Ecological Succession



Most natural ecosystems are in a state of equilibrium. This means that their biotic and abiotic features remain relatively constant over time.

The major **biomes**, for example, usually maintain a characteristic set of **species** over hundreds of thousands of years.

Changes on a large scale occur **slowly** and are caused by changes in **climatic** conditions.

Equilibrium is established when abiotic conditions are stable.

Equilibrium and Change



Energy **flows** through the **ecosystem**. Nutrients are **cycled** through food webs.

Equilibrium and Change

In addition, **photosynthesis** and **cellular respiration** are balanced.



When ecosystems are in **equilibrium**, populations are healthy and **stable**.

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On the scale of biomes, ecosystems remain relatively unchanged over time. This is not true, however, on a small scale.

Smaller ecosystems are in a constant state of change. A forest fire or disease outbreak can cause short-term changes on a local level.



On August 27, 1883, the volcanic island of Krakatoa in Indonesia literally blew up. This explosion produced a sound wave that carried for 4,600 km.

The island was destroyed, along with every living thing that inhabited its lush tropical forests.

The remaining part of the island was buried in more than 40 m of **ash** and **volcanic rock**.

Despite this dramatic disturbance, life had returned to the island within 9 months.

Seeds were carried from nearby islands by the wind, the sea and birds.

Insects and spiders soon followed. In time, many other **organisms** returned to the island.

Within a hundred years, a lush rainforest community was re-established.

Equilibrium and Change

This process of **establishing** and **replacing** a community following a **disturbance** is called ecological **succession**.

Ecological succession is initiated by a disturbance such as a geological event, a fire or human activity.

Primary succession occurs on soil or bare rock where no life previously existed, such as following a volcanic eruption. **Secondary succession** follows a disturbance that disrupts but does not destroy the community.

The regrowth of an area following a forest fire is an example of secondary succession.

Severe pollution events or industrial activity such as surface mining are human-caused disturbances that initiate secondary succession.

Succession results in gradual changes as plants, animals, fungi and micro-organisms become established in an area.

The typical pattern sees small, hardy plants such as grasses colonizing the open landscape.

These plants gradually alter the **soil** and local **abiotic** environment and make conditions suitable for **shrubs** and **trees** to grow.

These shrubs and trees in turn create conditions suitable for large trees that may come to dominate the landscape.

Ecological Succession

Eventually, a relatively **stable** community may form. While **plants** are the most **visible** part of succession, **animal** species also change.





Aquatic ecosystems also undergo succession. In northern Ontario, **bogs** form when small lakes of non-flowing water are gradually covered over and filled by **vegetation**.

Ecological Succession

Bog succession proceeds as sphagnum moss forms a floating mat along the shoreline.

Year after year, the floating moss grows further outward from the shore. The dying and decaying moss sinks below the surface, slowly filling in the lake.

This living carpet is **colonized** by other plants. Eventually, the once open body of water becomes completely covered in **vegetation**.

Another example of succession occurs along sandy shores of oceans and large lakes, such as along the coast of Lake Huron. Dune succession begins when grasses establish in loose sand. Once the grasses establish, they reduce wind erosion and their roots hold the sand in place.

Over time, plant numbers **increase** and **soil** characteristics change. Eventually a large sand dune can be transformed into a lush **forested** ecosystem. Unfortunately, sand dune communities are fragile and easily disturbed by human activity.

Benefits of Succession

Succession provides a mechanism by which ecosystems maintain their long-term **sustainability**.

It also allows ecosystems to **recover** from natural or human-caused **disturbances**.



Succession offers hope that even severe environmental damage may be **reversed**.

However, the time needed is very long and the original cause of the disturbance must be eliminated.

