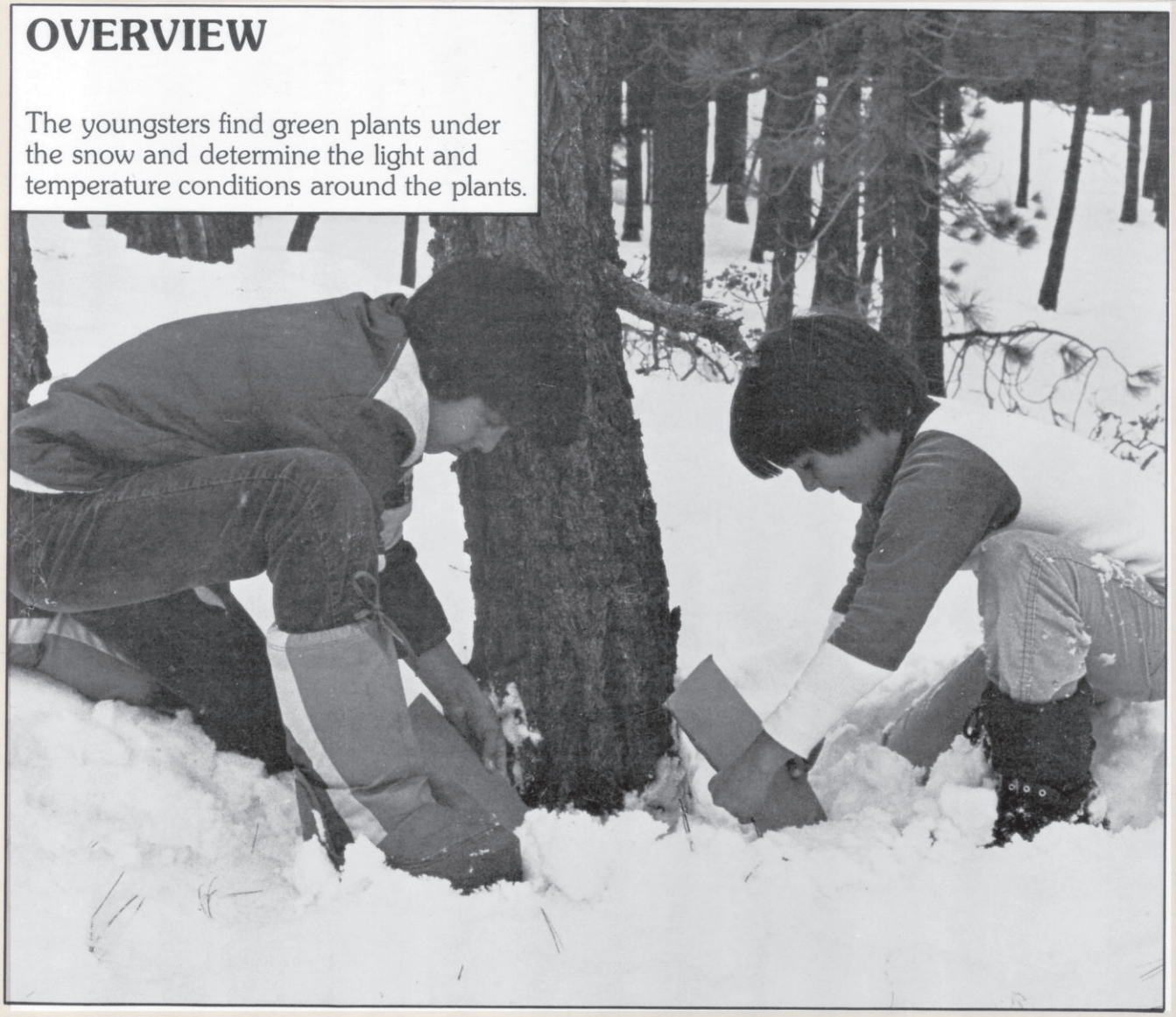
WINTERGREEN

BIO KEY

Snow-Covered Plants
Light Penetration
Temperature

OVERVIEW

The youngsters find green plants under the snow and determine the light and temperature conditions around the plants.



BACKGROUND

Note: This activity is more complicated than the other activities in the Wintertime Module, so save it for last.

