The Greenhouse Effect

Activity Info

Level: junior
Subject: science
Duration: one class, plus daily research time for a period of seven to 10 days (10 minutes each)
Group: four per group; class
Setting: classroom
Preparation: Each greenhouse requires a planter or box, seeds (radish or other fast germinating type), two coat hangers and clear plastic. Based on available classroom time, resources and space, decide whether each group will produce one greenhouse as part of a larger class project, or five greenhouses for a group experiment.

Summary

Students will create mini-greenhouses and use them to observe how changes in temperature, moisture/humidity, sunlight and soil can affect the growth of seeds.

Learning Outcomes

Students will:

- create mini-greenhouses and plant and care for seedlings
- predict what will happen when they change one of the climate variables and will compare it with their actual results
- observe and record their findings in a daily log
- compare the seedling in the greenhouse environment with a tree growing in a forest in the Earth's atmosphere
- discuss how changing different aspects of climate might affect nature

Background

Plants need warmth, sunlight, water and soil to grow. By varying these factors we affect the health of plants. When scientists study climate change they observe the effects that various environmental changes (temperature, humidity/water, incoming radiation) have on nature. They use this knowledge to try to predict the long-term effects that these changes might have, alone and in combination with each other.

1. Ask students to construct five nearly identical greenhouses and plant their seeds. Greenhouse #4 will have less soil than the others; see below. Greenhouse #1 will be the control. You should attempt to have the best growing conditions to promote seed growth. Keep in mind, seeds are prone to fungal diseases. Try to maintain good air circulation around the greenhouses.

2. Vary one factor in each of the greenhouses.

Greenhouse #1 — Control: All factors will be constant.

Greenhouse #2 — Temperature: Place near a heater or suspend 2 cm above a heating pad for four to six hours each day to increase temperature.

Greenhouse #3 — Humidity: Provide an equal amount of water to each plant using the control to determine need. Double the amount of water to each plant in this container.

Greenhouse #4 — Soil: Plant seeds in 4 cm of soil in all containers except for this container. Use only 1 cm of soil.

Greenhouse #5 — Sunlight: Place into direct sunlight or supplement with a growing light.

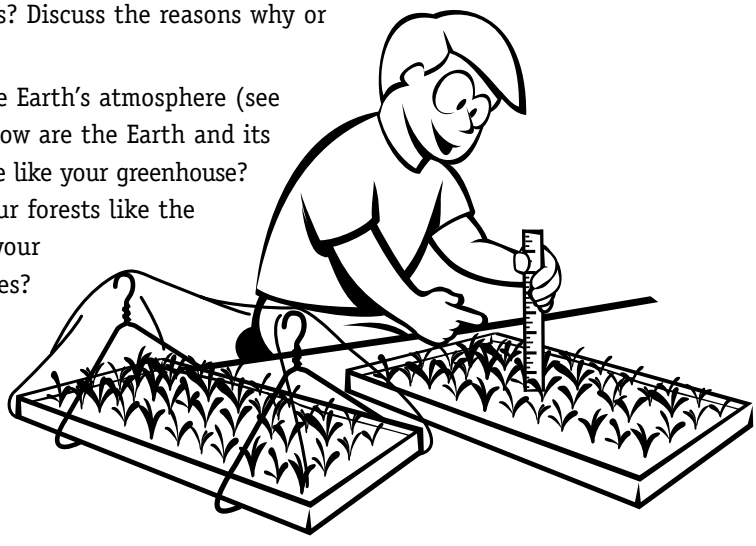
3. Ask students to predict what will happen in each greenhouse. There may be related effects that they should consider. For example, if you increase the sunlight, what will happen to the temperature and moisture?

4. Have the students record their daily observations for seven to 10 days.

5. Ask the groups to share their results through brief verbal presentations to the class. Create a class Greenhouse Comparison chart (see page 15) of the results of the five different greenhouse factors.

6. As a class, discuss and compare:

- What happened in each greenhouse? Did it match the students' predictions? Discuss the reasons why or why not.
- Discuss the Earth's atmosphere (see page 3). How are the Earth and its atmosphere like your greenhouse? How are our forests like the plants in your greenhouses?



Name _____ Date _____

Greenhouse Comparison

	Greenhouse 1	Greenhouse 2	Greenhouse 3	Greenhouse 4	Greenhouse 5
Prediction					
DAY 1					
DAY 2					
DAY 3					
DAY 4					
DAY 5					
DAY 6					
DAY 7					
DAY 8					
DAY 9					
DAY 10					
Results					

Plant Hardiness Map

Climate directly affects the types of plants and plant communities that can survive and grow in a specific area. For example, any gardener will tell you that growing large, vine-ripened tomatoes in a place like Thompson, Manitoba can be a challenging undertaking.

Since 1967 Agriculture Canada has made a map available, indicating the boundaries of plant hardiness zones across Canada. The map is used by gardeners across the country to determine how well specific plants will grow in their areas. The hardiness zones were developed based on things like winter temperature, length of frost-free period, rainfall, and maximum wind speed.

A couple of factors in recent years have reduced the accuracy of the hardiness zone map. Canada's climate has changed. We also have more detailed information about our climate now.

Scientists at the Canadian Forest Service have responded by re-evaluating Canada's plant hardiness zones to create a new map. The new map shows that hardiness zones appear to have changed in many parts of the country.

The new hardiness zones map is available now. We have included it as a pull out in this teaching kit, on the back of the National Forest Week poster. If the map has already been removed from this book visit the hardiness zones web site: http://sis.agr.gc.ca/cansis/nsdb/climate/hardiness/intro.html

Glow-in-the-Dark Seedlings?

What does it mean when a tree seedling glows in the dark? To scientists at the Ontario Forest Research Institute (OFRI) a healthy glow means a healthy seedling.

OFRI is a world leader with a 40-year tradition in seedling research. One of its many projects involves detecting the red light given off by seedlings and plants, called chlorophyll fluorescence.

First, after being stress-tested by exposure to heat and low humidity, special equipment is used to measure the glow of the research seedlings. These seedlings are planted and their growth is monitored for up to five years. Scientists have discovered that plants that recover well from stress tests — as indicated by their glow — also grow best after planting.

In future, scientists hope to develop a similar technology that would allow them to determine if a forest is under stress by conducting glow tests from airplanes. This would provide an indicator of forest health, which could be applied in forest management strategies.

Other Projects

Ontario's forests play an important role in Canada's commitment to reduce the impact of climate change. Forests cover 65 per cent of Ontario's landbase. The Ontario Ministry of Natural Resources is conducting research on the effects of a changing climate on our forest ecosystems, as well as developing strategies to help our forest managers adapt. Some of the projects underway include:

- the Ontario Carbon Budget Model, designed to estimate the amount of carbon stored in forests, and to quantify the effects of disturbances
- effects of changing climate on forest insect populations
- enhanced protection strategies from insects and fire
- potential effects on seed sources and forest genetics
- using genetically improved planting stock and enhanced stand management practices to increase carbon sequestration
- developing strategies to increase the amount of trees planted on marginal agricultural lands
- generating energy through the combustion of wood by-products and forest biomass
- role of wetlands in managing climate change

For more information, contact the Ontario Forest Research Institute or visit Ontario's Forests web site at http://ontariosforests.mnr.gov.on.ca