

## Climax persistence

**Persistence** is the key to **climax**. In a **climax** community, all species (including dominant species), are continually able to reproduce successfully and **persists** in a uniform climatic area. That is known as **climax persistence**.

**Climax** concept. According to classical ecological theory, succession stops when the sere has arrived at an equilibrium or steady state with the physical and biotic environment. Barring major disturbances, it will **persist** indefinitely. This end point of succession is called **climax**.

Because changes in climate, ecological processes, and evolutionary processes cause changes in the environment over very long periods of time, the **climax** stage is not completely permanent.

A **climax community** is a term used to express a **community** in its final stage of succession. Species composition is stable, and the **community** has reached equilibrium. ... The **climax community** may **change** if there are **changes** in climate or long-term evolutionary **changes** in one or more species.

**Climax communities** are said to be in a state of equilibrium because organisms have already adapted to their environment and succession is no longer taking place. Therefore, it can be assumed that it is **stable**.

Higher stability doesn't necessarily entail higher diversity. In fact, it is those communities with intermediate levels of stability that have the highest diversity.

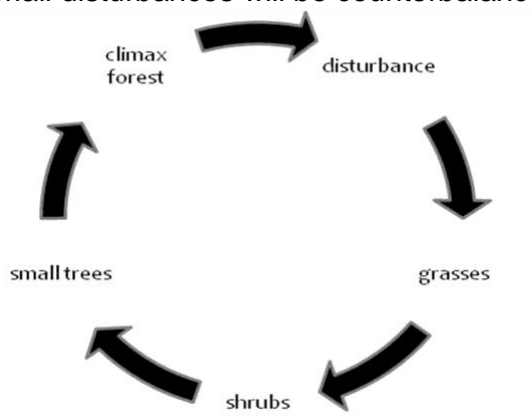
A community is known to be stable when there is no apparent change in the number of species and population size over a long period of time. It is then important to note that a community's stability is prevented by periodic or stochastic disturbances that give way to recolonization. It is the climax community that is most stable since the species that comprise it, which are the dominant late successional species, are least affected by gradual changes in the physical environment unlike the communities with lower stability. This high stability in climax communities would lead to a low species diversity since the time between disturbances is long, allowing dominance by one or a few number of species that, in turn, competitively exclude other species. It is the communities with

intermediate levels of stability that are most diverse since the interval between disturbances are long enough for a wide variety of species to colonize and become established but are disturbed before successional replacements result in dominance and competitive exclusion

*A **climax community** is the **end** result of ecological **succession**. The **climax community** is a stable balance of all organisms in an ecosystem, and will remain stable unless a disaster strikes. After the disaster, **succession** will start all over again*

### **Ecological succession & EQUILIBRIUM**

Ecological succession is the term that expresses how a community changes over time in regards to the composition and dominant species found in that community. Equilibrium in ecology refers to a state that occurs such that a small disturbance or change is counterbalanced by another change so that the community is restored to its original state. Thus, as a community goes through multiple changes through each stage of succession, it is not in equilibrium. New species enter the community and take the place of others and the community does not return to the way it was formerly. When a community eventually reaches the last stage of succession, what is typically referred to as a climax community, the composition of the community is stable. Thus, any small disturbances will be counterbalanced. The system is at a relative equilibrium.



#### ***Meaning of Climax Community:***

Climax community is the stable end product of successional sequence or sere. It is a community that has reached a steady state of species composition, structure and energy flow, under a particular set of environmental conditions. Steady state indicates the dynamic nature of the climax.

Also the end of successional change does not mean that community development has come to an end. As has been stated above, climax community is always in a state of flux and its structure undergoes changes due to birth, death and growth processes. However, these changes are less dramatic than the community transformations observed during succession.

**The characteristics of a climax community are:**

1. The climax community is able to tolerate its own reaction.
2. It tends to be mesic (medium moisture content) rather than xeric (dry) or hydric (wet).
3. The climax community is more highly organised.
4. The climax community with its more complex organisation has large number of species and more niches.
5. The organisms of earlier successional stages tend to be smaller, shorter-lived with a higher biotic potential (r-selected). In contrast, the species of climax community tend to be relatively large, long lived and with a low biotic potential (K-selected).
6. In climax community, energy is at a steady state (net primary production is zero), whereas, in immature stage of succession, gross primary production tends to be greater than community respiration, signifying accumulation of energy.
7. Immature ecosystems are temporary while in climax community the stability is high.
8. Climax communities show less broader changes and are more resistant to invasions than immature ecosystems.

*Nature of Climax Community:*

**A. Mono-climax and poly-climax:**

According to Clements (1916) succession resulted in a single true climax community, determined primarily by the climate of the region. This view of

his is called the mono-climax theory of succession, which elaborates that the many different vegetation communities found in a region are successional stages of the true climax community.

