



Activity 6

Succession in Communities



GOALS

In this activity you will:

- Investigate succession after a natural disaster.
- Distinguish between primary and secondary succession.
- Explain how human activities can lead to succession.

What Do You Think?

Following a forest fire, all that remains is a charred landscape. Yet, within a few weeks the ground begins to turn green as living organisms return.

- **From where does this new life come?**
- **How long will it take for the forest to return to its original condition?**

Write your answers to these questions in your *Active Biology* log. Be prepared to discuss your ideas with your small group and other members of your class.

For You To Do

This activity provides you with an opportunity to examine how “life re-establishes itself” after a devastating blow.

1. On August 27, 1883, two volcanoes located on a single island in the Indian Ocean erupted at the same time. The blast was so great that a hole about 250 m deep remained where the peak of the volcano had been. The eruption on the island of Krakatoa has been said to be the loudest noise ever heard on Earth. The blast was heard in Hawaii, several thousands of kilometers away. Hot cinders and lava covered the island. Before the eruption, Krakatoa had been covered with a tropical forest. The eruption completely destroyed life on Krakatoa and two other nearby islands.
2. Two months after the eruption, scientists visited the island of Krakatoa. They found it steaming from a recent rain that had fallen on the lava that was still hot. In some places, the volcanic ash was washing away. In other places the ash was still more than 60 m deep. No life was visible.
3. Scientists visited the island nine months after the explosion, and at

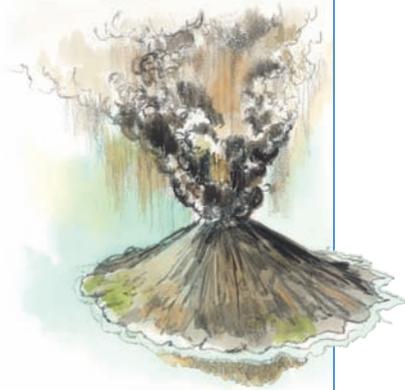
later times, to record the living things on Krakatoa. Some of the data recorded is shown in the diagram on the next page. Look for some interesting patterns in the rebirth of life on the island of Krakatoa. Study the plant life. (Reports of the animal life are interesting but too limited to use.)

- a) What happens to the number of kinds of plants as the years pass?
- b) Is there a change in the number of kinds of plant life?
- c) Do the numbers of some kinds of plants change more than the numbers of other kinds?
- d) Where do you think these plants might have come from? What reason do you have for your belief?
- e) How long a period was needed for the complete recovery of the forest growth?
- f) Write a statement that will describe the kinds of changes that have taken place on the island since the eruption.
- g) Compare the “rebirth” of plant life on the coastal areas with the rebirth of plant life in the inland areas. How would you explain the difference?





SUCCESSION ON KRAKATOA



COASTAL AREAS

INLAND AREAS



3/4 years since eruption

Only algae and one lone spider found... mostly bare lava.



No plant or animal types found. Ground completely bare.

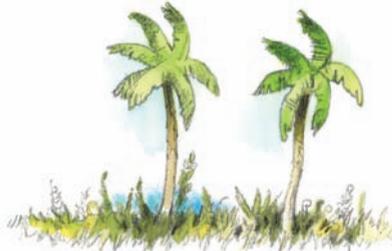


3 years since eruption

Ground completely covered with grasses. Many ferns, and many tropical seashore plants found. Insects also found.



A few grasses, many ferns and insects found.

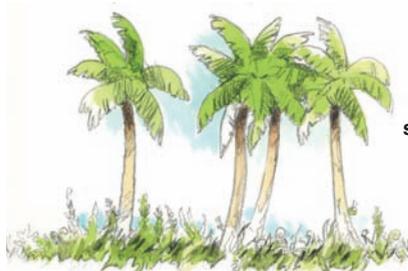


13 years since eruption

Completely covered with young coconut trees, horsetail trees, and sugar cane plants. Lizards as well as insects found.

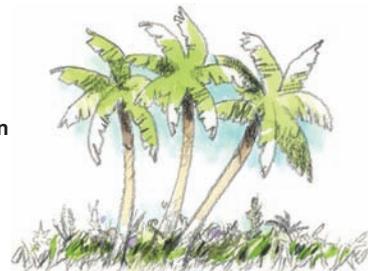


Almost all covered with grasses, orchids, and some horsetail trees. Lizards and insects found.



23 years since eruption

Completely covered as before, but with a greater number of trees.



Completely covered now with grasses, orchids, and groves of horsetail and young coconut trees.



47 years since eruption

By now a dense forest covers the area. All the previously listed plants and animals are found in abundance.



Inland areas now support same amount of plants and animals as the coast.

BioTalk

Succession

The destruction of a mature forest by a severe fire is a devastating scene. Yet, even this charred scene holds promise of new life. Within a few weeks the ground will slowly turn green as annual and perennial plants return. These plants can tolerate full sunlight and the resulting high soil temperatures. They take root, grow, and reproduce in a soil



Forest fires are one of the most destructive natural forces known. While sometimes caused by lightning, nine out of ten forest fires are caused by humans. Natural-occurring fires are vital in maintaining healthy ecosystems. However, human-caused fires have devastating effects on both wildlife and human lives.

change. It is called **succession**. It describes the gradual change in an area. The change takes place as the area develops toward a final stable community. In every case, the final community that can exist is determined by the abiotic factors of the area.

made fertile by the mineral content of the ash. Within two or three years shrubs and young trees are evident and growing rapidly.

