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SOME COMMUNITY CHARACTERISTIC TERMINOLOGY

BY

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ZOOLOGY: SEM- I, PAPER- C2T: ECOLOGY, UNIT 3: COMMUNITY

Vertical Stratification:

Stratification in the field of ecology refers to the vertical layering of a habitat; the arrangement of vegetation in layers. It classifies the layers (sing. stratum, pl. strata) of vegetation largely according to the different heights to which their plants grow. The individual layers are inhabited by different animal and plant communities (stratozones). The **vertical distribution** of different species occupying different levels in an ecosystem is called stratification. Trees occupy the topmost vertical layer of a forest, shrubs occupy

the second layer, and herbs and grasses occupy the bottommost or base layers.

Vertical structure in terrestrial plant habitats:

The following layers are generally distinguished: **forest floor (root and moss layers), herb, shrub, understory and canopy layers**. These vegetation layers are primarily determined by the height of their individual plants, the different elements may however have a range of heights. The actual layer is characterised by the height

range in which the vast majority of photosynthetic organs (predominantly leaves) are found. Taller species will have part of their shoot system in the underlying layers. In addition to the above-ground stratification there is also a “root layer”. In the broadest sense, the layering of diaspores in the soil may be counted as part of the vertical structure. The plants of a layer, especially with regard to their way of life and correspondingly similar root distribution interact closely and compete strongly for space, light, water and nutrients. The stratification of a plant community is the result of long selection and adaptation processes. Through the

formation of different layers, a given habitat is better utilized. Strongly vertically stratified habitats are very stable ecosystems. The opposite is not true, because several less stratified vegetation types, such as reed beds, can be very stable. The layers of a habitat are closely interrelated and at least partly interdependent. This is often the case as a result of the changes in microclimate of the top layers, the light factor being of particular importance.

Besides the superposition of different plants growing on the same soil, there is a lateral impact of the higher layers on adjacent plant

communities, for example, at the edges of forests and bushes. This particular vegetation structure results in the growth of certain vegetation types such as forest mantle and margin communities.

Tree layer:

- This layer of vegetation starts from a height of about 5 metres and comprises the top stratum, which consists of phanerophytes.
- They can be about 45 metres high.

- The trees (and sometimes shrubs) are of various heights.
- One tree has its crown at the height of another's trunk.
- At the top the crowns of the different species of trees form a more or less closed canopy.
- This layer creates special ecological conditions in the underlying layers of forests.
- The density of the trees determines the amount of light inside the forest.
- The force of heavy rainfall is reduced by the canopy and the passage of rainwater is fed more slowly downwards.

- The tree layer can be further subdivided into the upper tree layer or canopy and the lower tree layer or understory.

Canopy:

- The canopy usually refers to the highest layer of vegetation in a forest or woodland, made up of the crowns of its tallest trees.
- However, individual trees growing above the general layer of the canopy may form an emergent layer.

Understory:

The understory can refer to those trees above the shrub layer and below the canopy, but is often defined more broadly, including the shrub layer.

Shrub layer:

- The shrub layer is the stratum of vegetation within a habitat with heights of about 1.5 to 5 metres.

- This layer consists mostly of young trees and bushes, and it may be divided into the first and second shrub layers (low and high bushes).
- The shrub layer needs sun and little moisture, unlike the moss layer which requires a lot of water.
- The shrub layer only receives light filtered by the canopy, i.e. it is preferred by semi-shade or shade-loving plants that would not tolerate bright sunlight.

- Small to medium sized birds sometimes known as bush nesters are often found in the shrub layer where their nests are protected by foliage.
- European examples include blackbird, song thrush, robin or blackcap.
- In addition to shrubs, such as elder, hazel, hawthorn, raspberry and blackberry, clematis may also occur while, in other parts of the world, vines and lianas may form part of this stratum.
- At the edge of a woodland the shrub layer acts as a windbreak close to the trees and protects the soil from drying out.

Herb layer:

- This layer contains mostly non-woody vegetation, or ground cover, growing in the forest with heights of up to about one and a half metres.
- The herb layer consists of various herbaceous plants (therophytes, geophytes, cryptophytes, hemicryptophytes), dwarf shrubs chamaephytes) as well as young shrubs or tree seedlings.

