



Description: Students closely observe buds on a winter hike, then do detailed drawings and observations in the classroom.

Objectives: Students will:

- develop skills of observation and recording;
- use inquiry and analogy to make discoveries;
- learn to differentiate trees and shrubs by their buds; and
- understand the function and growth of buds.

Materials: field: field journal and pencils, hand lenses or magnifiers

classroom: plain white paper, colored pencils, hand lenses or magnifiers, tape, rulers, shears or pruner, twigs of assorted broad-leaved plants; optional: vase with water

Background: “. . .The approach of autumn, with its showers of many-colored leaves, spells the end of the season’s activities in the identification of deciduous trees and shrubs. Without leaves the members of the forest community, unless they be relatively large, seem to lose much of their summer’s identity and may even descend to the level of ‘brush’. This is in reality not the case, as may be easily discovered by examining any leafless twig with a 10X pocket lens, or even with the naked eye. A casual glance. . .will also serve to show that woody plants in winter are anything but featureless.”—William M. Harlow, Ph.D., 1941 (as reprinted in *Winter Guide to Central Rocky Mountain Shrubs*, 1976)

Deciduous trees and shrubs, those that lose their leaves in winter, may look dead without their leaves, but in reality they are preparing for the growing season to come. Each type of plant is very different when examined carefully. Trees may be identified during the winter by observing the position, size, shape and texture of the buds and leaf scars. This activity has students look at twigs carefully.

12. Winter Bud Activity

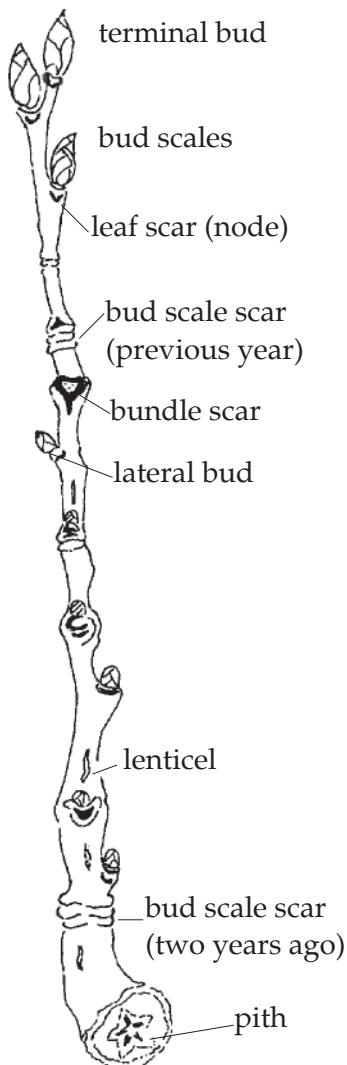


Grades: 3–12

Time: one or two class periods and field exploration

Subjects: science, art

Terms: *bud, bud scales, bundle scar, deciduous, terminal bud, lateral buds, leaf scar, lenticels, node*



Buds begin to form in the autumn when the leaves fall from the trees. **Buds** are the plants' protection from cold and dryness for its new growth. The **scales** that form a cover for this growth are actually modified leaves. Most buds are usually covered with overlapping scales but some are joined along the edges, like a clam shell.

In the seemingly dead twigs, the hormone gibberellin needed for spring growth is forming. This takes place only when it is cold. To use a non-bosque tree as an example, apple trees need 1,000 to 1,400 hours of temperatures below 50° F (10° C) to produce this necessary hormone.

All trees and shrubs develop leaf buds after the leaves fall in the autumn, and flower buds after the flowers are spent and fall off. The leaf buds appear at the **leaf scar** where the old leaf was attached to the twig, also called the **node**. The buds grow slowly all winter, but in spring they develop very quickly. Look at buds any time after the leaves fall off in the autumn to when they emerge in the spring. Our spring extends over many months. Siberian elms are one of the first plants to open their flowers, usually in February, while cottonwoods are several months behind them in April.

Terms:

bud: the encased, developing leaf or flower

bud scales: modified leaves that cover and protect terminal and lateral buds and flower buds

bundle scar: spots in the leaf scar where the exchange of water and nutrients between the leaf and the rest of the plant occurred

deciduous: a plant that sheds all of its leaves in one season

terminal bud: the bud at the end of a twig

lateral buds: the buds growing on the side of the twig. The arrangement of lateral buds (and eventually the leaves) can be:

- a. **opposite**—a pair of buds at the same node, opposite each other



- b. **alternate**—one bud at a time along the twig, usually spiraling along it
- c. **whorled**—several leaves will emerge from all sides at one node

leaf scar: where last year's leaf was attached to the twig

lenticels: breathing pores for the cells of the inner bark, where gases are taken-in and released

node: the point on a stem where one or more leaves are attached

(See illustrations in "A Rose by Any Other Name.")

Here are some things to look at closely when inspecting buds:

The bud at the tip of the twig is the **terminal bud**. The **lateral buds** on the twig may be attached with a pair of buds **opposite** each other, **alternating** along the stem, or what is called **whorled** where several leaves will emerge from all sides at one position. These are characteristics used in identifying a plant even in winter.

