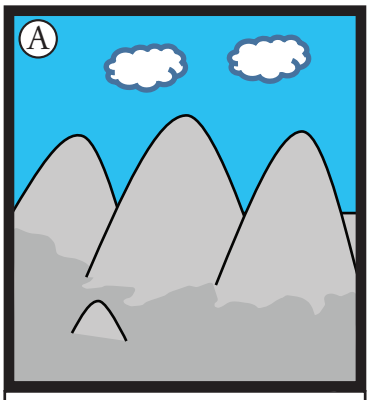
Succession

How do ecosystems develop over time?

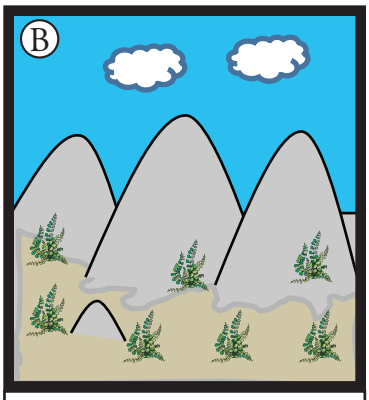
Why?

On May 18, 1980, Mount St. Helens in the state of Washington erupted with the force of a hydrogen bomb. The volcano had been dormant for over 120 years, but now 57 people were dead and forests and lakes were totally destroyed, including nearby Spirit Lake, which became a mud hole. The blast leveled trees in areas over 10 miles from the crater and ash deposits suffocated life on the mountain. However, within weeks, mammals that had taken shelter underground started to reappear in the area, and now, over thirty years later, many areas of the mountain are colonized with a large variety of plant and animal life. How does an area move from a sterile, barren wilderness to one full of life?

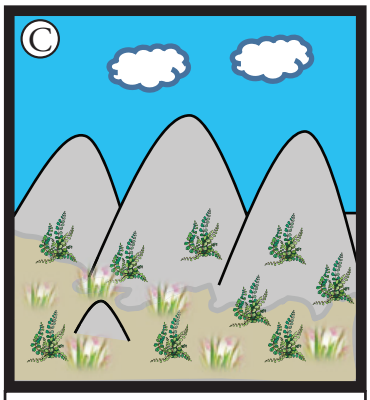
Model 1 – Primary Succession



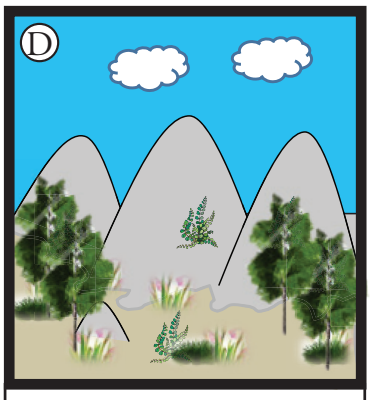
Barren rock from beneath a retreating glacier, or due to a volcanic eruption.



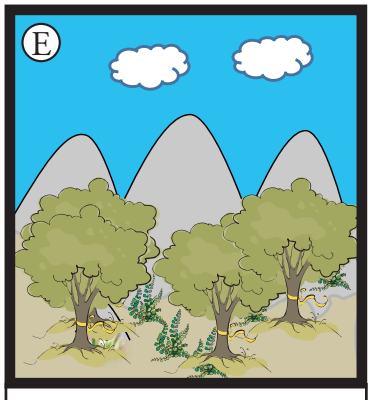
Low-growing plants such as mosses, ferns, and lichens begin to colonize.



Fast-growing grasses, flowering plants, and small shrubs begin to take root. A thin layer of soil develops.



Fast-growing trees such as birch and mountain ash form a low forest and shade out lower plants.



100–200 years since colonization began, large, slow-growing trees, such as an oak, become established.

1. Refer to Model 1.
   a. On what type of land does primary succession first begin to occur?

   b. Does there appear to be any life on the land when primary succession begins?

   c. Why would most plants such as shrubs and trees find it difficult to grow here?

2. Refer to diagram B in Model 1.
   a. What are the first organisms (colonizers) on this land?

   b. Suggest the mechanisms by which the first colonizers arrived on the land.

Read This!

The first colonizers are referred to as the **pioneer community**. These can include lichens, mosses, ferns, and bacteria—all organisms with low nutrient requirements. As they colonize, they break the weathered rock surface, which helps to create the first thin layer of soil. Without soil other plant life cannot be sustained and without plants no animal life can exist.

3. Refer to Model 1.
   a. Which diagram illustrates a pioneer community?

   b. What are some of the features of the pioneer community?

4. Notice the colonizers in diagrams C and D are taller and require more nutrients than those in the pioneer community. Considering what you already know about plants and photosynthesis, why might it be a competitive advantage for a plant to be taller?

5. What happens to the pioneer organisms once the new colonizers become established?

Read This!

As the newer colonizers begin to take over, animals will also begin to appear so they can feed on the more diverse food source. The pioneer plants die and decompose and the animals leave behind manure. Both add to the thin soil layer.

6. What effect will the addition of animal waste and decayed plant matter have on the soil and land?

7. How will grazing animals help plants to become established?

8. How will the grazing animals prevent or control further colonization by other plants?

9. Using the diagrams in Model 1 as a guide to develop a definition with your group for the term **primary succession**, as it relates to the colonizing of barren land.

