

Forests & Sunlight

National Science Education Standards

- ✿ Unifying Concepts *and Processes* — Constancy, change and measurement.
- ✿ Standard A: *Science as Inquiry* — Abilities necessary to do scientific inquiry.
- ✿ Standard A: *Science as Inquiry* — Understandings about scientific inquiry.
- ✿ Standard C: *Life Sciences* — Diversity and adaptations of organisms.



OVERVIEW

In this activity, students will visit two different types of forest sites. They will observe and take measurements to help determine the role that sunlight plays in each area.

OBJECTIVES

Students will:

1. Observe and compare densely forested and open forest sites to determine the role sunlight plays in a forest ecosystem.

SUBJECTS

Science

VOCABULARY

Canopy, groundcover, understory

TIME

60 minutes

MATERIALS

Clipboards and writing paper or field note books, pencils or pens for each student. Two sets of thermometers, five or more colored pencils, and copies of “Science Cards” for each student.

BACKGROUND

Plant succession is a repeatable, directional change in the types of plant species that occupy a habitat through time after a disturbance. Scientists have classified many different types of succession. In the majority of these successions types, the initial plant community is dominated by small, short lived weed species that have the ability to produce many seeds. The species found the late stages of succession tend to huge, long lived species that produce only a few large well developed seeds. A number of mechanisms have been identified as the causal mechanisms responsible for succession. The mechanisms involved in succession include: facilitation, abiotic modification and resource competition; differential competition of resources by the plant species; and differential competition of space by the plant species.

Primary Plant Succession

The process of plant succession begins just as soon as a land area capable of supporting plant life is formed. Some examples:

- accumulation of sand dunes at the edge of the ocean or a lake
- exposure of rock by a retreating glacier
- cooling of a lava flow

Secondary Plant Succession

Lumbering, grazing, farming, fires, and hurricanes interrupt the process of succession by removing the dominant plants in the community. Their elimination sets the stage for a new succession to begin.

The colonization of bare rock, the filling in of a pond, and the secondary succession that follows the abandonment of a field each involve different species in the early stages. In any

given region, though, the species in the final, self-sustaining climax forest are the same. The tendency for all plant communities to end in the same climax community is called convergence.

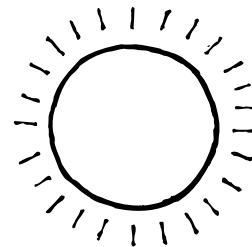
In general, plant succession is a reflection of the increasing efficiency of the community at intercepting the energy of the sun and converting it into chemical energy. As one stage of succession follows another,

- the **biomass** of the community increases. This is the outcome of the increasing amount of
- **net productivity** — calories stored by the plant community.
- This, in turn, provides calories for a larger community of **consumers**.
- As succession continues, the diversity of species in the community increases — at least for a time.
- When the system approaches its **climax**, the **rate** of increase in net productivity of the plants is consumed by its own heterotrophs.
- The system comes into equilibrium and reaches peak efficiency at channeling the energy of the sun into the food web of the community.

BEFORE THE ACTIVITY

Select two sites, one forested or densely forested, and one non-forested or open area.

Make copies of the “Science Cards” for each student.



ACTIVITY

Explain to students that they will be taking measurements at two forest locations to investigate the interrelationships between forests and the nonliving environment. Tell them they are to look for differences and determine what causes the differences.

Classroom Follow-Up:

Students discuss the two Forest and Sunlight sites.

- (a) Which site had the most plants in the shrub and ground cover layers? Was this the site where more or less sunlight reached the ground? Why would the amount of sunlight reaching the ground affect the number of plants growing there?
- (b) In which site was the air warmer? How does the air temperature relate to the amount of sunlight reaching the ground?
- (c) Which site, the sunny one or shaded one, would provide more food for animals that eat ground coverplants? Which site would provide more food for animals that eat shrubs? Would students expect to find more eaters of shrub and ground cover plants in a dense forest or in an open forest?

Students should conclude that where more sunlight reaches the shrub and ground cover layers, more plants will grow, because plants need sunlight for photosynthesis. Sunnier sites will have more low-growing plants and thus more food for those animals that feed on those plants.

CREDIT

This activity is adapted with permission from the Alaska Wildlife Curriculum (AWC). AWC is a program of the Alaska Department of Fish and Game. Go to <http://www.wildlife.alaska.gov/education/wilded/awc.cfm> or <http://www.adfg.state.ak.us/> for more information about this award-winning environmental education curriculum.





Name _____

Student Page

Science Card

Forests & Sunlight: Dense Forest

1. Turn to a page of your field notebook and write the heading "Forests and Sunlight." Draw a line down the center of the page. Write a heading that describes this site on the left side of the paper.

2. As you look up, the main plants you will see are trees, if any occur at this site. These form the overstory or **canopy** layer of plants. As you look straight ahead, you may see another layer of plants, the **understory** or shrub layer. As you look down, you will see a **ground cover** layer of plants. Different sites usually have different numbers and kinds of plant layers. Some sites have only one of these layers. Other areas may have more layers –perhaps a tall tree, small tree, tall shrub, low shrub, and ground cover layer will be present.

3. Look around you and draw a picture on the left side of your page that shows the different layers of plants in this area. Use a

different colored pencil to draw each layer. The number of lines you draw for each layer should show how many plant stems are in that layer. Draw in many lines to show that there are many plant stems. If there are large spaces between the plants in any layer, then draw just a few lines.

4. Look overhead at the number of leaves and branches. These block sunlight and prevent it from reaching the ground. How much sunlight do you think reaches the shrub layer at this spot: (a) nearly all sunlight, (b) some, but not all sunlight, or (c) very little sunlight? How much reaches the ground? Record your answers in complete sentences below your drawing.

5. Use the thermometer to measure the air temperature. Record this in your notebook below your drawing of this site.

Forests and Sunlight

America's Rain Forests



Name _____

Student Page

Science Card

Forests & Sunlight: Open Site

1. In your field notebook, turn to the “Forests and Sunlight” page that you set up earlier or start a new page. Write a heading that describes this site on the right side of the paper.
2. As you look up, the main plants you will see are trees, if any occur at this site. These form the overstory or **canopy** layer of plants. As you look straight ahead, you may see another layer of plants, the **understory** or shrub layer. As you look down, you will see a **ground cover** layer of plants. Different sites usually have different numbers and kinds of plant layers. Some sites have only one of these layers. Other areas may have more layers –perhaps a tall tree, small tree, tall shrub, low shrub, and ground cover layer will be present.
3. Look around you and draw a picture on the right side of your page that shows the different layers of plants in this area. Use a different colored pencil to draw each layer. The number of lines you draw for each layer should show how many plant stems are in that layer. Draw in many lines to show that there are many plant stems. If there are large spaces between the plants in any layer, then draw just a few lines.
4. Look overhead at the number of leaves and branches. These block sunlight and prevent it from reaching the ground. How much sunlight do you think reaches the shrub layer at this spot: (1) nearly all sunlight, (2) some, but not all sunlight, or (3) very little sunlight? How much reaches the ground? Record your answers in complete sentences below your drawing.
5. Use the thermometer to measure the air temperature. Record this in your notebook below your drawing of this site.