In the scar left after last year's leaf falls, look for several small dots. These were the transportation bundles (**bundle scars**) where the leaf exchanged water and nutrients with the rest of the plant.

Along the stem you can often see small warty spots. Look closely. Are they bugs? They are **lenticels**, breathing pores for the cells of the inner bark, where gases are taken in and released.

The number of years of growth of a twig can be counted by looking for rings around the twig. Each year at the terminal bud scale, scars are left as the twig moves into its new growth, as a set of small rings encircling the twig. You can count the number of **terminal bud scale scars** along a twig and know how many years it has grown. You can also compare different years by measuring the distance between the terminal bud scars—did it grow more one year compared to another year?

Does the plant have spines or thorns? These may be characteristic in differentiating them from other plants.

Is the bark smooth, waxy, fuzzy or hairy?

Break or cut the twig cross-ways. Look at this cross-section of the twig. Is the center a different color? In the cross-section of a cottonwood you should find a surprise: the inner pith (central stem tissue) is in a star shape! This is a characteristic that all trees in the genus *Populus* have.



The classroom activity consists of careful observation and illustration of a twig. Students make written notes describing their twig, illustrate and label the twig and write five analogies about the twig and buds. Analogies help students make personal connections to the object being observed. The students should think about how the twig or bud is similar in some way to something else they know about or have seen. This also can give students practice in theorizing about the natural world and lead them to question why something looks the way it does. This format is adapted from Kerry Ruef's *The Private Eye*.

In the spring, short branches can be cut, brought into a warm room and placed in a vase of water to force the buds to open earlier than they would outside. This allows the students to see the leaves or flowers emerge.

Procedure:

Discussion in classroom:

1. Ask the students to tell you what they know about buds on trees and shrubs. List on the board what the students know.
2. What are some questions you have about buds? Write these on the board. Optional: Develop a hypothesis or several hypotheses regarding buds. How can we find out about buds? How can we investigate and test our hypothesis? Encourage students to think about observation as a method for answering questions.

Trip to the bosque:

1. Take a "bud hike." Observe buds on many different shrubs and trees. Feel them, smell them, observe their position, color, sheen, etc. Use magnifiers to closely observe.
2. Each student should choose a bud to draw, measure and take notes on. Older students may wish to study several different buds.
3. Using pruning shears, the teacher can collect a few short, sample twigs from different trees and shrubs. A couple of different twigs for every three or four students are needed. These will be used for an activity back in the classroom.

Note: Please limit the amount of cutting you do. There are places such as the Rio Grande Nature Center where cutting will not be allowed. We don't want to have a major impact on the vegetation in the bosque so take only a minimal amount.

**Classroom:**

1. Using the original questions or hypotheses, discuss what was learned on the bud hike. What questions are still unanswered? How can the students find out the answers? Do the students understand the function of the buds?
2. Give each student an 8.5" x 11" piece of white paper and a pencil. Have them fold the paper like a science fair display board by having the two sides of the paper meet in the middle. Open it back up and have them put their name on the paper. Pass out the branches with buds to students. Have available magnifiers, rulers, and colored pencils.
3. On the left side of the paper, students should write down as many observations as they can about the buds and the twig.
4. On the right side of the paper, students should write down at least five analogies about the buds (what they look like or what they remind you of).
5. In the center, draw and label the twig with the buds. Students should predict if the buds are leaf or flower buds. (If the twigs are forced as in Step #9, they can see what emerges.)
6. (Optional) Dissect one bud from the branch. Observe and draw. Ask the students what they think the leaves and flowers will look like in the spring. Draw their predictions.
7. Exchange branches with other students and look for differences and similarities.
8. Give an overview of the bud information that is in the *Background* section. Have students add to their observation sheet any additional information that they now observe on their twig after the teacher's overview. Add to the drawing if needed.
9. Optional: In the spring, the teacher may bring in some twigs to force the buds to open in the classroom by placing them in water in a warm room. With this, students can observe the flowers or leaves emerging and see the shape of the plants' leaves. Have the students predict which buds will become flowers or leaves.

Assessment: Students' bud observation sheet/drawing—create a rubric for assessment; oral questioning.

Extensions:

1. Begin this activity in the fall and repeat during the late winter and spring. If a trip to the bosque is impossible, observe tree buds on the school grounds or have someone bring in sample buds from the bosque. Have the students make a bud book to take on their bud-observing trips through the school year—



looking for differences as the season changes. (Materials for bud book are white copy paper, cardboard for covers, stapler, colored pencils.)

2. Create a class bud book with the help of the students showing all of the different plants that have been studied.
3. Using analogies about the buds, students may write poems.
4. After the trees have leafed out, students could tape the leaves from the plants they studied into their bud books/observation sheets.
5. Tree silhouettes—observe the shapes of trees and shrubs during the seasons. Sketch or photograph.
6. Observe leaf cells with a microscope.
7. Investigate the differences in the structure of flowers that use wind or insect pollination.
8. Investigate trees like the cottonwood that have male flowers and female flowers on separate trees.
9. Investigate the effect of pruning on branch growth.
10. Record the date that each kind of plant emerges with flowers and leaves. Compare your results from year to year with your students.

**Resources/
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