- In forests, early flowering plants appear first before the canopy fills out.
- Thereafter, the amount of light available to plants is significantly reduced and only those that are suited to such conditions can thrive there.
- By contrast, grassland consists of only moss and herb layers. Sometimes, a shrub layer builds up in grasslands as part of a process of spontaneous reforestation (ecological succession).

Forest floor/Grassland:

The term forest floor can refer to the moss and root layers, but often is defined more broadly, including also dead trees, herbaceous plants, mushrooms, and tree seedlings.

Moss layer:

Growing on the surface of the forest floor is vegetation of up to about 0.15 metres in height in what is variously described as a moss, soil or cryptogam layer. The ground itself is covered by a

layer of dead plant and animal material. In this layer and the underlying few centimetres of the topsoil live innumerable small soil organisms such as bacteria, fungi, algae and microorganisms, which break down the dead organic substances and work them into the soil. In places the ground is covered by lichens and mosses.

Root layer/Subterranean:

Also known as the rhizosphere, the underground area of a plant habitat is the root layer. It consists of the plants' roots and related elements such as rhizomes, bulbs and tubers.

Ecotone:

- An ecotone is a transition area between two biological communities, where two communities meet and integrate.
- It may be narrow or wide, and it may be local (the zone between a field and forest) or regional (the transition between forest and grassland ecosystems).
- An ecotone is a zone of junction or a transition area between two biomes (diverse ecosystems).

- An ecotone is an area that acts as a boundary or a transition between two ecosystems.
- Ecotone is the zone where two communities meet and integrate.
- A common example could be an area of marshland between a river and its riverbank.
- Ecotones are of great environmental importance in the study of the environment and ecology.
- Because the area is a transition between two ecosystems or biomes, it is natural that it contains a large variety of species of

fauna and flora as the area is influenced by both the bordering ecosystems.

- Examples of ecotones include marshlands (between dry and wet ecosystems), mangrove forests (between terrestrial and marine ecosystems), grasslands (between desert and forest), and estuaries (between saltwater and freshwater).
- Mountain ranges can also create ecotones due to the changes in the climatic conditions on the slopes.
- The mangrove forests represent an ecotone between marine and terrestrial ecosystem.

- Other examples are grassland (between forest and desert), estuary (between fresh water and salt water) and riverbank or marshland (between dry and wet).
- The Kra ecotone between 11°N and 13°N latitude just north of the Kra Isthmus that connects the Thai-Malay Peninsula with mainland Asia is an example of a regional scale ecotone.
- General examples of ecotones include salt marshes and riparian zones.
- A riparian zone or riparian area is the interface between land and a river or stream.

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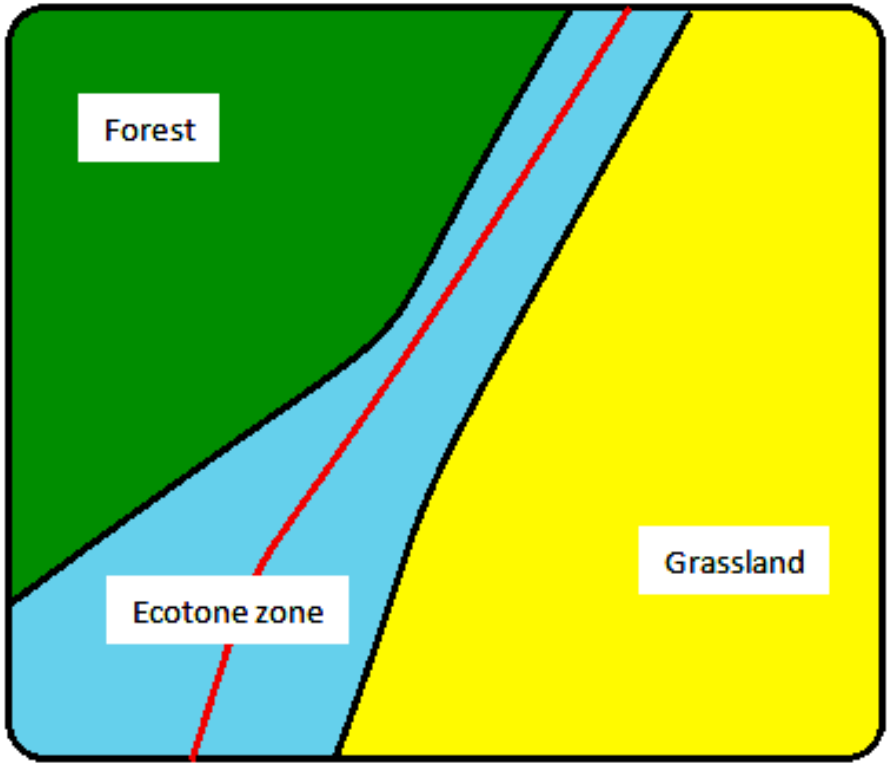

