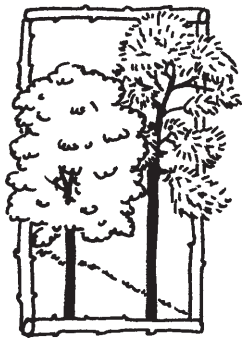
Nothing Succeeds Like Succession

Succession is the orderly replacement of plant and animal species through time in a given location, leading to a relatively stable biotic community. In a landscape that lacks both vegetation and soil (such as a sand dune or a recently cooled lava flow), primary succession may begin. In primary succession on land, living organisms slowly, often over hundreds or thousands of years, build soil. The first plants to arrive, sometimes called pioneer species, are usually fungi, lichens or mosses, and ferns, which are the oldest types of land plants. Over time, rock is weathered to soil; mosses and ferns cover the landscape; and small seeds, carried by animals or blown by wind, take root. Small shrubs and plants become established. Eventually, if conditions are right, this will be a healthy plant community with mature trees and plants. Secondary succession occurs on landscapes previously occupied by vegetation and can be considered an extension of primary succession (the soil building phase). Grass may begin to grow, followed by herbaceous and small woody plants, followed by shrubs and trees.

Each successional stage is accompanied by its characteristic animal species. Early-successional animal species find food and shelter among the weedy pioneer plants that invade areas cleared by natural or human causes. Mid-successional species are found in partially open areas. Openings in the forest canopy promote the growth of plants that are favored as food by many mammals and birds.

These openings provide edge habitat where field and forest meet, allowing animals to feed on the vegetation in the opening and to escape quickly into the forest. Late-successional animal species require mature forest habitats to provide the food and cover they need. Many species thrive in other types of mature plant communities such as grasslands, tundra, or deserts.

In some cases, whole regions are undergoing succession. For example, in the eastern United States, most of the trees were once cut down for timber and cleared for agriculture. When the fields were left fallow, native plants slowly began to recolonize the old fields. Today, whole new forests stand where the original ones used to be. A mature forest isn't always the stable climax community in succession. For example, because the redwoods of California live to be hundreds of years old, ecologists traditionally



Method

Students study the connection between plants, animals, and successional stages in local ecosystems.

Key Concepts

While every organism goes through a life cycle of growth, maturity, decline, and death, its role in the ecosystem also changes.

Ecosystems change over time through patterns of growth and succession. They are also affected by other phenomena such as disease, insects, fire, weather, and human intervention.

Objectives

- explore basic relationships between species diversity and ecosystem stability.
- identify successional stages in ecosystems based on plant and animal species
- draw conclusions about the process of succession based on study test plots in different stages of succession

Subjects & WI Academic Standards

Science:
A.4, C.4, F.4
A.8, C.8, F.8

Social Studies:
A.4, B.4, A.8, B.8

Math:
A.4, B.4, D.4
A.8, B.8, D.8

English/Language Arts:
A.4, B.4, C.4, F.4,
A.8, B.8, C.8, F.8

Environmental Education:
A.4, B.4
A.8, B.8

Materials

- chart paper
- crayons and pencils
- fencing (or rope)
- grass clippers
- stakes
- hammer
- string
- colored felt
- felt board
- clear plastic transparencies
- permanent or erasable ink markers
- copies of student pages
- camera (optional)

Preparation Time

30 minutes

believed that they were a climax species. Ecologists now believe that redwood forests that do not undergo periodic disturbances, such as fire or windstorm, will eventually give way to forests of hemlocks, which thrive in the shade of the redwoods. However, if the hemlock forest burns, it will grow back as a redwood forest, since redwoods have thick bark and are fairly fire resistant.

Sometimes, people purposely hold back succession to allow one stage to dominate, as when a farmer continually harvests and plows a field. Abandoned lots and neglected lawns, as well as parks, all show signs of secondary succession. When human-caused "setbacks" such as mowing or plowing are discontinued, new species of vegetation appear or begin to dominate the landscape. The first stage of secondary succession includes the plants we call weeds.

