

### Primary and Secondary Succession in America's Forests

*Teachers: This lesson contains three classroom activities with discussion questions related to the AFG video clips about forests. These parts may be used individually or together, depending on the needs of your class.*

*Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site: [www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)*

#### Grade Level: 9-12

#### Background

One of the basic concepts students learn in Ecology or Environmental Science is succession, which is the regular pattern of changes in the types of species in a community. While people tend to think of forests as static, they are constantly changing over time. These changes follow generally predictable patterns. Scientists study these patterns to learn how the forest grows and to understand more about how human interference is changing ecosystems. Because resources in an ecosystem are limited, organisms are constantly engaged in a battle to win the resources that they need for growth. Different organisms have adopted different techniques to take advantage of resources. Since the forest is constantly growing and changing, tactics that provided an advantage at one point may not be as advantageous later. For instance, some species of trees grow quickly with lots of sunlight. Once they have grown however, their own shade makes it difficult for their own offspring to survive. Other trees are better adapted to growing seedlings in shady conditions and eventually grow to crowd out the first group of trees. With an understanding of the usual pattern of succession in an area, foresters can determine how mature a forest is and they can predict what it will look like in the future.

Initial colonization of disturbed areas is also of interest to scientists. Particular plant species, known as opportunistic species, come first and pave the way for other plants. Primary Succession is the initial colonization of land that has never been colonized before. This might include areas after a volcanic eruption or after a glacier recedes. Secondary Succession is recolonization of areas after a disturbance such as a fire or when a large tree falls. Given the increasing disturbance of ecosystems by human activity, the concept of succession has dramatic implications for the future of the earth as we wait to see how it will recover.

In this activity, students will have an opportunity to experience video footage that will take them to several different North American Forests while learning about the concepts associated with succession in both natural and disturbed environments.

## Related National Standards

Content Standard C:

As a result of their activities in grades 9-12, all students should develop understanding of:

- The Interdependence of Organisms
  - Organisms both cooperate and compete in ecosystems. The interrelationships and interdependencies of these organisms may generate ecosystems that are stable for hundreds or thousands of years.
  - Living organisms have the capacity to produce populations of infinite size, but environments and resources are finite. This fundamental tension has profound effects on the interactions between organisms.
- Matter, Energy, and Organization in Living Systems
  - The distribution and abundance of organisms and populations in ecosystems are limited by the availability of matter and energy and the ability of the ecosystem to recycle material.

## Extension Websites from PBS

- **Scientific Frontiers – Nordic Sagas: Island Life**  
[http://www.pbs.org/safarchive/4\\_class/44\\_guides/guide\\_803/4483\\_island.html](http://www.pbs.org/safarchive/4_class/44_guides/guide_803/4483_island.html)  
The birth of a volcano provides virgin land to be colonized. Learn how organisms convert hostile ground into fertile land for an ecosystem to grow.
- **Journey to Amazonia – Levels of Life in the Rainforest**  
[http://www.pbs.org/journeytoamazonia/teacher\\_levels.html](http://www.pbs.org/journeytoamazonia/teacher_levels.html)  
Learn more about the structure of the forest and how different organisms have evolved to take advantage of resources in different ways.
- **Newton's Apple – Balloon Safari**  
<http://www.pbs.org/ktca/newtons/13/safari.html>  
Adopt a plot of land to learn the complex interrelationships of the organisms that use it.
- **Scientific American Frontiers - Galapagos: Backyard Science**  
[http://www.pbs.org/safarchive/5\\_cool/galapagos/q52e\\_ecosystems.html](http://www.pbs.org/safarchive/5_cool/galapagos/q52e_ecosystems.html)  
Learn techniques that help students and scientists learn more about ecosystems.

**Activity 1: Whose Woods are These?****Time Allotted:**

30 minutes

**Materials:**

Images of forest plants and animals with safety pins or yarn so that they can be worn on the students back. Choose organisms from several different types of forests, for instance a Northwest Old Growth forest might include: Douglas fir, ferns, spotted owl, deer, grizzly bears, and banana slugs. Other forests to consider might include Eastern hardwood forests, a mangrove swamp, the Everglades or other ecosystems from your area. If you choose organisms from several different forest ecosystems, place all the organisms from one ecosystem on cards of a particular color. For instance, organisms from a Northwest Old Growth forest might be pasted onto a red background, those from a mangrove swamp on a blue background.

**Objectives:**

- Students will become familiar with forest organisms.
- Students will learn features of some of the different types of forest.
- Students will begin to learn to classify organisms based on the type of forest they come from.
- Students will understand that certain species are connected with other, particular species within their own ecosystem.

**Teaching Instructions**

1. Place a picture of a forest organism on the back of each student without them seeing their organism.
2. Instruct students that they will play a version of 20 questions, asking only 'yes' or 'no' questions to try to identify the organism on their back. They may only ask one question of any individual at a time (this will keep them moving around the room).
3. Give them five minutes to work their way around the room, asking questions as they go. Under no circumstances should they look at their card.
4. Once the five minutes are up, ask for volunteers to guess what their organism is and then they can get their card to see if they are correct. Give hints to students who still aren't sure.
5. Once everyone knows who is on their card, ask them if they can think of any way to classify the organisms. They may group them into plants and animals, or evergreens, deciduous trees, animals, and bugs. Whatever is proposed, discuss the classification and have the class work out where everyone fits in.
6. Then, have students get together with other kids who have the same color card. Ask them to figure out what those organisms have in common.
7. Discuss the concept of ecosystems and interdependency in ecosystems. You might ask students to trace the flow of nutrients and energy through their group of organisms.