A forest-grassland Ecotone

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Characteristics of Ecotone:

1. It may be narrow (between grassland and forest) or wide (between forest and desert).
2. It has conditions intermediate to the adjacent ecosystems. Hence, it is a zone of tension.
3. Usually, the number and the population density of the species of an outgoing community decreases as we move away from the community or ecosystem.
4. A well-developed ecotone contains some organisms which are entirely different from that of the adjoining communities.

5. Ecotones can be natural or man-made. For example, the ecotone between an agricultural field and a forest is a man-made one.

Importance of Ecotone:

1. They have a greater variety of organisms.
2. They also offer a good nesting place for animals coming in search of a nesting place or food.
3. They serve as a bridge of gene flow from one population to another because of the larger genetic diversity present.

4. They can act as buffer zones offering protection to the bordering ecosystems from possible damage. For example, a wetland can absorb pollutants and prevent them from seeping into the river.
5. Ecotones are also a sensitive indicator of global climate change. A shifting of boundaries between ecosystems is thought to be due to climate change. So, scientists and environmentalists are studying ecotones with greater interest now.

Causes of Ecotone:

- Ecotones are created because of abrupt changes in environmental conditions.
- When an ecosystem (or community) changes abruptly from one to another, that zone is called an ecotone. This is a fundamental characteristic of landscapes that is often studied by landscape ecologists.
- This zone can traverse long stretches along two ecosystems and is a place where characteristics of both ecosystems can be seen.

Therefore, it makes for a completely different habitat. Plenty of examples exist in nature.

- The classic example of an ecotone is the transition from a forest to a grassland ecosystem.
- As the conditions of temperature and rainfall varies, we tend to see a slow change in the tree composition of the forest. Quite suddenly, the forest will give way to the open spaces of a grassland.
- Another example is that of a floodplain; a shift from terrestrial to aquatic ecosystem. The stretch of the bank where these two

ecosystems meet forms one of the most important ecotones in nature.

- Ecotones within an ecosystem as well is often seen in elephant habitats. When elephants move, they tend to break up the forest by trampling and create a grassland-type situation along their path. They use the same path over and over again (creating elephant corridors), eventually making sure there is no tree cover there.
- Ecotones are of interest to ecologists because they are not only a physical transition from one ecosystem to another, they also

represent a transition in the living conditions: both in habitats and niches.

- Along this ecotone, organisms from both communities face increasing environmental stresses. For example, a deer (terrestrial animal) cannot live comfortably in an area that consists of wet marshlands (the ecotone between terrestrial and aquatic ecosystems). Similarly, the same deer will find it difficult to survive along the ecotone of a forest and a grassland because of lack of open spaces. It cannot keep a lookout for predators as effectively as it can in open grasslands. However,

the zone also represent an opportunity for other organisms. This opportunity is as a result of different living conditions in close proximity to each other.

- Diversity leads to stability in nature; with greater vegetation complexity and landscape elements, many different organisms can survive in ecotones. For example, terrestrial organisms will come towards the river bank to drink water. Birds often thrive in these ecotones as they get fish for food.
- Ecotones are harsh conditions for interior organisms but zones of opportunities for edge organisms.

- Since the ecosystem characteristics are so unique in ecotones, we also find a completely new array of species along this zone.
- Taking the river-land example again, we will find many amphibians and reptiles living along this ecotone.
- These animals will not be found in the interior zones of either ecosystem.

