

Field Investigations

Using Outdoor Environments
to Foster Student Learning
of Scientific Practices



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Lesson 2: Descriptive Field Investigation: Twigs

What are the Physical Characteristics of Twigs on This Tree in Winter?

ENGAGE

1. In late fall or winter choose one question generated by students (see examples in Lesson 1 in this chapter) that had to do with twigs on a tree. Ask, “Where do new leaves come from?” Have students discuss in groups.
2. Share with students what happens in the spring in terms of weather and sunlight. (See Project Learning Tree Lesson 65, Bursting Buds).

EXPLORE

1. Ask a descriptive investigation question like:
 - a. What do twigs on _____ tree look like in winter? (For younger students)
 - b. What are the physical characteristics of twigs on _____ tree in winter?
2. Students look up a labeled twig diagram in a book and see the parts of a twig in a diagram (see example page 68).
3. Students go outside and observe a twig.
4. Students record date, time, place, air temperature, and weather.
5. Students describe, draw, and label a twig from the tree. Students should include the size, shape, and placement of the buds, leaf scars, and bud scale scars. (Student Page).
6. Measuring from the twig tip to the first bud scale scar, students record last year’s growth.
7. Students create questions about the winter twigs using the following observation prompts.
 - a. I wonder _____ about tree growth or twig growth
 - b. I have questions about...
 - c. I wonder what would happen if. . . .
 - d. A comparative question I could investigate is...

EXPLAIN

1. Have students read a non-fiction article or video about buds bursting and what influences the time the buds burst.
2. Discuss bud development by asking some of the following questions:
 - a. When do buds form on trees?
 - b. What are the functions of the parts of the twig?
 - c. What do buds become on trees and shrubs?
 - d. What did the leaf scars originally connect to?



- e. What factors (inputs) influence when buds burst into leaf or flower?
 - f. If temperatures increase (the spring is warmer than average) what might happen to the time (when during the year) twigs burst into leaf?
3. Students share and categorize questions by type.
- a. Book/internet Research
 - b. Essential-Life Pondering, Always Wonder
 - c. Descriptive
 - d. Comparative
 - e. Correlative
 - f. Why questions?

ELABORATE

1. Students could identify their winter twigs using a winter botany identification guide.
2. Students could teach younger children about twigs.
3. Students could compare and contrast their twig to another group's.
4. Students continue to observe their twigs weekly or monthly recording the changes.
5. When spring is approaching they could begin observing their buds daily and submit when their buds burst to Project BudBurst, www.budburst.org.
6. Students carry out investigations based on the questions they come up with (comparative question described in the next lesson).

EVALUATE

When assessing the journal descriptions and drawings, look for:

1. Words describing details of color, shape of twig and bud, size, leaf scars, bud placement, bud scale scars, texture.
2. Sentences or sentence fragments instead of lists of words.
3. Detailed drawings that fill the notebook page (details include shape of twig and buds, leaf scars, bud placement, and bud scale scars).
4. Labels indicating the parts of the twig (leaf scar, bud, bud scale scars).
5. Appropriate use of color.
6. Captions or titles that identify drawings and note the date and place recorded.



Date _____ Time _____

Name _____

What are the physical characteristics of your twig?

Weather _____

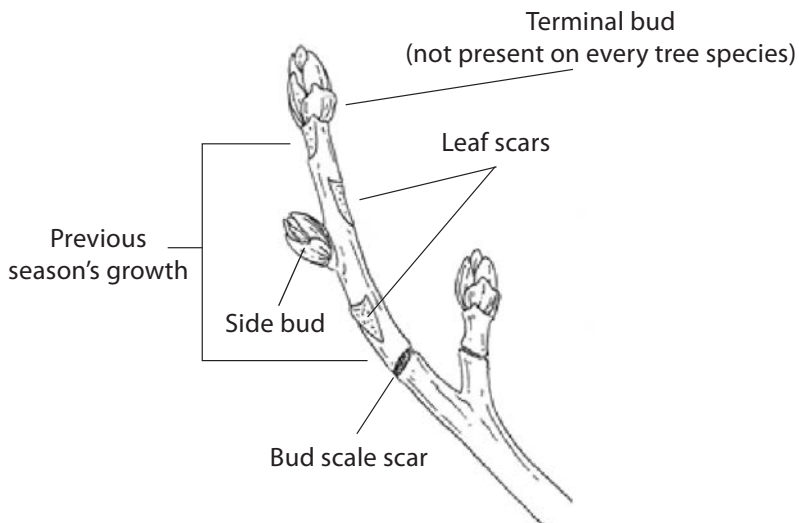
Draw and describe your twig, including the size, shape, and placement of the buds, leaf scars, and bud scale scars.

Describe the twig:

Questions I have about the twig:

Amount of twig growth last year:

TWIG DIAGRAM



Lesson 3: Comparative Field Investigation: Twigs

Is There More Twig Growth on the North or South Side of the Twig/Shrub?

Which type of tree/shrub do buds burst earlier in the spring?

