

A Remote Science Project: “Phenology; Seasonal Changes as a Science” Lesson (Grades 7-12)

Overview: Remote classroom activities and student-driven investigations related to phenology and seasonal change.

Goals: The overall goals of these lessons are to:

- Introduce students to the concept of phenology and its importance to seasonal change science.
- **To reinforce the knowledge that organisms rely on an interaction with other organisms to exist.**
- Provide educators with a local, relevant, and immediate context for teaching students about current and potential affects of seasonal change.
- **Provide opportunities for students to practice the process of science method (ask questions, conduct investigations, analyze data, and share their observations through graphing data).**

Help students understand the role that seasonal climate plays in ecological relationships.

Target Audiences: Middle and High School Teachers and Students.

Instructional Time: Variable. The lessons could be included individually in other teaching units related to ecology, seasonal change, history, data literacy, or visual art. They vary from 20 minutes to perhaps an hour in length per week, and recorded results are evaluated best when spread out over several weeks or months.

Lesson Plans and Field Investigations:

Introduction to Phenology: This lesson should be completed by all participating students so as to gain an understanding of the science of phenology and what protocol should be used to mark the progression of each species observed. *See Supplemental Resources for the power point link.*

Note: Some of the lessons below span all of the stages of an investigation, as they are written so they can be used individually or as part of a larger unit.

1) Phenology Calendar: Students create a week by week, month-by-month phenology calendar on a calendar board, or in a personal journal documenting the changes on one or two selected plants. (Photos can also record these changes.)

2) Species Life Cycle Match...or Mismatch? Create a life cycle calendar of two different species that depend on one another for food, pollination, reproduction, or habitat (such as the monarch caterpillar and common milkweed). Select plants sites that have a grouping of the selected species (a grouping is: 3 or more plants located near each other). Now track each species in a linear (parallel) calendar through the growing season noting when they interact with each other.

3) Phenology Snapshots: Students compare phenology of the current season by selecting one or two plants to take two photos weekly to record phenology changes by comparing growth and development of these plants over a period of time.

4) Bird Notebook: Watch a bird nesting box and keep records of what you see. Compare your notebook with historical records for the same species in your area, if you can find any. Try local or state birding organizations for historic information. Example source: Ohio Bluebird Society annual bird box reports.

Data Analysis:

1) Mapping and Graphing Your Phenology Observations: Using dandelions, since they are numerous and easy to identify, students learn basic mapping and graphing skills, and practice making sense of the phenology data they have collected.

2) Monarch-Milkweed Ecology: Looking at the Numbers: Students learn to graph a small dataset about the timing of monarchs and milkweed appearance in Ohio. The exercise involves graphing comparisons between groups, making predictions, and thinking about variability, an important concept in statistics and data literacy. *Note: Though the milkweed will be growing through-out the spring and summer, in southeastern Ohio, Monarchs do not arrive for nesting until about mid-August and nesting should be completed by the end of September.*

Science Communication:

Classroom Comparisons: Use student recorded observations of plants or animals phenology (seasonal changes) at their home sites and compare observations with those of other classmates participating in the remote program. *Note: This will work best if several students select the same species of plants or animals to observe at their home prior to beginning the activity.*

Supplemental Resources:

What is Phenology?: An introductory PowerPoint that includes key ideas for students to understand about phenology. Slides can be used as an introduction to the topic or as part of a wrap up for the Phenology Wall Calendar Activity. Online Source for in depth understanding of recording the stages of change in plants and animals known as a 'phenophase'. The following is for plants.

<http://ibis.colostate.edu/webcontent/ws/plantingtheseed/PhenologyGettingStarted.html>

A Graphing Tutorial:

https://nces.ed.gov/nceskids/help/user_guide/graph/whentouse.as