

PHENOLOGY GARDENS – LESSON PLAN I

FIRST EXPLORATION AND OBSERVATIONS IN THE PHENOLOGY GARDEN



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In this 60-minute activity in the native plant phenology garden, students are introduced to their new “outdoor classroom”. Activity leaders and docents ask leading questions of students to guide the students’ observations using sight, sound, touch, and smell. Activity leaders and docents also help students to learn to identify and classify vegetative and reproductive structures on plants, and to make connections between the seasonal appearance (i.e., phenological status) of these structures and recent weather and climate patterns. Students learn that the phenology garden is a site for year-round learning about nature and plant and animal species, and they begin to learn how to learn plant names and how to identify plant species. The students are introduced to the concept that they will make repeated phenological observations throughout the school year, and that scientists at UC Santa Barbara – as well as professional and citizen scientists (including other students) across the country – are also participating in this important effort to track impacts of climate change on plants and animals. Students later contribute their observations to the USA National Phenology Network (USA-NPN), a biological monitoring program that brings together citizen scientists, government agencies, non-profit groups, educators, and students of all ages to monitor the impacts of climate variability and climate change on plants and animals in the United States. The network harnesses the power of people and the Internet to collect and share information, providing researchers with far more data than they could collect alone.

Objectives

1. Students explore the phenology garden and gain an understanding of phenology and how the plants will change over the seasons.
2. Students learn to identify several plant species, and learn that all plants have similar structures (leaves, buds, stems, etc.).
3. Students use their knowledge of the native plant garden to adopt two individual plants that they will monitor over the school year.
4. Students observe plants and animals in the garden, record initial observations with labeled drawings, and report their observations to their group.
5. Students listen to others’ observations and compare them to their own observations in order to develop a more complete understanding of what is happening throughout their garden.
6. Students learn that they are helping scientists understand how nature changes over the seasons by recording their observations throughout the school year.

Photos by Brian Haggerty and UCSB’s *Kids In Nature* environmental education program

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CALIFORNIA SCIENCE STANDARDS

This lesson plan was designed for 5th grade, but is easily adaptable for other grades. Some standards may not be addressed directly in this lesson plan but were integrated easily into docents' conversations with students.

Grade 1

Life Sciences (2a, 2b, 2c, 2e)

- Plants and animals meet their needs in different ways.

Earth Sciences (3a, 3b, 3c)

- Weather can be observed, measured, and described.

Investigation and Experimentation (4a, 4b, 4d)

- Scientific progress is made by asking meaningful questions and conducting careful investigations.

Grade 2

Physical Sciences (1a)

- The motion of objects can be observed and measured.

Life Sciences (2a, 2b, 2c, 2d, 2e, 2f)

- Plants and animals have predictable life cycles.

Earth Sciences (3c, 3e)

- Earth is made of materials that have distinct properties and provide resources for human activities.

Investigation and Experimentation (4b, 4c, 4d, 4f, 4g)

- Scientific progress is made by asking meaningful questions and conducting careful investigations.

Grade 3

Life Sciences (3a, 3c, 3d)

- Adaptations in physical structure or behavior may improve an organism's chance for survival.

Investigation and Experimentation (5a, 5c, 5d, 5e)

- Scientific progress is made by asking meaningful questions and conducting careful investigations.

Grade 4

Life Sciences (2a, 2b, 2c, 3a, 3b, 3c)

- All organisms need energy and matter to live and grow.
- Living organisms depend on one another and on their environment for survival.

Investigation and Experimentation (6b, 6c, 6f)

- Scientific progress is made by asking meaningful questions and conducting careful investigations.

Grade 5

Life Sciences (2a, 2e, 2f, 2g)

- Plants and animals have structures for respiration, digestion, waste disposal, and transport of materials.

Investigation and Experimentation (6a, 6f, 6g)

- Scientific progress is made by asking meaningful questions and conducting careful investigations.

Grade 6

Life Sciences – Ecology (5a, 5b, 5c, 5d)

- Organisms in ecosystems exchange energy and nutrients among themselves and with the environment.

Investigation and Experimentation (7b, 7d, 7g, 7h)

- Scientific progress is made by asking meaningful questions and conducting careful investigations.

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Background for educators: The Phenology Stewardship Program at UC Santa Barbara, in collaboration with the UCSB *Kids In Nature* (KIN) environmental education program, established native plant gardens in 2008 at two elementary schools in Santa Barbara, California. We since have been developing and implementing phenology education activities in these gardens for several 5th grade classes, though we also have adapted these activities for a variety of other audiences including: after-school programs at Boys & Girls Club in Santa Barbara and Oxnard-Port Hueneme; university classes at UCSB; adult education courses and instructional workshops for teachers; and interpretation programs at several National Parks in California. For the *Kids In Nature* phenology garden activities, UCSB undergraduate students (“Docents” in this activity) who are enrolled in an UCSB Education Practicum course help test educational activities in the phenology garden, in addition to other activities they run for the KIN program. Phenology garden activities are designed for student participation with the USA National Phenology Network. We also integrate activities on species identification, morphology & anatomy, plant-animal interactions, plant-climate interactions, soil ecology, ethnobotany, photography, and other ecology-related themes. Garden activities have been complemented by docent-led in-class herbarium activities designed to teach students collection, preservation, and labeling skills. As a result of these combined activities, students begin to integrate several subjects through a single phenology framework, including math, writing, biology, climatology, geography, computer science, fine arts, and social/cultural history.

