Grade 3-5 | Time: 1 hour

EVERY TREE FOR ITSELF

Essential Question:

What do forests need to survive and be healthy?

Overview

Students play a game to simulate how trees compete for their essential needs.

Assessment

Can students describe how varying amounts of light, water and nutrients affect a tree's growth?

Vocabulary

- Competition
- Drought
- Nutrients
- Succession

Information and Procedure

Prior knowledge for students: Basic tree anatomy would be helpful

Source: AMEREF Forestry Module Every Tree for Itself. Copied with permission, American Forest Foundation, Copyright: 1993-1998, Project Learning Tree Environmental Education PreK-8 Activity Guide. The complete Activity Guide and High School Modules can be obtained by attending a PLT workshop. For more information visit the Project Learning Tree website at (www.plt.org). (Graphics from Depositphotos.com)

Materials needed

- 8½" x 11" (22 cm x 28 cm) pieces of paper or paper plates
- Pieces of blue, yellow and green paper or three colors or poker chips
- Tally Sheet (attached)
- Markers or crayons
- Tree Cookie or tree branch cross-sections showing annual growth rings if available (often available from tree-trimming services or forest industries)

Alaska Standards Addressed

Science GLEs

The student demonstrates an understanding;

- that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by:

[4] SC3.1 identifying examples of living and non-living things and the relationship between them (e.g., living things need water, herbivores need plants).

- those interactions with the environment provide an opportunity for understanding scientific concepts by:

[5] SA3.1 identifying the limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive.

Math GLEs

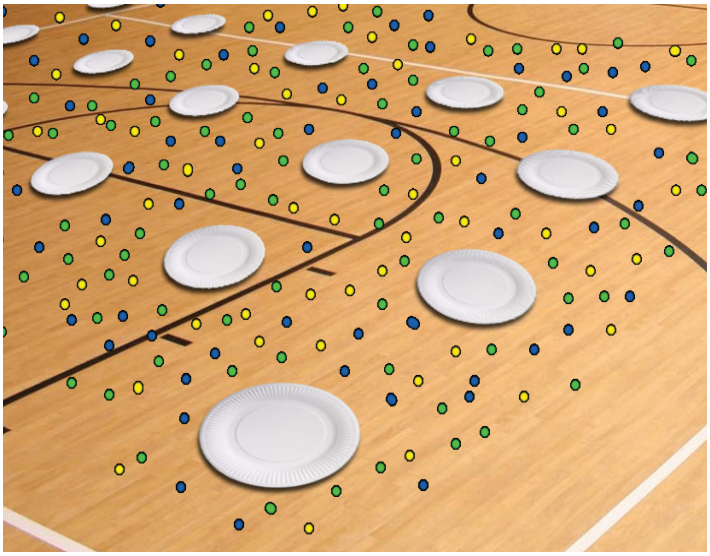
to classify and organize data by [3] S&P-1 [designing an investigation and collecting, recording L], organizing, displaying, or explaining the classification of data in real-world problems using bar graphs, and [Venn diagrams L]

[4] S&P-1 [designing an investigation and collecting L], organizing or displaying, using appropriate scale, data in real-world problems, using bar graphs, tables, charts, or diagrams with whole numbers up to 25

[5] S&P-1 [designing an investigation and collecting L], organizing, or displaying, using appropriate scale, data in real-world problems, using bar graphs, tables, charts, diagrams, or line graphs with whole numbers up to 50.

Alaska English/Language Arts and Mathematics Standards (2012)

- RI.K-5.4
- SL.K-5.1, SL.K-5.5



What to do in advance

Cut at least four 3" x 3" (7.6 cm x 7.6 cm) squares out of blue, yellow, and green construction paper for each student. To save time, you could use colored poker chips. **Poker chips work much better than paper,** especially if you're doing the activity outdoors on a breezy day. Copy Tally Sheets for students.

Teaching the Lesson

Gear-up

Ask the students, "If you were a tree and lived in the forest, would you rather be a strong older tree, a regular size tree, a small tree just starting out, or a tree that preferred shade. Why?"

Pass out the Tree Cookie or any cross-sections of trees you have. Have your students examine the growth rings. (If you don't have an actual cross-section, draw a big one on the chalkboard.) Explain that the number of rings indicates a tree's age.

Discuss

- What do trees need so they can grow?
- Trees have some of the same needs as those of people and animals. For example, they all need plenty of water.
- They also need an abundance of nutrients, which they get from food. But trees and people don't get food in the same way. Plants make their own food by using energy from the sun.
- If trees don't get enough water, nutrients, or sunlight, they may grow slowly or die. Growth rings show this graphically. In general, wide rings indicate good conditions for growth (plenty of nutrients, water, and sunshine) while narrow rings often indicate less favorable conditions for growth (drought, short growing seasons, insect damage, lack of nutrients or competition).

Explore

Give a large piece of paper (at least 8½" x 11" or 22 cm x 28 cm) or a white paper plate to each student. Tell students to imagine that they are trees. Have them draw a cross-section of themselves representing their age in growth rings. (You might laminate these drawings for durability.)