Getting Ready

1. Identify a nearby area that exhibits several stages of succession or plan this activity to correspond with a field trip to a natural area. If a field trip or walk is not possible, use the pictures of various stages of succession provided on page 44, cut additional pictures from magazines, or obtain pictures from land-use agencies (e.g., forestry, soil conservation, parks).
2. Make copies of student pages 45 - 46.

Doing the Activity

Part A

In the Classroom

1. Hand out the story "Tree Tops Valley" to each student. After reading it, discuss the changes that took place during the course of the story. (Forest burned and slowly grew back; people grew up, got old, had children and grandchildren, died . . .)
2. Hand out copies of the succession sequence on page 44 to let students see how succession typically proceeds in a forested area. Point out how each successional stage has its characteristic plants and animals.
3. Divide your group into teams. Using transparent overlays and colored markers, each team will create a sequence of pictures to show succession.

   The base drawing on a piece of 8 1/2" x 11" white paper should show a disturbed area (e.g., burned by fire or bulldozed). For example,

the base picture could show blackened ground with stumps of trees (perhaps with an animal passing through).

- Overlay drawings on transparencies should show successive phases of growth.
- Transparency 1 could display grass, flowers (seeds borne by wind or animal), and small animals returning.
- Transparency 2 could add small bushes, shrubs, and more animals.
- Transparency 3 could add young, small trees with characteristic animals.
- Transparency 4 could add full-grown, mature trees with characteristic animals.
- Have each team tape or staple the overlays to the base picture.

4. When finished, the teams can demonstrate their work to the group and describe what is happening in each successive scene.

Part B
In the Field

1. Take your students on a field trip through an area that has several types of vegetative communities (e.g., an urban park with wooded areas). Have them try to find plant communities in different stages of succession. Tell them not to worry about plant or tree names, only types (i.e., grasses, non-woody herbaceous plants, woody shrubs, trees). Have them look for animals and signs or sounds of animals. They should also look for evidence of disturbance (such as erosion, tire tracks, fire, construction) that might have altered the natural succession. They can look for the following stages of succession:
   - Grasses and nonwoody plants only
   - Grasses, and woody and nonwoody plants
   - Grasses and shrubs, with young tree saplings (stem < 1/2")
   - Ground vegetation and young trees (stem l/2" to 2")
   - Mature trees (stem > 2", can still be under canopy)
2. Call the group together and define the stages of succession evident at your site. Discuss what factors might alter succession at your site, including disease, insects, fire, wind, lightning, pollution, and drought.
3. Divide the class into teams with three members each. Have students draw a general map of the study area, including major

Activity Time

Part A: 1 50-minute class period

Part B: 1 or 2 50-minute class periods

Part C: small intervals of time over the course of the year

Setting

indoors and outdoors

landmarks (e.g., major trees, trail junctions, parking lots, benches, and creeks) and then identify areas on the map that fall into the different categories of succession identified in the preceding step.

Part C
In Your Backyard

1. For your study, get permission to designate three areas that are 10.75 square feet (1 m^2) on the school grounds or at a site nearby. The first area should be a non-blacktopped area that has been trampled. The second area should be a patch of lawn that is untrampled and is regularly mowed and watered. The third area should also be a lawn or grassy area that you will fence off and leave untouched (no mowing, watering, or fertilizing).

   NOTE—You will need to coordinate with your school's maintenance staff to designate this plot so it is not disturbed.

2. For an extended period of time (e.g., the school year), ask students to make written journal observations, drawings, or photographs of these three areas on a regular basis, about once a week. The camera position should be marked on the ground, so the same position can be used for each photo. This pictorial record should be displayed in the classroom. Photos can show the following:

   - Types of plants (record changes)
   - Plant growth rate (measure in centimeters and graph each week)
   - Changes in plant density (number of stems per square meter)
   - Changes in species composition (Do some plants gradually become more abundant and others less abundant?)
   - New plant species
   - Evidence of animal or human life

3. After each observation period, ask the students to make a general statement about apparent succession and differences in species diversity in all three sites. Create a wall chart to graph observations and measurements.

