



Lesson Plan Information

Estimated Duration: 30 to 45 minutes preparation for each activity, 2-4 weeks germination

Materials: Activity 1: Containers with lids, seeds, masking tape; Activity 2 and 3: Clear containers with and without lids, paper towels, cotton batting or sawdust, seeds, water, potting soil, graph paper

Setting: Indoors

Curriculum Links: See table of curriculum links on www.focusonforests.ca

Key Vocabulary: Seeds, seed coat, pressure, germination, absorption, quantity, lighting types (indirect and artificial), growth, liquid

PRIMARY/JUNIOR

SEED GERMINATION

Teacher Background

A tree starts life as a tiny seed. Water, warmth and time combine to start the growth process. This is called germination. When a seed starts to grow it takes in moisture, which makes it swell and splits the seed coat. Once the seed begins to expand, it has enough force to work its way through the soil toward the light. First a tiny root grows and bends downward into the soil under the influence of gravity. Finally, the stem and leaves emerge from the seed coat and push their way through the soil toward the sunlight. The seedling then begins to manufacture its own food. Eventually, it grows into a larger tree called a sapling. Each year the tree adds a new layer of wood and bark and the trunk and branches grow thicker. Once the tree has reached maturity, it produces seed for the next generation of forest.

Tree Growth Requirements

The rate of photosynthesis and hence tree growth is affected by the quality, intensity and duration of light. A tree's need for light varies depending on the species. Some trees, such as jack pine, require full sunlight in order to grow. Others, such as sugar maple will tolerate partial shade. In general trees can be classified into two main groups: the intolerants (requiring full sunlight) and the tolerant (which do not require full sunlight).

Water forms 80 to 90 per cent of the tree's bulk. Water is essential for transporting minerals and nutrients from the roots to the leaves. It is also an important raw material used in photosynthesis. Different trees all have different requirements of water, much like light. Cedars can be very water demanding tree species, whereas red oak can grow comfortably in drier areas.

Nutrients are important for growth. Nutrients come from the soil medium in which plants grow; therefore soil quality can affect how a tree grows. For more information about the value of soils for tree growth check out Focus on Forests lesson plans: *Forest Soils* and *Energize a Tree* at www.focusonforests.ca.

Activity 1

- Step 1** Fill a container with any type of seed. Add enough water to cover the seeds then seal the lid with masking tape.
- Step 2** Discuss the process of germination with your students. Ask them to predict what will happen to the seeds and the container and to write down some of their predictions.
- Step 3** Set the container aside and observe daily. Eventually the absorption of the water and internal pressures in the germinating seeds will create sufficient pressure to crack the plastic container. Compare students predictions with what actually occurred.

Extensions

Take a spring hike through the neighbourhood looking for signs of germinating seeds. In an urban environment, look for unusual examples of the power of germinating seeds (e.g. plants that have pushed through the asphalt or cracks in concrete).

Activity 2

Ask your students: Do plants need light to grow? What would happen to green plants if they did not have sunlight? Challenge students to create their own experiments to help find the answer, or have them try the following experiment as a model:

- Step 1** Plant four or five tree seeds in potting soil approximately 2.5 cm from the bottom of three containers. Add enough water to soak the soil. The seeds should germinate within a week or so.
- Step 2** After the seeds have germinated, let the class decide what type and amount of light each tree will receive (e.g. direct sunlight, indirect sunlight, artificial light, no light). Keep all other variables (e.g. temperatures, water) constant.
- Step 3** Label each container (date planted, type of light), place them in the chosen locations, and add water when needed.
- Step 4** Observe each tree daily with your class and record observations. Use a bar-graph to record results.
- Step 5** At the end of three to four weeks, discuss which tree grew the best. Did this have anything to do with the light conditions? What conclusions can be drawn about light conditions necessary for the growth of seedlings? Discuss with students how different species of trees have different tree requirements.

Extensions

Take the class on a forest walk. Observe which trees grow in full sunlight and which grow in full or partial shade. Using a tree identification book, make a list of these trees according to their differing light requirements.

Activity 3

Ask your students: How much water do you think a tree needs to grow? What would happen to trees if they did not have any water? Challenge them to create their own experiments to help find the answer, or have them try the following experiment as a model:

- Step 1** Choose two students to line three identical clear containers with paper towels, cotton batting, or sawdust. Plant four to five tree seeds approximately 2.5 cm from the bottom of each container. Add 3 cm of water in each container.
- Step 2** Have your class decide how much water each container will receive on a daily basis (e.g. none, 50 mL, 100 mL). Label the containers accordingly. Place all the containers in the same location in the classroom. Keep all other variables (e.g. light, temperature) constant.
- Step 3** Encourage students to predict what will happen by discussing as a group.
- Step 4** Have students water each container daily with the prescribed amount of water for a period of three to four weeks. Observe daily and record observations.
- Step 5** Which tree grew best? Did this have anything to do with the amount of water received? What conclusions can be drawn about the amount of water required for the best growth?

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