As spring approaches and the frequency of warm, sunny days increases, the winter snow layer under which plants are buried actually helps create favorable growing conditions. Some plants may be up and ready to flower within days after the snow around them has melted, indicating that a great deal of growth has taken place beneath the snow.

Plants buried in a layer of snow are insulated from extremely cold temperatures. When the air temperature plunges well below 0° C (32° F.), the temperature below the surface of the snow stays at about 0° C, which is above the freezing point of cold-adapted plants. The snow layer also allows some light to pass through to the buried plants. When enough light reaches a plant and the temperature is warm enough, the plant may begin to produce food and grow, even while still covered by snow.

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MATERIALS

FOR PART ONE

For each team of two:

1 trowel*
1 piece of triwall cardboard*, 40 cm × 40 cm
1 packet of photographic proof paper* (See the "Making a Light Reading" Technique Card.)
1 small jar of fixing solution* (See the technique card.)
1 small jar of water
1 pair of tweezers*
1 pencil
1 ruler*
1 watch with a second hand

For the group:

1 data board or large drawing pad*
felt-tip marking pens*
2 rolls of transparent tape*
1 extra packet of proof paper*
1 "Making a Light Reading" Technique Card*

FOR PART TWO

For each team of two:

1 thermometer dip-stick (See the "Thermometer Dip-Stick" Equipment Card.)

For the group:

1 "Thermometer Dip-Stick" Equipment Card*

* Available from Delta Education.

PREPARATION

Group Size. This activity is easier to conduct with small to medium-sized groups, but it can also be used with large groups if you have sufficient materials. For groups of more than sixteen, we recommend using an assistant to help conduct the activity.

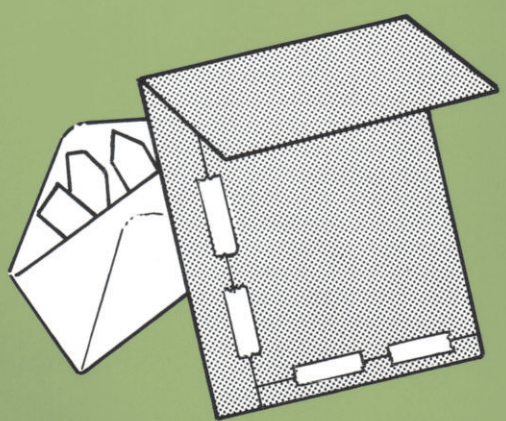
Time. Plan on thirty to forty minutes for each part of the activity. Part One works best on a sunny day in late winter or early spring. If the air temperature is above −4° C (25° F.), postpone Part Two for a colder day.

Site. Choose a snow-covered site in which you can find green plants under the snow. The site must have been covered with snow for several weeks. The snow layer should vary in depth, but should be less than one meter deep and soft enough so that the kids can dig to the ground with their hands.

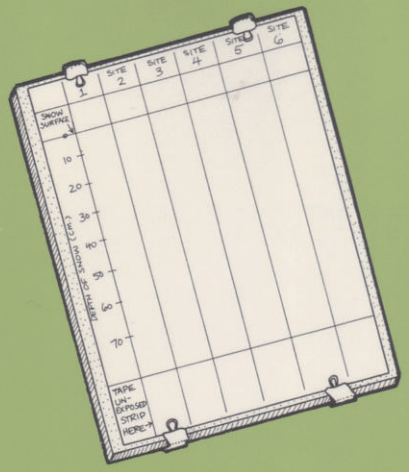
Safety. Make sure the youngsters dress warmly and wear mittens or gloves.

Materials

1. Light-Reading Materials. For each team, prepare one small jar of photographic fixing solution and a packet containing two envelopes of proof paper. Before conducting the activity, take a



light reading with the photographic proof paper on top of and below the snow to acquaint yourself with the procedure and to determine the exposure time. In addition, take a couple of readings fairly deep in the snow to determine the maximum depth to which light can penetrate. (See the "Making a Light Reading" Technique Card.)



2. Chart. Draw the illustrated chart on the data board or drawing pad.

3. Thermometer Dip-Stick. For Part Two, make a thermometer dip-stick for each team of two, and practice using one so you can demonstrate the procedure to the youngsters. (See the "Thermometer Dip-Stick" Equipment Card.)