Edge Effect:

- Edge effects refer to the changes in population or community structures that occur at the boundary of two or more habitats.
- Generally, there is a greater number of species found in these regions (ecotones) and this is called the **edge effect**. The species found here are called **edge species**.
- The greater number of landscape elements, vegetation complexity and mixed ecosystem characteristics result in

greater density and biodiversity along the ecotones. This phenomenon is called the **edge effect**.

- Areas with small habitat fragments exhibit especially pronounced edge effects that may extend throughout the range.
- As the edge effects increase, the boundary habitat allows for greater biodiversity.
- Amphibians are the classic edge species of floodplain ecotones. They are able to perform most of their daily activities along these edges.

- There are some species that are “edge species” for only a short period of time.
- Seasonal edge species are quite common in nature. For example, there are some species of fishes that come from the sea to estuaries for spawning.
- Sea turtles are also unique organisms that come into beaches to lay eggs, and get back to their sea habitat when their young ones are ready.
- Some other species are found in both edge as well as interior habitats. The squirrel is an example.

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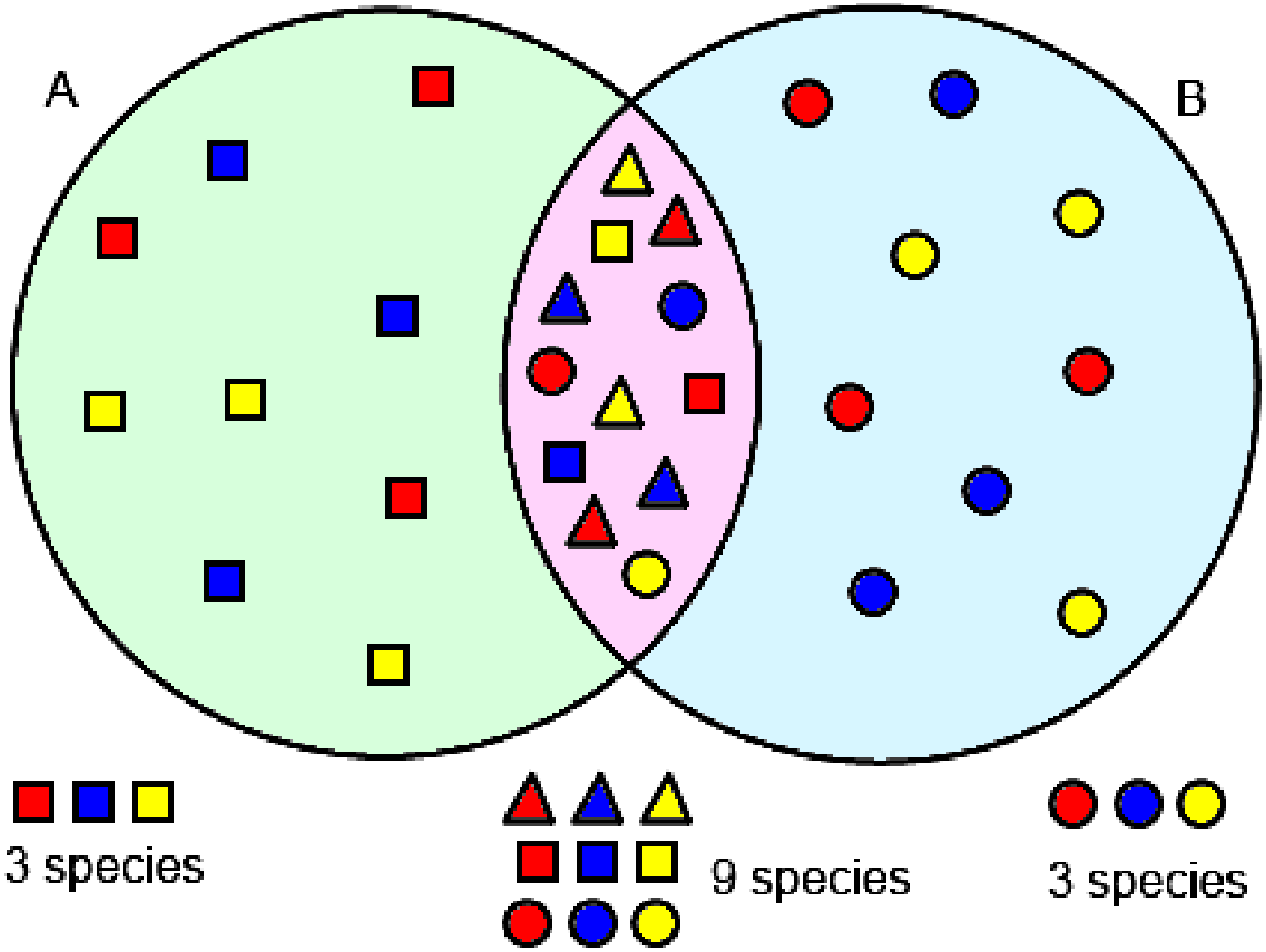