Enrichment – Say It on Felt

Assign teams for each of the stages of succession that were studied in the activity. Have teams use different colors of felt to cut out the shapes of plants and animals that are characteristic of their assigned stages of succession. Ask teams to write brief

stories describing them. Create a large felt board, in which the bottom third is brown (for soil) and the top two-thirds are blue (for sky). Have groups come up in order, place their plants and animals in appropriate places on the felt board, and tell their stories (felt naturally sticks to felt). Your class can re-create the story of succession, stage by stage.

Assessing Student Understanding

At the end of the designated observation time in Part C, ask students to write a summary report of what happened at all three sites and what stages of succession they observed. Look for descriptions of the life cycles and stages of plant growth, disturbance factors, and evidence of animal life.

Extending the Learning

Read About Succession

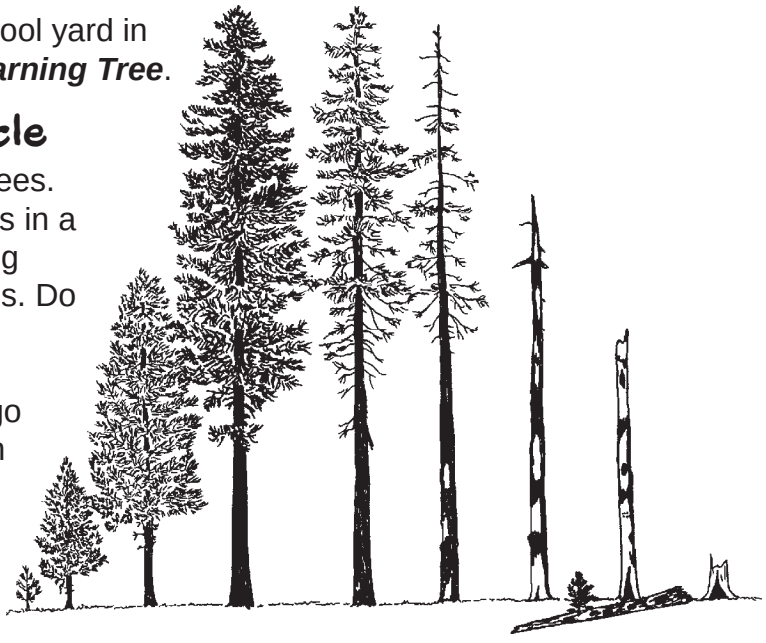
How the Forest Grew by William Jaspersohn tells the story of the gradual transition of a cleared farm field into a dense forest over the course of 200 years.