A few years later, an untrained observer would probably never know that the area had once been burned out. Over the long term, the forest will again reach maturity. This pattern is not limited to forests. It occurs in many other environments. This process of re-growth follows an environmental

Bio Words

succession: the slow and orderly replacement of community replacement, one following the other





Bio Words

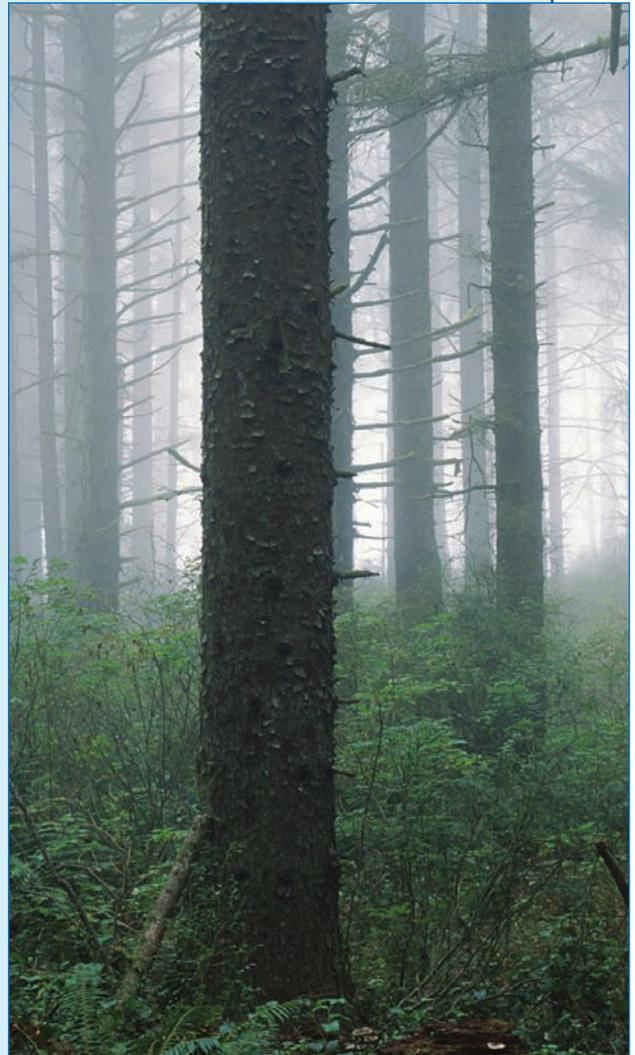
primary succession:
the occupation by plant life of an area previously not covered with vegetation

secondary succession:
the occupation by plant life of an area that was previously covered with vegetation and still has soil

There are two types of succession: primary and secondary succession. **Primary succession** occurs in an area where no other community existed before. For example, this could happen on land left behind by a receding glacier. It could also happen on a newly formed volcanic island. **Secondary succession** occurs following destruction of a community. The re-growth after a forest fire is an example of secondary succession. Since soil is already present, the long time needed for soil to form in primary succession is not necessary.



Primary succession occurs on rock left behind by retreating glaciers, and transforms it into a living community. The process must begin with organisms that form organic soil, the pioneers or soil builders. This soil will be necessary to provide for the next group of plants to succeed.



After a forest fire, a sequence of ecological responses begins. Amid the charred forest remains, a pioneer community is established.

Each community goes through a succession of plant and associated animal species. The first community to appear is the **pioneer community**. It includes plants that are able to tolerate sunlight and the resulting high temperatures. This development of vegetation sets up new ground-level conditions. Eventually, conditions become more favorable to other plants that cannot tolerate full sunlight. These plants tend to be taller than the pioneer plants. This process continues through several in-between communities called **seral stages**. The plants and animals and their wastes at each stage contribute to the community development until a final community is reached. This final community is the one that can continue to perpetuate itself. It is called the **climax community**. Generally, both the biomass and the nonliving organic matter increase during the stages of succession. They then level off when the climax community is reached. The climate plant and animal life (biota) vary greatly by area. The types depend upon the temperature and rainfall patterns.

Bio Words

pioneer community: the first species to appear during succession

seral stages: the communities in between the pioneer and climax community during the stages of succession

climax community: the final, quite stable community reached during the stages of succession

Reflecting on the Activity and the Challenge

In this activity you observed some of the changes that occur after a dramatic environmental change. Sometimes, human activities are responsible for the environmental changes. Consider how the issue that you are researching for the **Chapter Challenge** came about. Can secondary succession be part of the solution to the problem?



Is the succession that occurs after a volcanic eruption primary or secondary succession?



Biology to Go

1. What is succession?
2. Explain the difference between primary and secondary succession.
3. Which community would support the greatest number and diversity of organisms, the pioneer community or the intermediate stages? Explain your answer.
4. Explain how abiotic factors change within a community as a result of the succession of vegetation.
5. Give two examples of how human activities can lead to secondary succession.

Inquiring Further

1. Primary succession

How does life establish itself on a rock surface? Describe the stages of succession that must occur to “transform” rock into a climax community.

2. Hydrarch succession

Hydrarch succession is the name for primary succession in a new freshwater environment. What type of organisms constitute the pioneer, seral, and climax communities in the stages of succession in fresh water?



3. Succession and Mt. St. Helens

At 8:32 Sunday morning, May 18, 1980, Mt. St. Helens in southwestern Washington state erupted. About 600 km² of forest was blown over or left dead and standing. The eruption lasted nine hours, but Mt. St. Helens and the surrounding landscape were dramatically changed within moments. Scientists and visitors follow the changes in the landscape and the volcano. Surviving plants and animals rise out of the ash, colonizing plants catch hold of the earth, birds and animals find a niche in a different forest on the slopes of Mt. St. Helens. Research the succession pattern on Mt. St. Helens.

Volcanoes provide a unique opportunity to study plant succession, animal behavior, evolutionary and geologic processes, and ecology. Understanding how natural systems respond to disturbances is essential in facing environmental challenges of the future.