

Ecological Succession Scenarios

Succession, a series of environmental changes, occurs in all ecosystems. Ecological succession is the gradual change in species composition of a given area. The stages that any ecosystem passes through are predictable. There are 2 types of ecological succession: 1) **Primary** succession – starting with rock, and 2) **Secondary** succession – starting with soil.

Primary Succession

Primary succession will ALWAYS be on areas where there is NO SOIL – a) bare rock from a retreating glacier, b) newly cooled lava; c) abandoned lot with an impervious surface (parking lot).

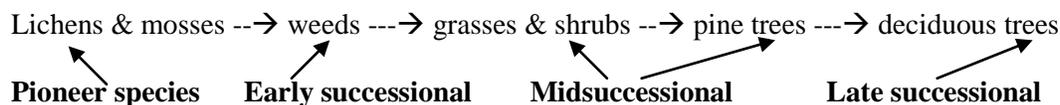
Primary succession is broken into 4 stages: pioneer, early, mid, and late succession

In primary succession the first organisms (lichens) are called **pioneer species**. The pioneer species attach to the rock. Mosses are generally included as pioneer species because they require almost no soil to grow. Both of these produce mild acids that will slowly start decomposing the rock. This, in combination with chemical weathering (oxidation of minerals on the rock surface and dissolving polar molecules by rainwater) and physical weathering (wind, water expansion and contraction, etc.) will ultimately change the rock to soil. It takes several hundred to a thousand years just to make 1 inch of soil!

The next group is the **early successional species**, which 1) grow low to the ground, 2) can establish themselves quickly, 3) produce many offspring, and 4) have short lives (so that they can be succeeded by other plant species) The species are typically what people call ‘weeds’.

The next group is **midsuccessional species**. These all need for lots of sunlight but limited amounts of nutrients. These would include grasses, shrubs and herbs first and then replaced by pine trees and other small trees that require abundant sunshine. All these are considered midsuccessional species.

The last stage of succession is the **late successional species**, which is characterized by plants that are shade tolerant and require many nutrients. These would include many of the deciduous trees (those producing leaves) and those understory trees and shrubs that don’t require much sunlight. The collection of the last species that inhabit the area is called the **climax community**. Without dramatic environmental events, the climax community will remain unchanged.



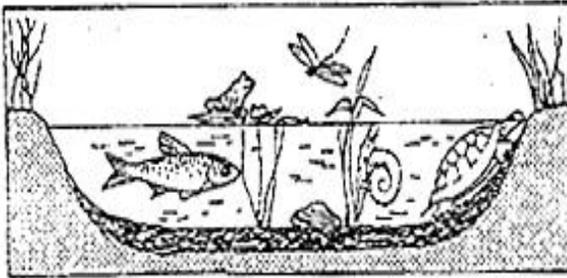
Secondary Succession

Secondary succession begins when something has arrested the development of an area in primary succession. Usually all that remains is the soil. Scenarios that would begin secondary succession would be: 1) farmland/dwellings that have been abandoned, 2) a forest fire or clear cutting forests, 3) air or water pollution that has denuded the area, or 4) flooding that deposited excess soil that smothered the other vegetation or removed the vegetation down stream.

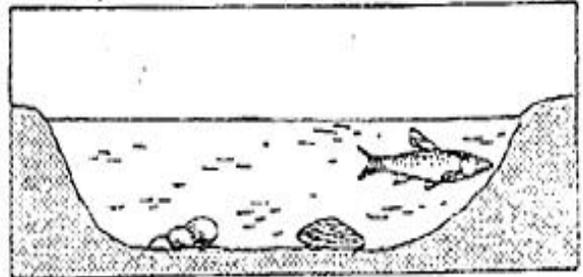
The only difference in the sequence of successional stages is that Secondary Succession does NOT have a pioneer species. All other stages will be as they were for Primary Succession.

Changes in succession bring about changes in the amount of species diversity, the trophic structure, the number of niches, the amount of nutrients available, and the amount of energy flow through the system. The water level of Lake Michigan was once 18 meters higher than it is today. As the water level fell, land was exposed. Many small lakes or ponds were left behind where there were depressions in the land. Below are illustrations and descriptions of four ponds as they exist today. Use the illustrations and descriptions to answer the questions about succession.