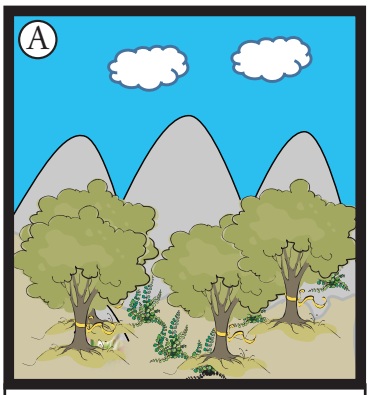
Read This!

As soil quality and quantity improves, the life forms present in the area undergo a series of changes, each referred to as a **seral stage**. Eventually a stable climax community is formed.

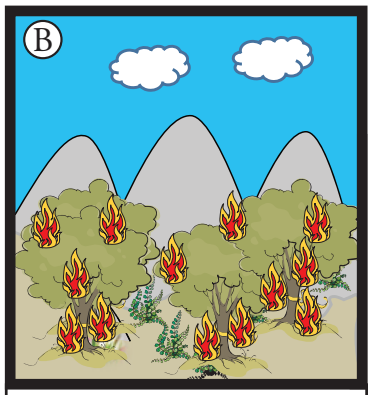
10. Label the pictures in Model 1 as pioneer community, seral stages, and climax community.
11. Most climax communities are mature forests. What features of mature forest species, such as oak trees, make them able to dominate and compete in the ecosystem?

12. What environmental factors may affect the type of climax community that develops in an ecosystem?

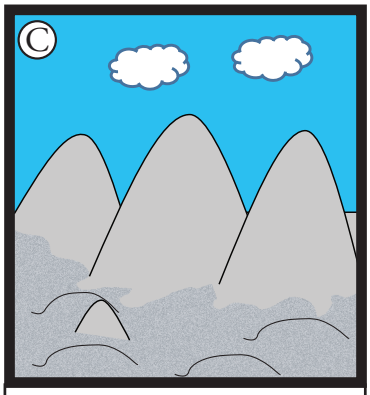
Model 2 – Secondary Succession



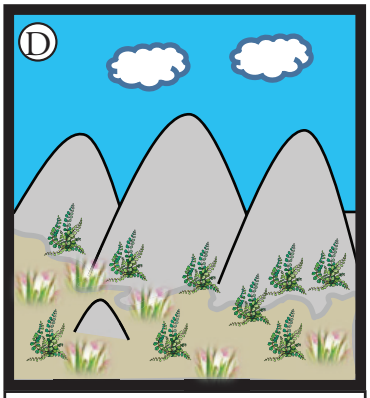
Established climax community.



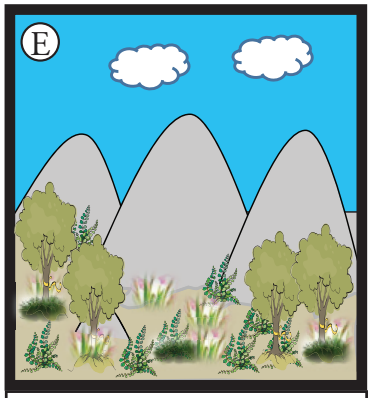
Forest fire.



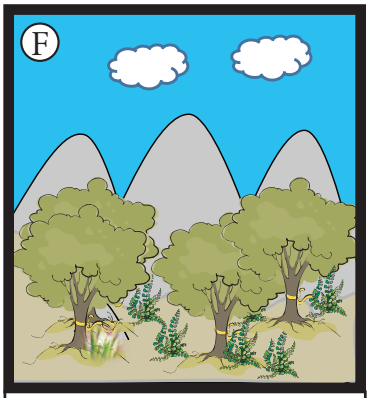
Plants have been destroyed and animals have fled the burned out area. A layer of ash is over the soil.



After 3–5 years grasses and low-growing shrubs have colonized the land.



After 20 years small trees form young woodland.



50–100 years after the setback event, mature oak woodland is restored.

13. Refer to the diagrams in Model 2.

    a. What stage of development does diagram A represent?

    b. What appears to have happened in diagram B?

    c. What could be two causes of this event?

    d. What process will begin again after this event has occurred?

14. Can the ecosystem totally recover from this set-back? What evidence is given in Model 2?

15. What effect does an existing soil presence have on the seral stages of secondary succession and the time it takes to return to the climax community compared to primary succession? Give your answer in complete sentences and justify your reasoning.

16. Why is the title of Model 2 **Secondary Succession** rather than Primary Succession?

17. Consider each event below and determine if the recovery process for the environment will happen by primary succession or secondary succession.

    a. Melting, receding glaciers.

    b Logging a wooded area.

    c. Major flooding of a creek bed.

    d. Volcanic eruption with lava flow.

18. Are these destructive methods always natural? Explain your answer.

19. Human activity may alter or "deflect" the natural course of succession, which leads to a change in the climax community. An example of a human activity that deflects succession would be grass mowing. The climax community that develops from a **deflected succession** is called a **plagioclimax community**. Suggest some other human actions that may lead to plagioclimax communities.

Extension Question

20. Large canopy trees in rainforests reduce light penetration to the forest floor and slow down the growth of tree saplings. In a dense forest, selective logging is often used as a means of conservation, rather than clear cutting large sections of land. Why might selective logging be considered preferable to clear cutting?