

SUCCESSION

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ECOLOGICAL SUCCESSION

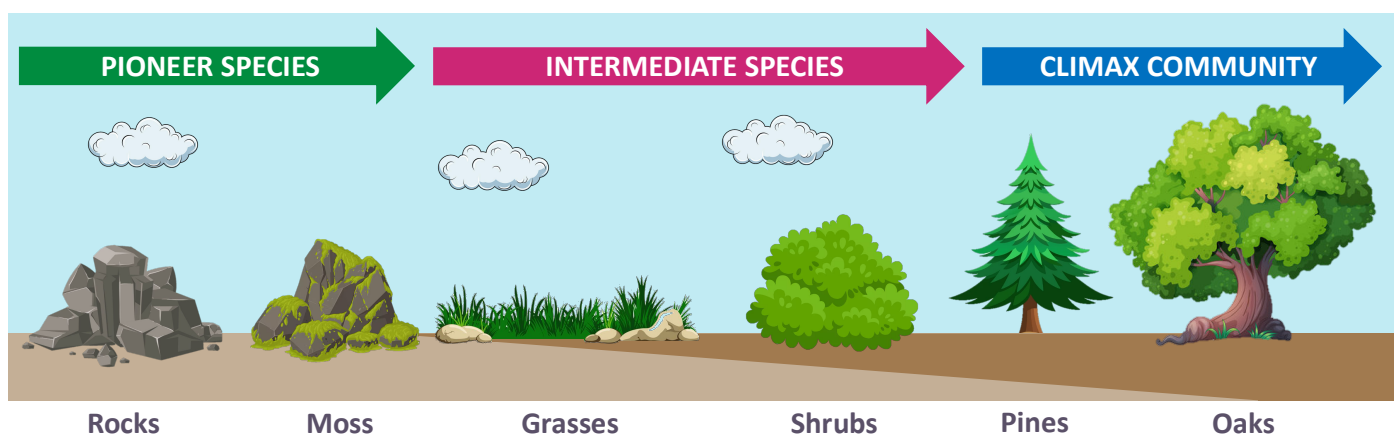
Ecosystems are dynamic and so the habitat conditions and species compositions are constantly changing. Ecological succession describes a **progressive change** in the structure of a biological community over time. The process of ecological succession can be triggered by changes in either abiotic factors or biotic factors:

- **Abiotic** – Climatic factors can trigger succession (e.g. seasonal changes, natural disasters, erosion, etc.)
- **Biotic** – Changes in organism activity can trigger succession (e.g. migration, competition, aggregation)

Ecological succession can occur in various ways. Types of ecological succession include primary succession, secondary succession and cyclical succession. Succession can also be prevented (i.e. arrested succession).

PRIMARY SUCCESSION

Primary succession occurs when communities develop on **entirely new land** without any established soil. Such locations may include river deltas, sand dunes or exposed rock. New land can also be exposed as a consequence of volcanic eruptions, landslides or the melting of a glacier. The organisms which first colonise the region are called **pioneer species** and typically consist of lichen or moss. As the lichen and moss die and decompose, they create the first organic soil capable of sustaining plant growth. This allows **intermediate species** of plant to begin to colonise the area, and the litter produced by their growth and decomposition will cause changes to the environment. Soil depth and soil mineral content will increase as the plants add humus to the soil. Rocks begin to be broken down by the action of roots and the soil becomes aerated with increased water retention. These changes allow for the growth of larger plants, which consequently reduce erosion through the binding action of their roots. The larger plant species lead to an increase in the primary production of the community, which supports a greater rate of nutrient cycling and the establishment of more complex food webs. A **climax community** is subsequently reached when succession has finally ended and the community has all of its characteristics. This is a stable community that reflects the conditions of the ecosystem (e.g. a boreal forest is dominated by coniferous trees while grassland is dominated by grass).



