

Overview

Conduct this activity before students are introduced to data collection using the *Nature's Notebook* observation protocols. This activity will familiarize students with some of the main phenophases present on select species during certain times throughout the school year. After students do this activity you may wish to have them make observations using the *Nature's Notebook* observation protocols and then at the end of the year students can view their collected data in conjunction with the data they viewed during this activity.

Grade levels

- Middle school and high school (Grades 7-12)
- This exercise works best with groups of 10 or fewer students per group. Ideally the group of 10 can be split in half again.

Learning Outcomes

1. Students will be able to identify five local plant species.
2. Students will understand why plants undergo changes throughout the year.
3. Students will be able to name four phenophases.
4. Students will understand why we study phenology.
5. Students will make observations of plant structures and relate them to function and phenology.

Time Required

This activity can be done throughout the course of the academic year. Depending upon how much time is available, teachers can revisit the activity more than one. Ideally teachers should set aside at least 4 or 5 class sessions of 50-90 minutes. Conduct this activity prior to asking students to collect phenology observations using the *Nature's Notebook* protocols.

Materials Needed

- A selection of 5 different species of plants
- Identify phenophases of each plant, e.g. fruits, flowers, leaves, etc.
- Clipboards and paper or nature journals
- Something to write with
- Phenophase photo guides or field guides
- Litmus papers or pH meters
- Soil moisture sensors
- Outdoor space to conduct the activity
- Access to at least one computer to review data submitted to the *Nature's Notebook* Database

Conducting the Activities

Engage

1. Give students some intriguing part of a plant. This could be willow catkins, buckbrush flowers, manzanita berries, a gall. Have them make “I notice” and “I wonder” observations about the object. If they have seen the object before, tell them that the goal of the exercise is to observe something they have never seen before.
2. Students share out their observations to the group.
3. Zoom in/Zoom out
 - a. Get students to journal using the zoom in/zoom out method. First students draw the plant as the actual size. Then have students draw a close up of one of the structures of the plant. Make sure students focus on the details and tell them not to worry about trying to draw a work of art. Let them know that they will continue to get better the more they do these kinds of drawings. Have students that want to describe their drawing talk about their plant and the special structure they drew.

Explore

1. Adaptations
 - a. Ask the students if the structures they drew are so different in different plants? Ask them why different plants may have developed different kinds of structures?
 - b. Tell the students that not only are the structures very different, but they also appear and disappear at different times of year depending on the plant. Ask them why that might be and let them know that we are going to explore this question further.
2. Pheno-Hike
 - a. 4 stops with 5 or more tagged plants at each
 - b. Phenophases: Leaves, colored leaves, flowers, fruits/seeds
 - c. Potential species: redbud, scotch broom, manzanita*, blue and/or live oak*, buckeye*, bracken fern, golden poppies* *= California Phenology Project species (cpp.usanpn.org/AllSpecies)
 - d. Students observe the tagged plants in pairs. Each pair can observe a couple plants or do all of them, time dependent
 - e. At each stop take soil moisture and pH measurements
 - f. Mix of shade and sun, species at different trail stops= repetition and variation
 - g. Between stops play trail games or have them look a particular structure or phenophase as they walk

Explain

1. Discussion - frame the data that was collected
 - a. Transition into talking about seasonal changes (Are all of parts of a plant present at all times?)
 - b. What is phenology? Why to plants change throughout the year?
 - c. Why does it matter?
 - d. Intro to our project
 - i. Overarching question: How is the phenology of our five-study species changing over time?
 - ii. Specific question: How does the phenology of a plant relate to its structures?

Extend

1. Look at the data
 - a. Compare and contrast the species and relate phenological differences to structures

- b. This discussion can be season dependent e.g. fall- why would redbuds drop their leaves and scotch broom doesn't? spring-different types of flowers for different pollinators, seeds- think about dispersal and durability, etc.
- c. Compare student data to past data from CA or national pheno-networks
- d. Reiterate the idea that they are scientists collecting real data on a large-scale project
 - i. Would be cool to send them some kind of summary of their data along with that of other classes for them to analyze in the classroom.

Evaluate

1. Group check-in and closing
 - a. What did the students find the most interesting about their experience?
 - b. What did they find confusing or not interesting?
 - c. What did the adults take away from the lesson? What did the find interesting or confusing?

Resources

- California phenology Project: <https://cpp.usanpn.org/>
 - Lesson plans and activities
- USA Phenology Network: www.usanpn.org/home
 - Good for raw data that we can simplify for students
- Pepperwood: www.pepperwoodpreserve.org/project/california-phenology-project/
- Project Budburst: www.budburst.org/
 - Talking to young students about phenology