A Sneak-Preview of Budburst

Purpose

To develop an understanding of the relationship between budburst and the environment

To help students recognize actual budburst when they are doing the *Green-up Protocol*

Overview

Students will do simple explorations to observe the relationship between budburst and temperature. This is a winter or dry season activity to be done prior to green-up observations.

Student Outcomes

Students recognize budburst and understand time of budburst is affected by factors such as temperature, moisture and plant species.

Science Concepts

Earth and Space Sciences

- The sun is the major source of energy at Earth's surface.
- Solar insolation drives atmospheric and ocean circulation.
- Each element moves among different reservoirs (biosphere, lithosphere, atmosphere, hydrosphere).

Physical Sciences

- Sun is a major source of energy for changes on the Earth's surface.
- Chemical reactions take place in every part of the environment.

Life Sciences

- Organisms can only survive in environments where their needs are met.
- Organisms' functions relate to their environment.
- Organisms change the environment in which they live.
- All organisms must be able to obtain and use resources while living in a constantly changing environment.
- Sunlight is the major source of energy for ecosystems.
- The number of animals, plants and microorganisms an ecosystem can support depends on the available resources.
- Atoms and molecules cycle among the living and non living components of the ecosystem.
- Energy flows through the ecosystems in one direction (photosynthesis-herbivores-carnivores-decomposers).
- Energy for life derives mainly from the sun.
- Living systems require a continuous input of energy to maintain their chemical and physical organizations.

Scientific Inquiry Abilities

- Observing
- Inferring
- Predicting
- Collecting data
- Analyzing data
- Use appropriate tools and techniques

Time

One full class period and a number of short sessions to check buds daily or every other day and record observations in GLOBE Science Logs

Level

Beginning and Intermediate

Materials and Tools

- Twigs or small branches cut from a variety of dormant broadleaf shrubs or trees (cut and placed in water the night before)
- Containers of water
- Light source
- GLOBE Science Log

Prerequisites

None

Background

What are buds and why are they formed?

Buds are small, hard, protective structures containing miniature leaves. Budburst is an example of a phenological occurrence. In the fall, short days and decreasing temperatures trigger the cessation of growth in deciduous trees and shrubs, the drop of leaves, and the onset of dormancy, similar to the hibernation of animals. *Dormancy* is a state of suspended growth and metabolism. When plants become dormant, growth stops due to a growth inhibiting substance, the liquid and food-laden sap stops flowing, and each branch's tender growing tip is carefully enclosed in a tight bud. The buds protected by layers of bud scales, are formed every year by trees and many other plants in preparation for the next growing season.

Why do buds open?

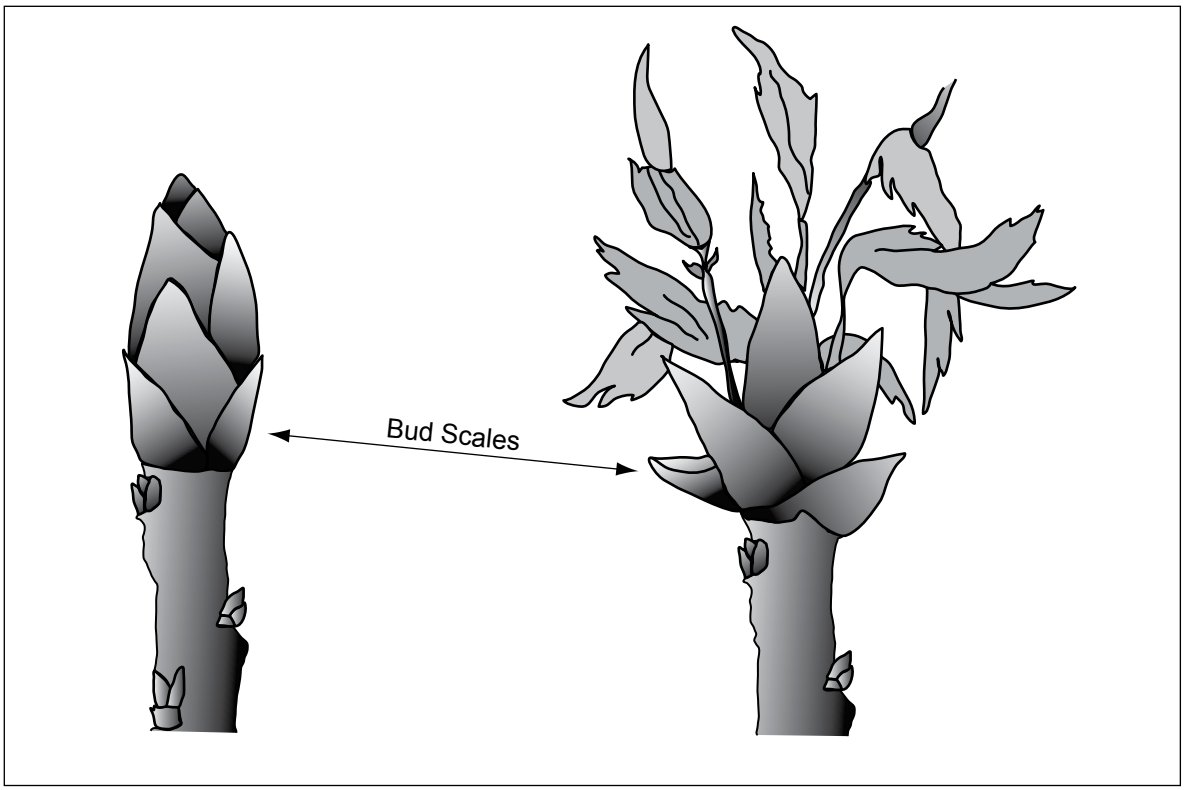
These buds stay closed through the cold or dry season and burst open with the return of rains or warmer temperatures breaking plant dormancy. This opening is called budburst or bud break, and is easy to detect. Buds open and new leaves begin to expand. Hence, the timing of budburst is influenced by temperature or moisture. Trees can be awakened from dormancy by being warmed, exposed to a minimum time of 300 hours, at temperatures near 25° C. Plant roots start absorbing water and transport these along with stored food within the plant to other plant parts including buds or shoots. Plant leaves start to come out, make chlorophyll to capture light energy and begin to photosynthesize or make food using carbon dioxide from the air, light and water. See background for *A Beginning Look at Photosynthesis: Plants Need Light Learning Activity*.