Resource: *Winter Twig Investigation lesson in NSTA Press Citizen Science: 15 Lessons That Bring Biology to Life, 6-12.*

ENGAGE

1. Have students look at the list of comparative questions the class created. Students should decide which questions they have the materials and access to address. For example, comparing upper twigs on a tall tree with lower twigs may not be feasible since students could not reach the upper twigs.

Comparative Questions

- Which type of tree will have the largest leaves?
- Which type of tree has the largest buds in March?
- Which type of tree has the most twig growth?
- Are buds larger on the south or north side of the tree?
- Are leaves larger on the south or north side of the tree?
- Is last year's twig growth greater in maple trees on the north or south side of the building?
- Did taller maple trees (over a certain height) or shorter maple trees have more twig growth last year?
- Which year (last year or 2 years ago) had the greatest twig growth on the tree?
- **Was there more twig growth on the north or south side of _____ tree/shrub last year?**
- **Which type of tree/shrub do bud (Otto, 2013)s burst earlier in the spring?**

EXPLORE

1. Students choose a comparative question to investigate.
2. Students gather the materials needed for the investigation.
3. Students make a prediction.
4. Students write a procedure of the investigation and create a data sheet including a table. For the two questions above in bold we have created example data sheets.
5. Students carry out the comparative investigation.



EXPLAIN

1. Students analyze data and create charts and graphs.
2. Students discuss in groups the meaning of the data.
3. Students do a non-fiction read on the factors that affect twig growth.
4. Students do a turn and talk about the reading and take notes about what they learned.
5. Students write a conclusion for their data or write a claim, evidence, reasoning.
6. Students participate in or write a discussion for their data.

ELABORATE

1. Students could identify their shrub/tree using a winter botany identification guide.
2. Students could do the same investigation on another type of tree/shrub to see if the north versus south growth differences is species specific or a general pattern of tree/shrub growth.
3. Students could do web research of what types of research scientists are doing on tree growth.
4. Students could view videos or read articles on what affects tree/shrub growth.

EVALUATE

1. Check graphs and tables for accuracy of titles, labels, numbers and units.
2. Use the rubrics for Explanations to evaluate student work.



Fifth grade students from Orchard Center Elementary in West Valley School District, Washington, measuring the previous year's twig growth on trees.

EXAMPLE 1- Investigation Plan and Data Sheet

Comparative Investigation Question: Is there more twig growth on the north or south side of our _____ tree/shrub?

Prediction: _____

Materials: Compass, ruler, string, scissors or marker

Procedure:

1. Record date, time, and location of tree/shrub.
2. Describe study site.
3. Determine the north and south sides of the tree/shrub.
4. Choose four twigs (each twig is a new trial) at random on the north side of the tree/shrub.
5. Measure the last season's growth with the string on each of the 4 twigs and either cut or mark the string (growth is measured from the tip to the bud scale scar).
6. Measure the string with a ruler to determine centimeters of growth and record as trials 1 through 4.
7. Repeat steps 3-6 for the south side of the tree/shrub

Side of Tree/Shrub vs. Twig Growth

Side of Tree/Shrub	Twig Growth (cm)				
	Trial 1 (twig 1)	Trial 2 (twig 2)	Trial 3 (twig 3)	Trial 4 (twig 4)	Average growth
North Side					
South Side					
Observations					



Sample Data:

*Issaquah Valley Elementary, Issaquah, Washington
 March 29, 2007, 2:00 p.m.
 Cool, sunny day*

Question: Is there more twig growth on the north or south side of the spindle bush?

Side of Spindle Bush vs. Twig Growth

Side of Tree/Shrub	Twig Growth (cm)				
	Twig 1	Twig 2	Twig 3	Twig 4	Average growth
North Side	30	32	28	30	30
South Side	21	24	23	20	22

Sample Data:

Orchard Elementary, Spokane, Washington

Question: What effect will the North side or South side of a bush have on the length of growth on a twig from the red dogwood?

Location of Twig	Length of the Twig Growth in Millimeters for the Red Dogwood				
	Trial 1	Trial 2	Trial 3	Trial 4	Average
North Side	36	42	7	39	41
Southside	81	47	74	62	66



EXAMPLE 1- Investigation Plan and Data Sheet

Comparative Investigation Question: Is there more twig growth on the north or south side of our _____ tree/shrub?

Prediction: _____

Materials: Calendar

Procedure:

1. Start recording observations in late winter.
2. Record the date, time, place, and types of the trees/shrubs.
3. Observe the number of buds that have burst on type 1 tree/shrub and record under the correct date.
4. Observe the number of buds that have burst on type 2 tree/shrub under the correct date.
5. Repeat with two other trees/shrubs of each type at the same time and record the number of buds burst on trial 2 and 3 charts.
6. Repeat steps 2 through 4 daily until the buds have burst on both types of trees/shrubs.

Date _____ Time _____ Place _____

Description of Study Site:

Location of Study Site:



Data Sheet

Type of Tree/Shrub Date and Number of Buds Burst				
Type of Tree/Shrub				
Date				
Number of buds that have burst on tree 1				
Number of buds that have burst on tree 2				
Number of buds that have burst on tree 3				
Type of Tree/Shrub				
Date				
Number of buds that have burst on tree 1				
Number of buds that have burst on tree 2				
Number of buds that have burst on tree 3				

