrium state is never reached and succession is infact a variable approaching a variable rather than a constant …… **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.

2. POLYCLIMAX THEORY

Monoclimax theory opposed by many ecologists.

Tansley (1935)….. 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 (**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 stabilization.

EDAPHIC CLIMAX – 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 e.g. mountains, hills etc.

FIRE CLIMAX – due to repeated effects of fire.

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

3. CLIMAX – PATTERN HYPOTHESIS

R.H.Whittaker (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.