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Types of Edge Effect:

- **Inherent** – Natural features stabilize the border location.
- **Induced** – Transient natural disturbances (e.g., fire or flood) or human related activities, subject borders to successional changes over time.
- **Narrow** – One habitat abruptly ends and another begins (e.g., an agricultural field.)
- **Wide**– A large distance separates the borders of two clearly and purely definable habitats based upon their physical

conditions and vegetation, and in between there exists a large transition region.

- **Convoluted** – The border is non-linear.
- **Perforated** – The border has gaps that host other habitats.

Height can create borders between patches as well.

Ecocline:

- Ecocline is a zone of gradual but continuous change from one ecosystem to another when there is no sharp boundary between the two in terms of species composition.

- Ecocline occurs across the environmental gradient (gradual change in abiotic factors such as altitude, temperature (thermocline), salinity (halocline), depth, etc.).

Edge Effect – Edge Species:

- Edge effect refers to the changes in population or community structures that occur at the boundary of two habitats (ecotone).
- Sometimes the number of species and the population density of some of the species in the ecotone is much greater than either community. This is called edge effect.
- The organisms which occur primarily or most abundantly in this zone are known as edge species.

- In the terrestrial ecosystems edge effect is especially applicable to birds.
- For example, the density of birds is greater in the ecotone between the forest and the desert.

Ecological Niche:

- Niche refers to the unique functional role and position of a species in its habitat or ecosystem.

- The functional characteristics of a species in its habitat is referred to as “niche” in that common habitat.
- In nature, many species occupy the same habitat, but they perform different functions:
  - habitat niche – where it lives, food niche – what is eats or decomposes & what species it competes with,
  - reproductive niche – how and when it reproduces,
  - physical & chemical niche – temperature, land shape, land slope, humidity & another requirement.

- Niche plays an important role in the conservation of organisms. If we have to conserve species in its native habitat, we should have knowledge about the niche requirements of the species.

Difference between niche and habitat:

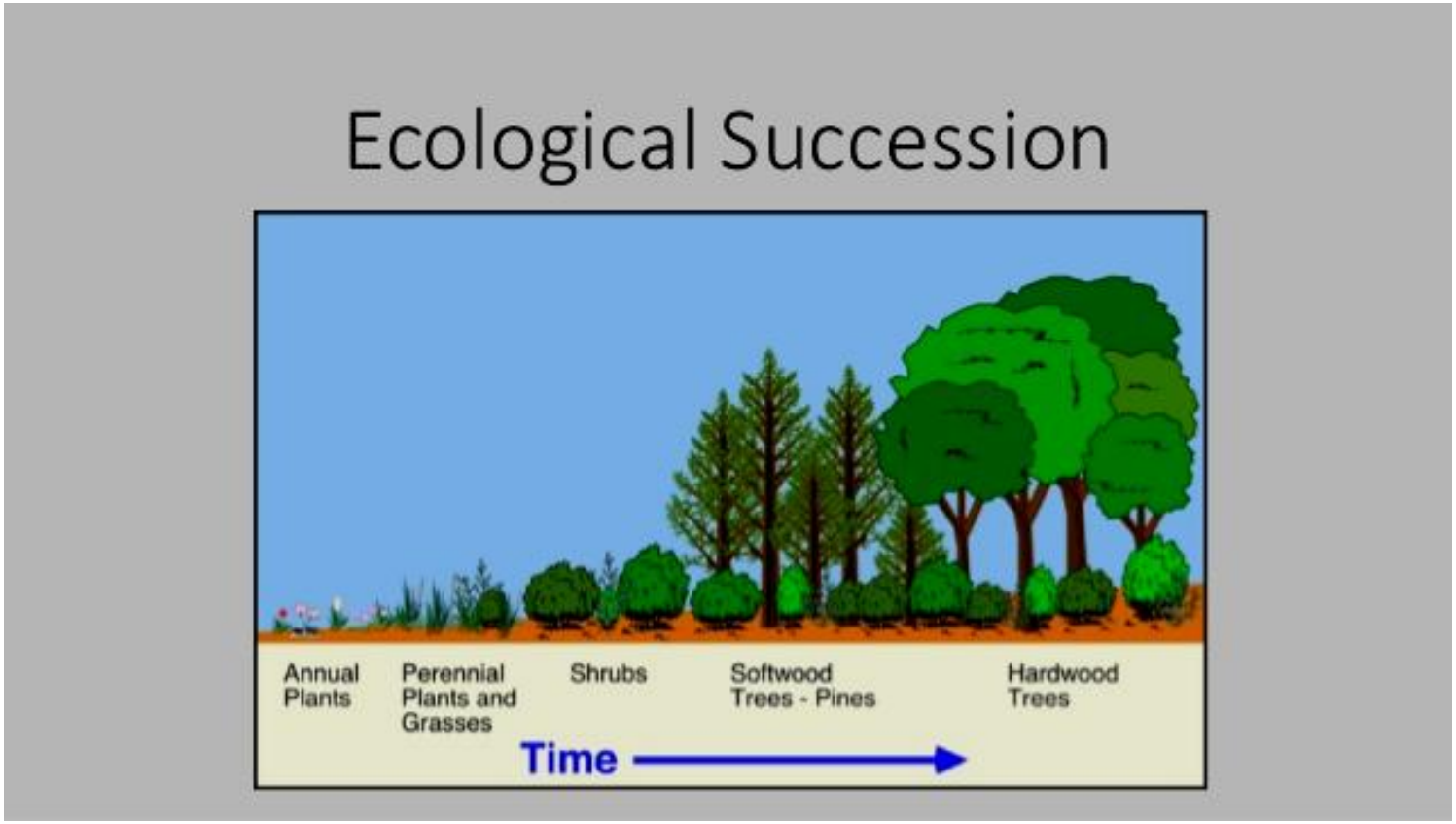
- The habitat of a species is like its 'address' (i.e. where it lives) whereas niche can be thought of as its "profession" (i.e. activities and responses specific to the species).

- A niche is unique for a species while many species share the habitat.
- No two species in a habitat can have the same niche. This is because of the competition with one another until one is displaced.
- For example, a large number of different species of insects may be pests of the same plant, but they can co-exist as they feed on different parts of the same plant.

Ecological succession:

Ecological succession is the process of change in the species structure of an ecological community over time. Ecological succession is a series of changes that occur in an ecological community over time. The time scale can be decades (for example, after a wildfire), or even millions of years after a mass extinction. Succession is the order of colonization of species in an ecosystem from a barren or destroyed area of land. Mosses and lichens are the first species that inhabit an area. They make the area suitable for

the growth of larger species such as grasses, shrubs and finally trees.



Ecological succession is the steady and gradual change in a species of a given area with respect to the changing environment. It is a predictable change and is an inevitable process of nature as all the biotic components have to keep up with the changes in our environment. The ultimate aim of this process is to reach equilibrium in the ecosystem. The community that achieves this aim is called a climax community. In an attempt to reach this equilibrium, some species increase in number while some other decrease. In an area, the sequence of communities that undergo

changes is called sere. Thus, each community that changes is called a seral stage or seral community.

All the communities that we observe today around us have undergone succession over a period of time since their existence. Thus, we can say that evolution is a process that has taken place simultaneously along with that of ecological succession. Also, the initiation of life on earth can be considered to be a result of this succession process.