Have students stand on their cross-sections (paper plates) about three feet (91 cm) apart from each other.

Equally distribute the colored squares (or poker chips) on the floor around the students so the squares (poker chips) are about one to two feet (30-61 cm) apart. See photo to the right.

Tell students that they'll be playing a game called ***"Every Tree for Itself."*** The object of the game is for the "trees" to gather as many colored squares (poker chips) as they can. Explain that each colored square (poker chip) represents a tree requirement. Blue represents water, yellow represents sunlight, and green represents a nutrient such as nitrogen, oxygen or carbon dioxide. Make appropriate adjustments if you use poker chips. (Blue = water, White = nutrient, Red = sunshine)

Rules:
Students must keep one foot (their tap root) planted on their cross-section (paper plate) at all times. They are not allowed to slide their cross-section (paper plate) along the floor or step off it; they will be disqualified for doing so.

Round 1:
Give a signal to start. Have student trees reach out with their roots and branches (arms and legs) to gather their requirements. Allow student trees to gather these requirements for one 30-second round. (They can either collect all types of requirements at once or one type of requirement each round.) Have students use a notebook or tally sheet (provided with this exercise) to record how many of each color requirement they gathered. Use the following questions to discuss the results of the first round:

- How many requirements did each tree get?
- Do any trees lack a particular requirement?

- What might happen to a real tree that lacked one of its requirements?
- (It might grow slowly or eventually die. Point out to the students, that different species of trees have different requirements.)
- Is there such a thing as too much water, sunlight, or nutrients? (Yes, every species has optimum levels for each requirement. Beyond which the tree becomes stressed.)

Round 2: Have students stand on their cross-sections in groups of three to five. Gather the colored squares and spread them around the room again. Play another round and have student trees record their results. Compare the results of this round with those of the first.

In most cases, students will notice that each tree gathered fewer requirements. Ask your students if they can reach any conclusion about trees that grow close to each other. (Such trees compete for requirements. Often they don't grow as well as trees that are more widely separated from one another.) Ask if any trees "died" because they couldn't get a particular requirement. (You can allow trees to fall down or look tired and droopy if they haven't received their vital requirements.) Try several more rounds, comparing the results each time.

Additional rounds:
After the round is played change it up and create a natural disaster to think out the forest:

- Have a certain amount of red from sun to fire
- Have a certain amount of blue represent a flood
- Have a certain amount of white to spruce bark beetle

Generalize

Assign values to the amounts of requirements the students gather (see attached rubric on last page). For example, a collection of three or more of each requirement could represent superior growth. Two of each requirement could represent average growth. One or fewer of each could represent poor growth. Using these values as a basis, have students record the numbers of trees that are growing very well, fairly well, and poorly for each round. Students can use graphs to show results.

Foresters plant trees a certain distance apart so the trees will be able to get enough nutrients. The distance varies depending on the species of the tree. Foresters also thin young stands of trees. Ask students how foresters might use their knowledge of competition in caring for a stand of trees.

Assess

Ask students to describe on paper, what trees need to survive and how arrangement of trees in a forest can affect the growth of individual trees.

Extensions, adaptations, and more resources:

Extensions could include examining the effect of natural disasters (see "Additional Rounds").

Date: _____ Name: _____

"EVERY TREE FOR ITSELF" Activity

Tally Chart

Description	ROUND 1	2	3	4	5	6	7	8	9	10
Spacing from other trees										
Sun Intake										
Water Intake										
Nutrients Intake										
Other Factors										
Health of the Tree Please circle one										
	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy	Healthy
	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk	Slight Risk
	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk	Great Risk
	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead	Dead

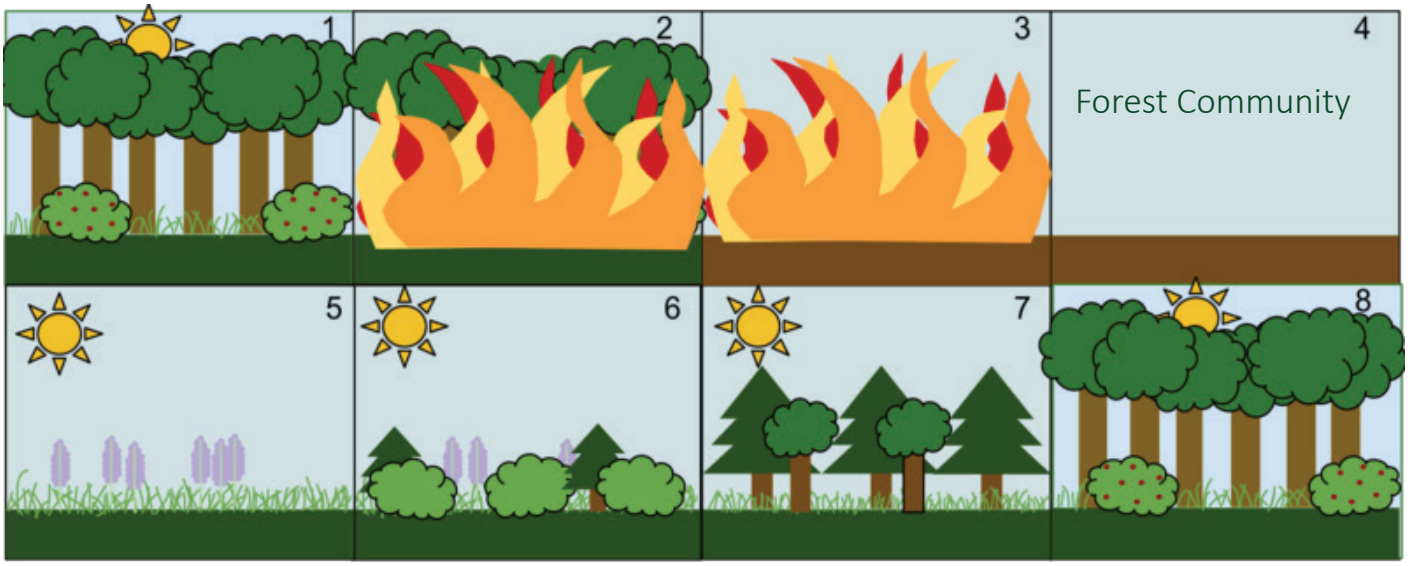
Healthy = 8 of Each Color Chips **Great Risk = 4 of Each Color Chips**
Slight Risk = 6 of Each Color Chips **Dead/Dying = 2 of Each Color Chips**