ACTION

PART ONE CHALLENGE: FIND GREEN PLANTS UNDER THE SNOW, AND DETERMINE HOW MUCH LIGHT REACHES THOSE PLANTS.

1. Tell the youngsters that they are going to look for green plants living *under* the snow. Define boundaries for your site, and divide the group into teams of two. Give each team a trowel, and send the youngsters off to search for green plants.

2. After five to ten minutes, gather the youngsters and ask them to describe the plants they found. Tell the kids that green plants can produce food and grow when conditions are right: A plant must have enough light, moisture, good soil or nutrients, and adequate temperature.

Tell the youngsters that they are going to investigate one of these factors: light under the snow.

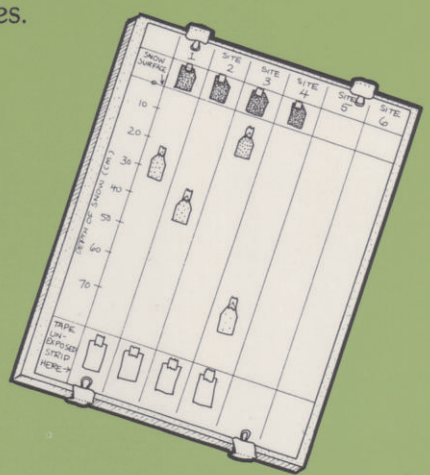
3. Ask the kids if they think any sunlight reaches snow-covered plants. Tell the youngsters that they can find out by using the materials you have brought for measuring light.

4. Gather the youngsters around one of the green plants. Show the kids the proof paper, and explain that its shiny side turns brown when exposed to sunlight. Expose a strip until it turns brown, then fix and rinse it to familiarize the group with the procedure for making the light record permanent.

5. Show the youngsters how to place the paper strips in the snow and how to record the data. Review the proof-paper coding system. (See the "Making a Light Reading" Technique Card.)

6. Distribute the light-reading materials to each team. If the temperature is below freezing, ask the youngsters to keep the jars of water and fixing solution warm by keeping them in their pockets. Send the teams out to gather light and snow-depth data around their plants.

7. Circulate among the teams. Remind them to write the location, snow depth, and length of exposure on the envelopes. (Make sure at least one team takes a reading on a plant buried so deep that very little or no light reaches it.) Call the teams together after twenty to twenty-five minutes.



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8. Show the teams the chart and how to position the strips on the chart. In a column for each location, tape the unexposed (control) strip in the proper box on the chart, the strip from the snow surface above the "Snow Surface" line (zero centimeters), and the strip from under the snow at the appropriate snow depth.

SEEING THE LIGHT

1. Ask the youngsters to discuss what they learned about the light conditions around their plants.

2. To what depth must the snow melt before light can reach the buried plants?

PART TWO CHALLENGE: FIND OUT HOW THE SNOW LAYER AFFECTS THE TEMPERATURE AROUND PLANTS UNDER THE SNOW.

Note: The air temperature must be $-4°$ C (25° F.) or lower for this part of the activity.

1. Tell the youngsters that plants usually don't freeze until temperatures fall well below 0° C. Ask one of the youngsters to determine the air temperature with a thermometer from one of the thermometer dip-sticks.

2. Ask the group if they think the temperature under the snow is warmer, colder, or the same as the air temperature. Tell the youngsters that they are going to use thermometer dip-sticks to find out.

3. Demonstrate the dip-stick technique for measuring the temperature under the snow. (See the "Thermometer Dip-Stick" Equipment Card.) Assign each team a different snow depth at which to take their temperature readings.

4. After fifteen to twenty minutes, bring the group together to share results.

CHILLING THOUGHTS

1. Was the temperature under the snow warmer or colder than that on the surface?

2. Do you think small plants have a better chance of surviving a long period of below freezing weather if they are covered with snow or uncovered? Why?

BRANCHING OUT

1. Your youngsters can obtain further evidence of the insulating ability of the snow layer by comparing the length of time it takes for a juicy fruit to freeze on the snow's surface with the time it takes when buried in the snow. Choose a time when the air temperature is $-10°$ C (15° F.) or less. Bury half the fruit samples (e.g. orange slices, cherry tomatoes, or grapes) in the snow, and leave the other half on the surface. When the surface samples feel somewhat frozen, collect all the fruit. Cut them open and compare the numbers of frozen sections found in the fruit that was left above and below the surface.