If we consider an area where life starts from scratch by the process of succession, it is known as primary succession. However, if life starts at a place after the area has lost all the life forms existing there, the process is called secondary succession.

It is obvious that primary succession is a rather slow process as life has to start from nothing whereas secondary succession is faster because it starts at a place which had already supported life before. Moreover, the first species that comes into existence during primary succession is known as pioneer species.

Main types of Ecological Succession:

These are the following types of ecological succession:

Primary Succession:

Primary succession is the succession that starts in lifeless areas such as the regions devoid of soil or the areas where the soil is unable to sustain life.

When the planet was first formed there was no soil on earth. The earth was only made up of rocks. These rocks were broken down by microorganisms and eroded to form soil. The soil then becomes the foundation of plant life. These plants help in the survival of different animals and progress from primary succession to the climax community.

If this primary ecosystem is destroyed, secondary succession takes place.

Secondary Succession:

Secondary succession occurs when the primary ecosystem gets destroyed. For eg., a climax community gets destroyed by fire. It gets recolonized after the destruction. This is known as secondary ecological succession. Small plants emerge first, followed by larger plants. The tall trees block the sunlight and change the structure of the organisms below the canopy. Finally, the climax community arrives.

Cyclic Succession:

This is only the change in the structure of an ecosystem on a cyclic basis. Some plants remain dormant for the rest of the year and emerge all at once. This drastically changes the structure of an ecosystem.

Seral Community:

"A seral community is an intermediate stage of ecological succession advancing towards the climax community."

A seral community is replaced by the subsequent community. It consists of simple food webs and food chains. It exhibits a very low degree of diversity. The individuals are less in number and the nutrients are also less.

There are seven different types of seres:

Hydrosere- Succession in aquatic habitat.

Xerosere- Succession in dry habitat.

Lithosere- Succession on a bare rock surface.

Psammosere- Succession initiating on sandy areas.

Halosere- Succession starting in saline soil or water.

Senile- Succession of microorganism on dead matter.

Eosere- Development of vegetation in an era.

Examples of Ecological Succession:

Following are the important examples of ecological succession:

Acadia National Park:

This national park suffered a huge wildfire. Restoration of the forest was left to nature. In the initial years, only small plants grew on the burnt soil. After several years, the forest showed diversity in tree species. However, the trees before the fire were mostly evergreen, while the trees that grew after the fire were deciduous in nature.

Ecological Succession of Coral Reefs:

Small coral polyps colonize the rocks. These polyps grow and divide to form coral colonies. The shape of the coral reefs attracts small

fish and crustaceans that are food for the larger fish. Thus, a fully functional coral reef exists.

Causes of Ecological Succession:

A number of causes induce together the process of succession.

Some important causes may be outlined as below:

(i) Climatic Causes: The climatic causes include temperature, rainfall, light intensity, gaseous composition, wind, erosion, fire, etc.

(ii) Biotic Causes: The biotic causes include the various activities of organisms. In a community, there is competition amongst different members for their existence. In such a process, some of the members are not found suitable and thus are gradually replaced by new ones.

(iii) Continuing Causes or Ecesis Causes: The continuing causes are those that are responsible for changes in population shifting features of an area. The soil condition is also changing by the process of invasion, migration due to industrialization and

urbanization, competition and reaction of the Population against local problems.

(iv) Stabilising Causes: The causes, which bring stability to the communities. Succession is taking place in order to attain the climax stage. Such factors are:

- fertility of land,
- climatic condition of the area
- abundance of availability of minerals etc.

Characteristics of Ecological Succession:

Ecological succession has the following characteristics:

1. It is a systematic process which involves change in species structure.

2. The changes are directional and take place as a function of time.

3. The succession occurs due to the changes in physical environment and population of species.

4. The changes are predictable.

5. The process of succession is self going, stake and biologically feasible.

6. The change also occur due to population explosion of the species,

7. It results from modification of the physical environment of the community.

8. It is an orderly process of community development.

9. It involves changes in species structure and it increases diversity of species.

10. Nutrient variation determines the settlement of new com-munity.

11. Succession cumulates in a stabilized ecosystem.

Types of Ecological Succession:

Some basic types of successions may be outlined as below:

(1) Primary sucession:

This type of succession being in a sterile area or barren land or in an inorganic environment. When a bare or nude area is colonized by

organisms for the first time and subsequently the communities are changed in a successive form, the process in known as primary succession.