If one color greatly out numbers the others, then:

Too many water units = flooded roots, soil erosion, etc.

Too many sun units = very hot? Wilted? Or Drought if water is low.

Too many nutrient units = if not much water then nutrients could not be absorbed.



Kmurphy12/wikipedia.org

An example of Secondary Succession by stages:

1. A stable deciduous forest community
2. A disturbance, such as a wild fire, destroys the forest
3. The fire burns the forest to the ground
4. The fire leaves behind empty, but not destroyed, soil
5. Grasses and other herbaceous plants grow back first
6. Small bushes and trees begin to colonize the area
7. Fast growing evergreen trees develop to their fullest, while shade-tolerant trees develop in the understory
8. The short-lived and shade intolerant evergreen trees die as the larger deciduous trees overtop them. The ecosystem is now back to a similar state to where it began.

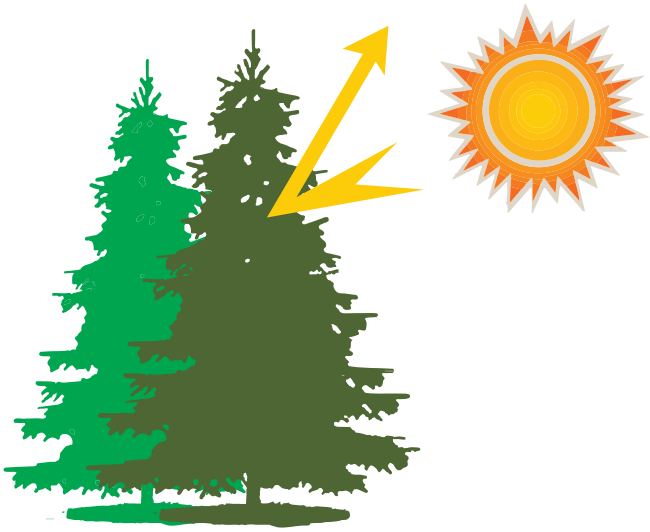
Background

The pattern of change from bare rock to deep forest is called succession – the order that plants colonize a barren site or reestablish themselves on a disturbed site. How a forest grows and which plants come first or second depends on 1) differences in the needs of the plants, 2) the effects of the non-living environment on plants and other living things and 3) competition. (Items #1 and #2 have been addressed in previous lessons.)

Competition occurs when the supplies of energy, nutrients, and space are limited. Any plant that can get more water, nutrients, and sunlight than its neighbors will grow better and be able to have more offspring.

Plants have a variety of adaptations to help them compete for the resources they need for survival and growth. Some plants grow tall, such as Sitka spruce, to get more of the available sunlight energy. Plants with long roots, such as black or white spruce, reach farther and get more water and nutrients than those with short roots. Some produce chemicals to kill the roots of other plants and assure a larger supply of nutrients and water for themselves.

All living things compete with similar organisms to one degree or another. It is not unusual to find 2 trees of the same species, same height, and same diameter, growing side by side, which are significantly different in age. One scientist in Southeast analyzed western hemlock trees growing next to one another. He found it was not uncommon to find trees of the same diameter in which one was 1,000 years old and the other only 200 years old. The slower growth of the older tree can be attributed to the competition for soil nutrients and sunlight during a time when the forest was young and overcrowded. The younger tree, growing in an old growth forest, which has more space, was able to grow quickly putting on more girth and height during a growing season than its next-door neighbor at its same age.



In early successional Coastal forests, trees will usually grow very closely spaced with several thousand trees per acre. Foresters often thin these young forests to several hundred trees per acre. In looking at these forests several years after such thinning, growth on the remaining trees is more extreme as the competition was minimized.

Competition is a constant interaction among ecosystem organisms. The specific mixture of organisms in any forest is due, in part, to the effects of competition.

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