2. The youngsters can observe how the snow layer insulates plants from cold temperatures by removing the snow from a small area of green plants. Have the youngsters keep the snow off the area and observe the plants over a period of time. Then have the youngsters compare the uncovered plants with snow-covered plants after several days of below-freezing temperatures.

3. Monitor the air temperatures for a period of several days.

Wintergreen

MAKING A LIGHT READING

Technique Card

Side One

You can use photographic proof paper to measure light intensity. The emulsion-coated (glossy) side of the paper is sensitive to light. A piece of white proof paper turns dark brown when exposed to direct sunlight for about ten minutes, light brown when exposed to moderate light, and light tan when exposed to very little light. You can halt the color change by dipping the paper into photographic hypo (fixing solution) and then rinsing the paper in clear water. Proof paper is insensitive enough to allow for small time delays as well as exposure errors.

MATERIALS FOR ONE PACKET

1 8.5″ × 11″ piece of black construction paper*
3 small letter envelopes* (3.5″ × 6.5″, preferably brown)
9 strips of proof paper*, 2 cm × 6 cm
tape* or stapler
1 paper clip*
1 small jar*
photographic hypo solution* (fixing solution)
water

* Available from Delta Education.

MAKING THE PACKET

1. Fold the black construction paper in half to form an 8.5″ × 5.5″ packet.

2. Fold over one centimeter of one short side and one centimeter of the long open side.

3. Staple or tape the folded edges to make lightproof seams.

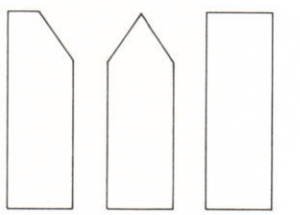
4. Fold over a four centimeter flap at the remaining open end, and secure the flap with a paper clip.

PREPARING THE PROOF PAPER

1. *Be careful not to expose the proof paper to direct sunlight.* Cut the sheets of proof paper into 2 cm × 6 cm strips. (One 8″ × 10″ sheet makes forty strips.) Make sure you have nine strips for each team.

2. Divide the strips into three equal piles. Cut one corner off the strips in one pile. Cut two corners (making a point) off the strips in the second pile. Don't cut the strips in the third pile.

3. The strips are now keyed by shape for use in different locations. Have the kids use the shapes in the locations shown in the illustration.



EACH STRIP 2 CM × 6 CM

4. Put one strip from each pile into each envelope, and place two envelopes in the black packet. Indicate the strip-coding system on the outside of the black packet. Make a black packet for each team.

5. Put some extra envelopes into your packet to use for demonstration and for spares.

PREPARING THE FIXING SOLUTION

1. In the small jar, combine one tablespoon of photographic hypo crystals with one cup of water.

2. Prepare a jar for each team.

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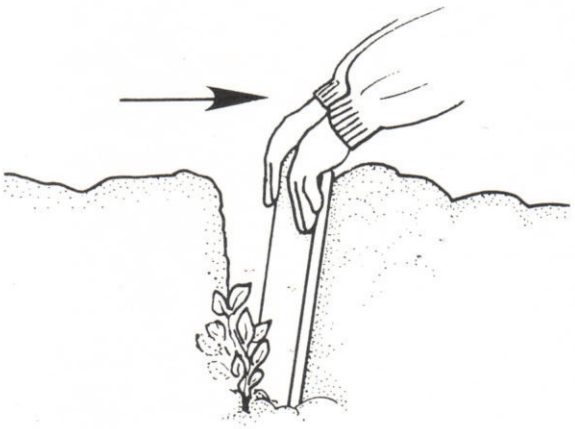
MAKING A LIGHT READING

Technique Card

Side Two

MAKING A LIGHT READING

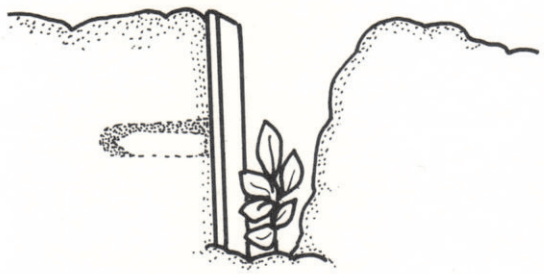
1. Push a piece of cardboard straight down through the snow next to a green plant. Pull the cardboard horizontally away from the plant to expose it.