Explore Your School Grounds

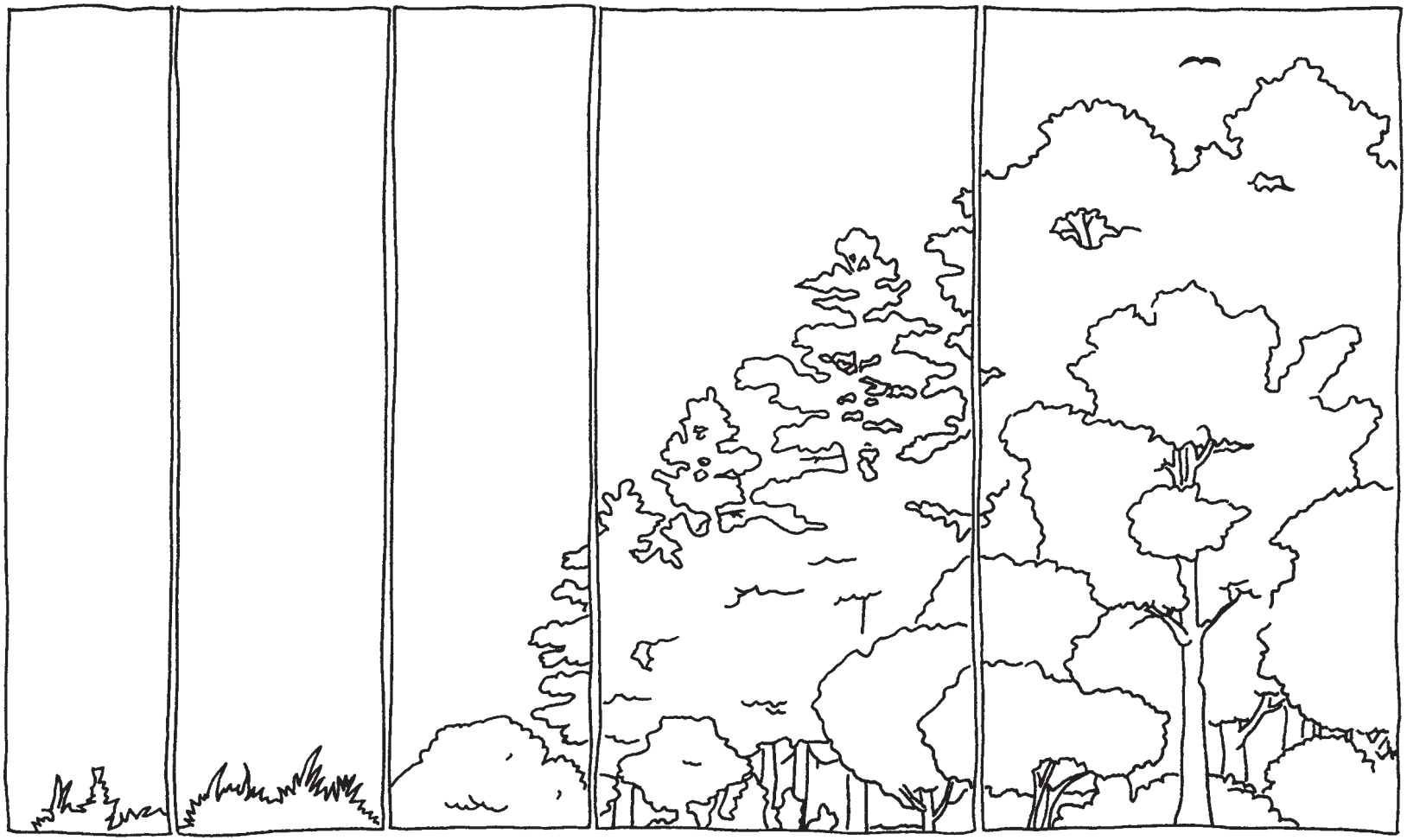
Find more ideas for studying your school yard in "School Yard Safari" from ***Project Learning Tree***.

Check Out a Tree's Life Cycle

Go stand in a forest and look at the trees. Because trees are the dominant plants in a forest, what happens to them has a big impact on the other plants and animals. Do you see tree seeds, saplings, young trees, mature trees, dying trees, or maybe an old snag or two? As trees go from birth to death, their physical form changes, as well as their role in the forest ecosystem. Think of all the different plants and animals that might use a tree as it goes through its life cycle from birth to death.



Picture of Succession



Tree Tops Valley

Once upon a time, a boy and a girl lived with their parents at the edge of a beautiful green valley in the Pacific Northwest. Their names were Sara and John.

The valley was filled with a vast evergreen forest. Its trees towered over the log cabin where John and Sara lived. Sara and John loved the forest. Every day they went exploring. They paddled in the forest's cool streams and made trails under the giant conifers.

They also liked to have picnics at the top of a hill near their home. Up there, they could look down on the tops of the valley's huge trees.