(2) Secondary succession:

The community development on area previously occupied by another well developed living community amidst the interruption due to adverse conditions like natural calamities, biotic intervention etc. is designated as secondary succession. The natural calamities include forest fire, disease, flood, grazing etc.

(3) Autotrophic succession:

When the population of autotrophs (plants) dominate the population of heterotrophs, the succession caused is known as autotrophic succession.

(4) Heterotrophic succession:

It is characterised by early dominance of heterotrophs like bacteria, fungi and some animals in an organic environment. Since the environment is dominated by heterotrophs the succession is called heterotrophic succession.

(5) Autogenic succession:

Due to the continuous interaction of community with environment, there happens a modification of the later. Such a modification of environment causes the replacement of an old community by a new one, which is known as autogenic succession.

(6) Allogeneic succession:

When the replacement of a community is caused by any other external condition and not by the existing organisms, the course of succession is known as allogeneic succession.

(7) Habitat Succession:

Successions are also named differently basing upon the type of habitat from which the phasic replacement starts.

(a) Hydrosere: The succession starting from aquatic habitat is known as "Hydrach" and the series of changes occurring in the vegetation of hydrarch are called 'Hydrosere'.

(b) Mesarch: The succession starting from a habitat where adequate moisture condition are present.

(c) Halosere: The succession occurring at saline water or soil is known as holosere.

(d) Xerosere: Succession taking place in xeric havitat like sand or rocks where moisute is present at minimal amount is known as xerosere. Xeroseres can further be subdivided into:

(i) Psammosere: Where the succession starts on sandy habitat.

(ii) Lithosere: Where the succession starts on the surface of rocks.

(e) Oxylosere: The succession starting on acidic soils in known as oxylosere.

General process of Ecological Succession:

The entire process of primary autotrophic succession is completed through a series of sequential steps followed by one after another.

The different sequential steps may be outlined as below:

(1) Nudation:

It is a process of developing a bare area without any form of life for the arrival of new species. The causes of nudation may be:

(a) Topographic:

The existing community may disappear due to soil erosion (by gravity, water or wind), land slide, volcanic activity etc.

(b) Climatic:

The existing community may be destroyed due to storm, fire, frost, drought.

(c) Biotic:

The community may also be destroyed by anthropogenic activities like destruction of forest, destruction of grass land etc. Besides, diseases induced by bacteria and virus can also destroy the population.

(2) Invasion:

The successful establishment of a species in a bare area is called as invasion. This process of establishment is completed in three successive steps:

(a) Migration (dispersal):

The seeds, spores or other progagules of the species are brought to the bare area by the agents like air, water etc.

(b) Ecesis (Establishment):

The process of successful establishment (germination and growth) of the species in the new area as a result of adjustment with the prevailing conditions is known as ecesis.

(c) Aggregation:

After ecesis, the individuals of species increase their number by reproduction and thus, are aggregated in a particular area.

(3) Competition and Coaction:

As the species aggregate at a limited space, there happens competition (inter as well as intra specific) mainly for space and nutrition. Secondly the life process of one individual is affected by

the surrounding species in various ways which is known as coaction. The species which are found unable to compete with others in the existing environment get discarded.

(4) Reaction:

The species present in an environment constantly interact with it there by causing its modification. The mechanism of the modification of the environment through the influence of living organisms on it, is known as reaction.

Reaction induces changes in soil composition, water content and light organisms on it and is known as reaction. Reaction induces changes in soil composition, water content, light conditon, temperature etc. Due to drastic modifications of the environment/ it may not be suitable for the existing community.

Hence, the existing community may be replaced by another community. The whole sequence of communities that substitute one another in the given area is known as sere and the various

communities constituting the sere are known as seral communities or seral stages.

(5) Stablisation (Climax):

At last a final or terminal community is established. Which is stabilized for a longer period of time and which can maintain an equilibrium with the environment of that area. This community is known as climax community and the stage is as climax stage.

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