PROCEDURE

Materials:

- Writing utensil and writing surface (clipboard or notepad)
- Each student needs two “Plant ID tags” with their name written on them (flat wood sticks, like large popsicle sticks or plastic ID tags). Time saver: print names in advance.
- Worksheets for students – for the *Kids In Nature* program, worksheets have space for making and labeling drawings as well as several questions guiding students to carefully observe plants, animals, soil, and environmental conditions (light, water, temperature). (Worksheets were printed and bound in the *KIN Journal* for year-round use.)
- Suggested: plant identification guide or homemade plant identification flashcards, coloring pencils, magnifying glass, metric ruler, digital camera
- Optional: Data sheets, phenophase definitions, and life form definitions from the USA National Phenology Network (for the *Kids In Nature* program, these sheets were adapted and printed into each student’s *Kids In Nature Journal* that they used year-long for phenology garden and other environmental education activities and field trips). These will be introduced in the next activity (data collection), but concepts of phenophases and life forms can be introduced to advanced students.

Suggestions for activity leaders and docents:

- Always use the term *soil*, never use the term *dirt*.
- When using the term “Data”, remember that it is a plural term. Thus, “The data are...” and not “The data is...”.
- When animals of any kind are discovered, we always observe their activities for at least a few seconds (but up to a minute or longer) to discover what they’re really doing. (“Ooh, a butterfly!” ... “Yes it is, what is it doing? Let’s follow it and watch what it does”).

Procedure:

1. **10 minutes.** Fifth grade students are escorted from the classroom to the Phenology Garden by their undergraduate docents. Activity leader (Brian) delivers an introduction about the activities, making connections with: establishment of the phenology garden; recent weather patterns and plant requirements of water, sunlight, and temperature; soil properties; and the overall status of plants

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and animals in and around the phenology garden. Students split into groups of 4 and work with their docents on the following activities.

2. **35 minutes.** Students use their senses to explore the garden and record observations through labeled drawings. Students learn some of the plant species and adopt two individual plants to monitor throughout the school year.
 - Students are to follow their curiosities, but are encouraged to discover which plants smell strong, which plants have flowers and/or fruits, which plants have the largest leaves, etc., as well as the activities of any animals in the garden. Docents make use of magnifying glasses, cameras, identification guides, and other educational tools.
 - At one point during this time, docents direct their students to engage different senses (but not taste). Docents might have their students record their observations.
 - Students shut their eyes and listen to everything around them.
 - Students touch the soil and the leaves and stems of several different plants. Docents engage the students in comparing and describing textures and thinking about why there is variation among species.
 - Students smell leaves of several different plants and question why some plants smell and others don't (docents are prepared to discuss this topic in advance).
 - Students learn the common name of each plant from their docent and look up that plant in plant identification guides (for the *Kids In Nature* program, docents had a local field guide published by the Cheadle Center for Biodiversity and Ecological Restoration, which is the organization that created and runs *Kids In Nature*). Students discover facts about the plant name, ecology, phenology, and other interesting facts.
 - Students adopt two plants to monitor throughout the school year. Docent writes student name on tag and inserts in ground near plant (writing names on tags can take place the previous day to reduce time spent doing so here).
 - Docents direct their students to open the activity worksheet (the *KIN Journal* phenology garden chapter, page 27). Each student draws one of the plants they adopted, making a careful and accurate drawing focusing on the details such as number of petals (if flowering); leaf size, shape, and color; and overall plant form (morphology). Color pencils will be available for the students.
3. **10 minutes.** All groups gather into one large group. Brian calls on students to share experiences and observations. Brian wraps up the session by pointing out phenology of surrounding trees (especially Liquidambar trees in fall/winter or spring phases) and discusses the weather forecast. Brian has students make educated guesses about when the Liquidambar trees will be at USA-NPN's "all leaves colored" and "all leaves fallen" stages. Students can revise their guesses in future visits. Brian takes a photograph to be used in a time-lapse sequence developed over subsequent visits.

Throughout the activity... Students are in groups of 4, with 1-2 docents per group. Each group has a digital camera to document observations, methods, and interesting things. Brian visits each group throughout the session to encourage students and docents to share their observations, to introduce specific knowledge about plants and year-long goals for monitoring the phenology garden, and to engage the students in "pop-quiz" activities.

Preview of the next phenology garden activity

The next phenology garden activity focuses on introducing the students to phenological monitoring. During subsequent garden visits throughout the school year, phenological monitoring takes place the first 15 minutes followed by an activity designed to reinforce knowledge gained during that activity. Activities to reinforce phenological literacy include *Flight of the Pollinator*, *Ethnophenology*, *Phenology Relay Race*, and various drawing/labeling and photographing activities. Students continue to use USA-NPN protocols and data sheets to observe and record the phenology of their two adopted plants. Option: At the end of the year, students help upload their data to the USA-NPN online database and receive a “Junior Phenologist” certificate.

More phenology activities and lesson plans are available online, including guides to establishing phenology gardens and activities that can be run in phenology gardens, school yards, back yards, or National Parks. To learn more and to download materials, visit the Education section of the California Phenology Project website www.usanpn.org/cpp/education or the USA National Phenology Network www.usanpn.org/education.



Liquidambar trees beginning to show signs of autumn leaf coloring. The native plant phenology garden at this Santa Barbara elementary school is in the lower left of the photo, arranged in three separate linear plots. To learn more about establishing and using phenology gardens, download our guide “*Phenology gardens: A practical guide for integrating phenology into garden planning and education*” from the California Phenology Project website www.usanpn.org/cpp/education or the USA National Phenology Network www.usanpn.org/education.