One day when they were up on the hill, they decided to give the valley a name. They called it Tree Tops Valley.

Then, in the middle of a hot summer day, everything changed. A lightning storm started a fire in the forest. Luckily, the wind blew the flames away from Sara and John's home. But when the fire went out, they saw it had burned their Tree Tops Valley. All the tall trees were burned. The tender little seedlings that had grown on the forest floor were gone. All that was left was the burned remains of trees.

They both wanted to cry. Sara said, "I just can't look at it. Our beautiful forest is gone forever. I never want to sit on our hill again." After the fire, the family moved away to a settlement where other families lived. There were children there, and Sara and John made new friends.

Then, five years after the fire, their father said, 'Why don't we visit the valley? It would be good to see it again."

Sara and John didn't want to go. They remembered how the valley had looked after the fire. But they agreed, and one day, the family saddled their horses and rode up to the valley.

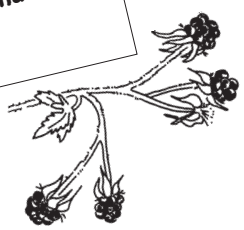
What a surprise! Things had happened since the fire. Winds had blown seeds into the valley. Birds had dropped them from the air. The seeds had sprouted. Now, instead of bare, burned ground, there were mosses, weeds, grasses, and ferns growing everywhere. The children rode back home feeling much better about Tree Tops Valley.

The years went by. Before they knew it, Sara and John had grown up. The settlement where they lived was much bigger now. John became a teacher and taught at the one room school that the settlers had built

Sara decided to be a prospector. She had heard stories about people who were finding gold farther north. So Sara bought supplies and one day was ready to leave. She promised John she would write him.

John didn't hear from Sara for many months. Then, finally, a letter arrived. In the letter, Sara wrote,

> On my way north, I passed through Tree Tops Valley. You would be amazed at how the valley looks now! Our old cabin is still there, but everything else has changed. The whole valley is full of berry bushes. I had a feast!



The letter gave John an idea. He thought, "When I have children of my own, I'll take them berry picking in the valley. That would be fun!"

Soon after that, John got married. When his oldest son was 10 years old, he remembered his idea. He took his family to the valley to pick berries. His children loved the valley. But there were no berries to pick. Most of the bushes were gone.

Instead, the valley was filling with deciduous trees. John wrote to Sara about them. He wrote,

> There are lots of leafy green trees in the valley. And I saw some conifer seedlings. The leafy trees have shaded the berry bushes and choked them out. I don't know what the trees are called, but they have made the valley all green again."

Many years passed. John's children grew up and had families of their own. One summer, when John was 75 years old, he received a letter from Sara. It read:

> Dear John,
>
> Remember how we loved Tree Tops Valley when we were young? Last month I decided to visit it again, before I got too old to make the trip. It was a long ride, but I made it! You would be happy to see our valley now. It's beautiful!
>
> Remember those leafy green trees you saw on your last trip there? Well, most of them are gone. Now the valley is full of young coniferous trees. Who knows? Maybe our grandchildren will see the valley looking the way we once saw it.
>
> Love, Sara

The years went by. It was now 100 years since the fire had swept through Tree Tops Valley.

One day, John's granddaughter, Jennifer, was looking at some old family letters. She found the letter Sara had written to John after her last visit to Tree Tops Valley.

"Look at this,"Jennifer said to her husband. It's a letter that belonged to my grandfather John. His sister wrote it to him. It's all about a place called Tree Tops Valley. I wonder if we could find the valley. Why don't we try?"

And that's what they did. Jennifer and her husband found the valley. They even found the hill where Sara and John had taken their picnics.

From the hill, they could see tall conifers filling the whole valley. They climbed down and explored. Jennifer and her husband didn't know it, but Tree Tops Valley was well into the long journey of rebuilding the same kind of forest that Sara and John had enjoyed so many years before.