These different vegetation communities were often called subclimax, pre-climax or post-climax communities. This theory further stresses that, given sufficient time, the difference in local conditions of soil moisture, temperature, nutrient availability, hydrology and so on (that give rise to different vegetation types) would be overcome and a homogeneous true climax would develop.

Many observations seem to conflict this hypothesis as it is evident that even under primeval conditions it was difficult to find large areas of uniform vegetation. Rather, it is appropriate to recognise several different communities as climax.

Poly-climax theory of succession stresses that many different types of vegetation form the climax community, depending on local conditions. The climax community should be in harmony with the whole environment and not just climate. However, the hypothesis of poly-climax is also basically terminological.

#### **B. Climax pattern theory:**

More recently a third hypothesis was proposed by Robert H. Whittaker (1953) known as climax pattern theory, which rejects the classification approach. It recognises a regional pattern of open climax communities whose composition at any particular locality depends on the specific environmental conditions present at that time.

The climax pattern concept, in a sense, views only one big community that changes according to soil, slope and other habitat factors. This approach is considered to be more useful and closer to reality to describe such pattern of variation.

#### **Factors Determining the Nature of Climax Community:**

Many factors such as soil nutrients, moisture, slope, exposure etc. determine the nature of the climax community. Fire is another important feature

of many climax communities. Fire-resisting species are favoured while other species that would have dominated are excluded. Fire triggers the release of seeds in some pine species. After the fire has receded the pine seedlings grow rapidly in the absence of competitors.

Grazing pressure is another factor that determines the nature of climax community. Intense grazing may turn grassland into shrub-land. Shrubs and cacti may establish themselves as they are unsuitable for forage. The grazing of many herbivores may suppress many species of plants and favouring competitors that are less desirable as food.

**Transient and cyclic climax:**

Once the climax community has established itself, its general appearance does not change in spite of the constant replacement of individuals within the community. However, all climaxes do not persist for ever. A stable climax community is not possible for long, as natural disturbances like storms; fire, cold waves, season etc. have detrimental effects.

Non- successional, short term, reversible changes in the floristic and faunal composition (or fluctuations) of a community are also common. These, are said to be cases of transient climax. Transient climaxes develop on ephemeral resources and habitats such as temporal ponds and carcasses of animals.

The development of animal and plant communities in seasonal ponds is a simple case of transient climax. Pond waters either dry up in summer or freeze solid in winter, thereby regularly destroying the communities. These communities reestablish each year during the growing season from the pores and resting stages left by plants, animals and microorganisms.

Another example is the excreta and carcasses of dead organisms. They are resources for a wide variety of detritus feeders and scavengers. The dead body of a large animal is fed upon by a succession of vultures in African savannas. First, the large, aggressive species eats the largest masses of flesh, followed by smaller species that picks smaller bits of meat from the bones.

Finally, another kind of vulture invades the area that cracks open the bones and feeds on the bone marrow. Later scavenger mammals, maggots, microorganisms enter the area and ensure that nothing edible remains. When the feast is concluded all the scavengers disperse. Thus, no climax is present in this sort of succession or we may consider all the scavengers as a part of a climax.

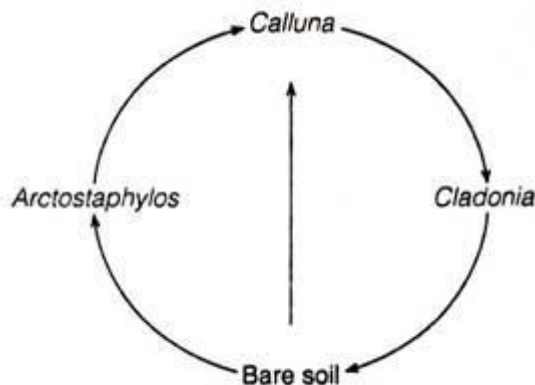
A few dominant species in a few simple communities may create a cyclic climax. Cyclic climax develops where each species become established only in association with some other species. The change in cyclic pattern occurs due to the life cycle of dominant species.

Stable cyclic climaxes usually follow a cyclic pattern often with one of the stages being bare substrate. Harsh physical conditions, such as frost, strong winds etc. result in cyclic climaxes.

Examples of cyclic vegetation changes was studied by Watt (1947). Watt found that the dwarf *Calluna* heath in Scotland was the dominant shrub. It loses its vigor as it ages and is invaded by the lichen, *Cladonia*. The lichen mat dies in time to leave bare ground.

This bare area is invaded by bearberry (*Arctostaphylos*). It is, in turn, invaded by *Calluna*. *Calluna* is the dominant plant, while *Arctostaphylos* and *Cladonia* are allowed to occupy the area that is temporarily vacated by *Calluna*.

Thus, the life history of this dominant plant controls the cyclic sequence:



The concept of climax community incorporates cyclic patterns of change and mosaic patterns of distribution. The climax is a dynamic and self-everlasting state. Persistence is the key to climax. In a climax community, all species (including dominant species), are continually able to reproduce successfully and persists in a uniform climatic area.