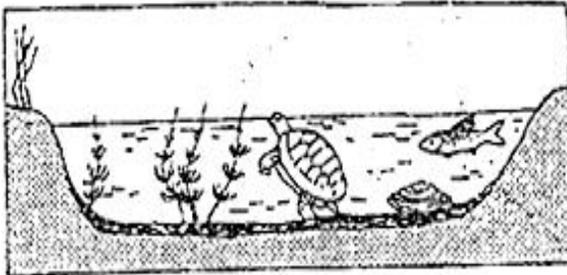
Pond A



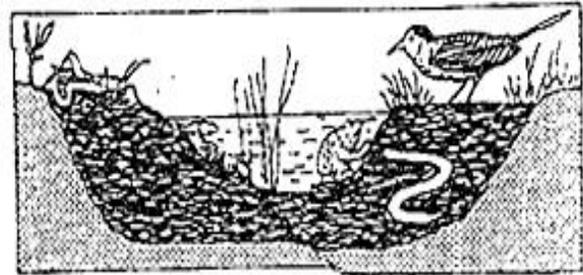
Pond B



Pond C



Pond D



Pond A:

Cattails, bulrushes, and water lilies grow in the pond. These plants have their roots in the bottom of the pond, but they can reach above the surface of the water. This pond is an ideal habitat for the animals that must climb to the surface for oxygen. Aquatic insect larvae are abundant. They serve as food for larger insects, which in turn are food for crayfish, frogs, salamanders, and turtles.

Pond B:

Plankton growth is rich enough to support animals that entered when the pond was connected to the lake. Fish make nests on the sandy bottom. Mussels crawl over the bottom.

Pond C:

Decayed bodies of plants and animals form a layer of humus over the bottom of the pond. Chara, branching green algae, covers the humus. Fish that build nests on the bare bottom have been replaced by those that lay their eggs on the Chara.

Pond D:

The pond is so filled with vegetation that there are no longer any large areas of open water. Instead, the pond is filled with grasses. The water dries up during the summer months.

Questions

1. Some amphibians and crayfish can withstand periods of dryness by burying themselves in mud. In which pond would they survive best?

- A) Pond A
- B) Pond B
- C) Pond C
- D) Pond D

2. Some mussels require a sandy bottom in order to maintain an upright position. In which pond will they die out?

- A) Pond A
- B) Pond B
- C) Pond C
- D) Pond D

3. Which pond would most the most likely to lead to terrestrial succession?

- A) Pond A
- B) Pond B
- C) Pond C
- D) Pond D

4. The area around the pond is an oak-hickory forest. After the pond fills in, the area will undergo another series of stages of succession and eventually develop into the oak-hickory forest. What is the oak-hickory forest?

- A) Climax community
- B) Pioneer species
- C) Midsuccessional species
- D) Primary producers

5. In a certain area of North Texas some ground was cleared. Soon afterwards, grasses began to grow in the area. After 10 years, small bushes replaced the grasses. This is an example of –

- A) a new conifer biome.
- B) a new deciduous forest.
- C) primary succession.
- D) secondary succession.

6. Which organisms would most likely be the pioneer organisms on a newly formed volcanic island?

- A) Conifers
- B) Lichens
- C) Deciduous trees
- D) Tall grasses

7. Starting on bare rock, what is the usual ecological succession of organisms?

- A) mosses → grasses → shrubs → trees
- B) grasses → shrubs → lichens → trees
- C) lichens → shrubs → grasses → trees
- D) shrubs → grasses → lichens → trees

8. The stable stage that is established in an area as a result of the process of ecological succession is known as the

- A) pioneer organism
- B) climax community
- C) biotic stage
- D) heterotrophic community

9. A climax community will persist until it is altered by-

- A) a major change in an abiotic factor
- B) seasonal dieback of vegetation
- C) the reappearance of lichens and mosses
- D) the growth in diameter of the trees

10. What is a major limiting biotic factor for animal succession in each stage?

- A) plant species
- B) sunlight
- C) soil minerals
- D) vitamins

11. Which statement concerning the climax stage of an ecological succession is correct?

- A) It is the first community to inhabit an area.
- B) It consists entirely of plants.
- C) It persists until the environment changes.
- D) It changes rapidly.

Complete a Venn diagram that compares and contrasts Primary Succession to Secondary Succession using the following bulleted phrases.

- No previously existing life.
- Plants and Animals adapt.
- Comes after a natural disaster.
- Climax Community.
- Starts as a result of a forest fire or flood.
- Starts as the result of a volcano or receding glacier.
- Previously existing life.
- Pioneer Species.
- Starts with previously existing soil.
- Starts on bare rock.
- Lichens break down rock.
- Happens relatively slow.
- Happens relatively fast.
- Gradual growth.