2. Make a little cavity with your finger in the snow at the level of the green leaves. The cavity must be large enough to hold the proof-paper strip.

3. The uncut strip remains unexposed. Use the pointed strip under the snow, and the one-corner-cut strip above the snow.

4. Quickly place one strip on top of the snow and one in the little cavity. Make sure the *glossy sides are up*. One team member seals off the cavity by holding the cardboard *tightly* against the opening during the exposure period.



5. Leave the strips in place for at least ten minutes (or longer if the surface strip has not yet turned brown).

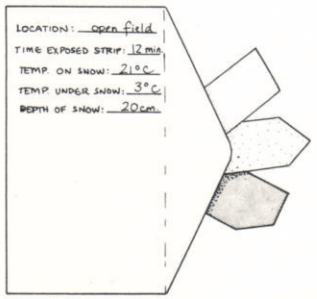
6. The other team member fixes the unexposed strip by:

a. placing it in the hypo solution for one minute, and then. .
b. rinsing it with water.

7. At the end of the exposure time, fix the other two strips in the same manner.

8. With the ruler, measure the depth of the snow from the surface to the cavity.

9. Record the data on the envelope. Let the strips dry as much as possible and then put them into the envelopes.



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THERMOMETER DIP-STICK

Equipment Card

MATERIALS FOR ONE DIP-STICK

1 meter stick* or dowel with a centimeter scale
1 roll of plastic electrician's tape, shipping tape, or duct tape*
1 small (6 oz.) metal juice can
1 small (6 oz.) cardboard juice can
1 one-meter length of brightly colored string*
1 Celsius thermometer*
1 rubber band*

* Available from Delta Education.

MAKING A THERMOMETER DIP-STICK

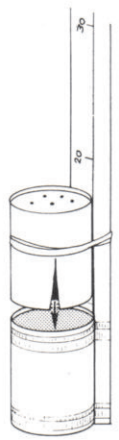
1. Remove the tops from both juice-cans.

2. Poke four to six holes in the bottoms of the cans.

3. Tape the *metal can* with two bands of the plastic tape to the zero end of the meter stick or dowel. The bottom of the can should be even with "zero."

4. Cut a slit half way down the side of the *cardboard can*.

5. Overlap the edges of the slit so that the open top of the cardboard can fits into the open top of the metal can.

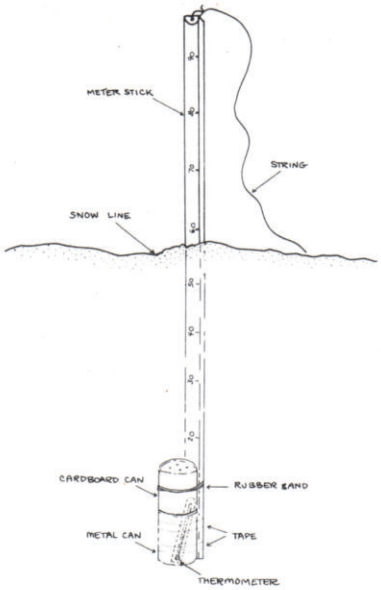


6. Loop the rubber band several times around the stick, and then slide the rubber band down over the cardboard can to secure the can to the stick, thus forming a sliding lid for the metal can.

7. Tie a string through the hole in the 100-cm end of the meter stick.

8. Place the thermometer, bulb end down, into the metal can and slip the cardboard can down over it.

9. Your dip-stick is ready to use.



USING THE THERMOMETER DIP-STICK

1. For best results, leave the prepared dip-stick outside or in a cool place for thirty minutes before using it.

2. Poke the 100-cm end of the meter stick into the snow to the depth at which you want to measure the temperature. Rotate the stick to enlarge the hole.

3. Remove the meter stick and turn it can-side down. Push the can (with the thermometer inside) into the snow to the desired depth. Fill the hole with snow.

4. Read the depth of the thermometer in the snow from the meter stick (the number at the surface).

5. Wait fifteen minutes.

6. Pull the stick out of the snow.

7. Quickly open the thermometer case, and read the temperature from the thermometer.

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