What To Do and How To Do It

Getting Ready

- Show the students the branches from local shrubs/trees that you have selected
- Ask students what budburst is and what they think causes budburst in plants?
- Ask them what makes them think so?
- Ask students to predict if they think all the branches/twigs will burst at the same time? Why or why not?

Figure EA-P2-1: Tip of Deciduous Tree Stem Enclosed in a Bud Protected by Bud Scales



- Have them predict in what order they think the buds will burst.
- They should enter both predictions in their GLOBE Science Logs.

Explore

Have students get into groups. Pass out branches/twigs to students. Try to be sure that each group has a variety of branches. Have students put the plants in water. Ask them to begin their GLOBE Science Log entries by drawing a line down the center of one of the pages. They should record their observations, inferences, and predictions on the left of the page and draw their observations on the right. Remind students to keep the water full in their containers. Give students time daily to record their observations in their GLOBE Science Log until several days after budburst is complete.

Generalize

- After budburst occurs, ask students to share their observations.
- Ask students to list all the ways the plants changed when they were brought into the classroom.
- Ask students why they think the buds burst when the branches/twigs were brought into the classroom. What were the variables (environmental conditions) that changed as branches were brought in? List variables.
- Ask students if they have any ideas about what might be going on inside the plant to cause the budburst. Discuss. For primary students, help them understand that many things (variables such as temperature, water and kind of plant) affect what buds do in the classroom. For intermediate students, ask them whether it is a good idea to set up a controlled experiment (changing only one variable or factor at a time and keeping others constant) and why. (The reason for the controlled experiment is to be able to determine which factor affects timing of budburst). Discuss possible experiments they could do (different temperatures for same plant species, all twigs in water, different plant species at one temperature with all twigs in water, etc.) but let students come up with their own ideas first.

Assessment

GLOBE Science Notebook Entry

Have students write and/or draw in their GLOBE Science Log about:

- What changes occurred when the plants came into the classroom
- Why they think the changes occurred
- The similarities and differences among the branches/twigs.
- Students who have difficulty writing can be interviewed for understanding.

Students will recognize budburst of trees/shrubs and record correct date on the green-up data sheet when it occurs during the *Green-up Protocol*.

Assessment Rubric for Students' Entries in their GLOBE Science Log

Exceeds Standards: Student clearly articulates what changes occurred in the plant branch over time, using good observation skills and states reasonable explanation for why changes might have occurred.

Meets Standards: Student clearly articulates what changes occurred in the plant branch over time, using good observation skills; explanation for why changes might have occurred is not reasonable.

Needs Improvement: Student does not clearly articulate what changes occurred, observations are poor and explanations are not reasonable.