### **Watch the AFG video Segment "Kentucky's Blanton Forest - Part 1"**

*Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site ([www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)).*

#### **Discussion Questions for Video Segment**

- What is an old growth forest?
- What is diversity? Why is there so much diversity in an old growth forest?
- He said that he looked for an 'uneven canopy' when trying to locate old growth forests. Why do you think that would be a clue?



### **Watch the AFG Video Segments "Northwest Temperate Rainforest, Parts 1 and 2"**

#### **Discussion Questions for Video Segment**

- In what ways was the Temperate Rainforest similar to Kentucky's Blanton Forest?
- In what ways were the two forests different?
- What are examples of limiting factors in forests?
- Why is water not a limiting factor in the rainforest?



### **Alternatively, choose additional segments from the AFG video selection on forests for a virtual tour of a forest in your neck of the woods.**

- Bulls Island, South Carolina – Maritime Forest
- Denali National Park – Tiga Forest and Moist Tundra
- Acadia National Park – Forest and Pond
- Mingo Wildlife Refuge – Oak Hickory Forest
- Washington's Hoh Rain Forest - Sitka Spruce Forest
- Hawaii Volcanoes National Park - Tropical Rain forest
- Adirondack Mountains – Forest
- Redwood National Park – Forest
- Siskiyou National Forest – River
- Cape Cod National Seashore - Beech Forest
- Glacier National Park – Forest
- White Mountain, New Hampshire – Forest

**Activity 2: Which Came First?****Time Allotted**

30 minutes

**Materials**

Access to the AFG video clips and projection capability

**Objectives**

- Students will learn the concepts of primary and secondary succession
- Students will illustrate an example of primary succession after a volcanic eruption.

**Teaching Instructions:**

- Introduce students to the concepts of primary and secondary succession in ecosystems. Primary succession is succession that occurs in areas where no ecosystem or biological activity has existed previously (eg. After a volcanic eruption, in paved areas). Secondary succession is a pattern of change in areas where biological activity or an ecosystem has previously existed (e.g. after a fire, landslide, logging).

**Watch the AFG Video Segment "Kentucky's Blanton Forest – Part 2"**

Start at "Hey what's this formation all about?" and stop after hearing "pretty neat huh, very".

*Note: You can access and view the video clips used in this lesson in the Teacher Resources section of the AFG Web site ([www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)).*

- Discuss the following questions
  - How does nature make opportunities for secondary succession in these woods?
  - What would happen here if no trees ever fell down and left features like this?
- Instruct students to take notes about succession during the next video. The topic comes up repeatedly but not in order and not necessarily clearly, so students will have to listen carefully to catch all references.

**Watch the AFG Video Segment "Crater Lake National Park: Pine Forest".**

- Have students work with a partner or in a group of three to pool their notes and to make a diagram of succession after a volcanic eruption. They should try to include as many steps as they can, using examples from the video (access to computers so that students can replay the video might help them to search for things they missed).
- Discuss the following questions
  - Is this an example of primary succession or secondary succession? Why?
  - Why do you think a pumice desert is called a desert?
  - What organisms come first after a volcanic eruption? Then what happens?
  - How might a volcanic eruption be good for an ecosystem?

**American Field Guide Teacher Resources: Forests**

Access this lesson plan online at: [www.pbs.org/americanfieldguide/teachers](http://www.pbs.org/americanfieldguide/teachers)

**Activity 3: Succession Field Trip****Time Allotted**

45 minutes or more (depending on set-up)

**Materials**

Paper and pencil

Tape

Cameras (optional, see teaching instructions)

**Objectives**

- Students will observe examples of primary and secondary succession areas around their community.
- Students will classify development of ecosystems as primary or secondary.
- Students will project the future of succession in an area.
- Students will examine the impact of human involvement on succession.

**Teaching Instructions**

Once students are familiar with concepts related to succession, have them look for examples in your area. This activity can be conducted by taking students outside to parking lots and school grounds, or by taking a field trip to a nearby park or forest. It can be done in class, or as homework. It can constitute a quick observational trip, or it can become a major project, depending on the needs of your class. Here are several suggestions for set-ups:

- Take a walk around campus, around the block, or to a local park. Ask students to find examples of primary and secondary succession (e.g. grass growing through cracks in asphalt, a grassy lot). Students can create a map to show where different types of succession occur on their walk. See discussion questions below.
- Ask students to observe an example each of primary and secondary succession for homework. They should make observations in a notebook and bring in to share.
- Assign a project. Students can make a portfolio illustrating different stages of succession in your area. They might take photos or make sketches of examples they see and then organize these into a series showing earliest succession to more mature examples.

**Discussion Questions:**

- How is primary succession different from secondary succession?
- What impact do humans have on succession?
- Is a planted garden an example?
- Did you see, or have you ever seen, examples of succession on houses or other buildings?
- Imagine a lawn on campus or in someone's yard. Are there any examples of succession there now? If no one maintained it for five years, what might it look like? What would it look like after 10 years? 50? 100?
- What might happen in New York City (or L.A., or a city near you) if people didn't keep it clean?

- In National Forests, government policy has been to suppress forest fires whenever possible for the last century. Now some regions are starting to allow fires to burn. Based on what you know about succession, what impact do you think this might have in the area? (Note, see the AFG activity on Forest Fires for more information).