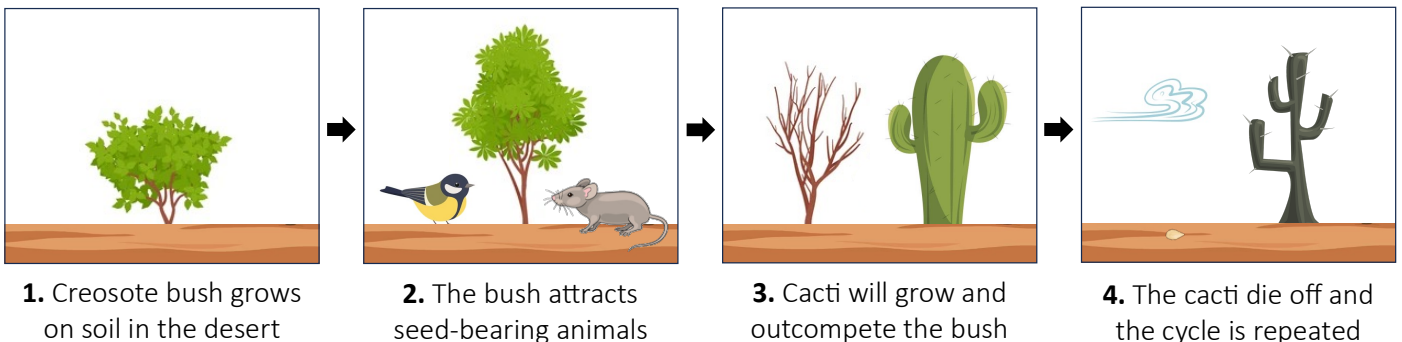
SECONDARY SUCCESSION

Secondary succession occurs when succession starts on **existing soil** following the upheaval of a previously existing ecosystem. This upheaval is typically caused by an environmental disturbance (such as a bushfire or an earthquake) and results in the removal of original climax community, allowing a new ecosystem to develop on the site of the old. Because soil is already developed, pioneer species do not colonise the land and the fastest growing plants tend to dominate. Hence, the new community will be different from the old. Given time, the fast-growing trees may be overtaken by larger, slower-growing trees and the ecosystem may gradually revert back to its prior state (climatic conditions will promote a certain type of ecosystem).

CYCLICAL SUCCESSION

In some ecosystems, the climax community may not be stable and is **regularly and repeatedly replaced** in a process of cyclical succession. The periodic changes may be caused by recurring events (such as seasonal conditions) or by changing interactions between animal and plant species. Cyclical succession differs from secondary succession in that change is caused by a reliably recurring factor (bushfires are not predictable).

Cyclical succession occurs between two species of desert plant – the creosote bush and Christmas cactus. Via the dispersal of wind, seeds from the creosote bush will initially colonise an open space. The bush will draw birds and rodents, which transfer seeds from the Christmas cactus. The cactus grows under the bush and begins to compete for available water. The cactus has a shallower root system which is more effective at absorbing water – this causes the creosote bush be outcompeted and die off. Without the deeper root system of the creosote bush, the soil begins to erode and roots of the cacti become exposed – causing the Christmas cactus to die. This re-establishes an open space, allowing the cyclical succession to begin again.



ARRESTED SUCCESSION

A climax community represents the final and stable stage of an ecological succession, whereby the community has **all of its characteristics**. The type of climax community that develops will depend on specific environmental conditions of the biome (e.g. temperature or rainfall). If humans interfere with the succession process by altering certain conditions, then the climax community is prevented from developing and an alternative habitat may be promoted in its place. For example, grazing by livestock prevents tree seedlings from becoming established. This prevents the forest community from eventuating and promotes the development of a different ecosystem in its place (i.e. meadow). Humans may also drain marshy bogs to free up land for agricultural use (or for the extraction of peat for combustion) and this will prevent the normal wetland community from developing in these locations. This is called **arrested succession** as a natural change is aborted.



Cattle Grazing



Drainage of marshes