Lesson 4 - Field trip: Exploring citizen science and making connections between phenology and ecology

Time Needed	50 minutes
Materials/Prep	1. Teacher Slides (slide 58) 2. Identify a site on school grounds to make observations 3. Print enough copies of articles (from Lesson 3) to hand out to groups--each group will get one copy of their assigned article 4. Print Article summary worksheets (1 per group) 5. Print Observation worksheets 6. Print Phenological report worksheets 7. Gather enough clipboards and writing utensils for all student groups 8. Create students groups of 4-6 with others who read the same article for homework *9. Optional*: Create account with Project Budburst (instructions here) *10. Optional*: App or field guide for plant ID
Student Learning Outcomes	Students will be able to: 1. Describe citizen science and its importance. 2. Name and identify basic phenological stages of plants. 3. Evaluate ways in which climate change and subsequent phenological shifts could affect other species in an ecosystem.
Additional Resources	• Project Budburst • Deciduous and Evergreen Report Forms: http://budburst.org/reportforms

Next Generation Science Standards

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

*Expanded preparation: To do before this lesson

Register for Project Budburst (Optional)

- We recommend that you spend some time on Project Budburst to get a general sense of familiarity with it. The site is very easy to use and has ample resources to look at if you have questions about phenology, phenological stages, or would like to know more about Project Budburst's mission and what the data is used for.
- If you would like to log your students' observations into Project BudBurst (in order to help track long-term phenology data), you will need to register for an account.
    - The process for this is described in the "Registration for Secondary Teachers" PDF. This document also walks through how to set up student accounts under the teacher account and other information.

Site Selection

- Select a site within walking distance of the school. The site should contain some type of vegetation; Project Budburst has reports available for wildflowers, deciduous trees, coniferous trees, grasses, and evergreen trees and shrubs so there is a lot of flexibility in this.
- Another important consideration is safety; those in heavily wooded areas, near a river or large body of water, or close to traffic may not be ideal.

Species Selection

- We have a list of recommended species to use based on ease of identification, ecological importance, and/or ubiquity throughout Michigan:
    - Red maple (Acer rubrum)
    - Butterfly Milkweed (Asclepias tuberosa)
    - Chokecherry (Prunus virginiana)
    - Eastern white pine (Pinus strobus)
    - White oak (Quercus alba)
    - Common dandelion (Taraxacum officinale)
- More species can be found on http://budburst.org/plantresources_list_bystate and then clicking on "Michigan."
- Whatever the species selected, you should feel comfortable identifying them or providing students with resources for identifying them. Quality field guides or apps such as LeafSnap (available for free download) are excellent for this.
    - Examples of Michigan tree/plant Field Guides
        - *Trees of Michigan Field Guide (Tree Identification Guides)* by Stan Tekiela
        - *A Field Guide to Eastern Trees: Eastern United States and Canada, Including the Midwest (Peterson Field Guides)* by George A. Petrides and Roger Tory Peterson
        - *National Audubon Society Field Guide to North American Trees: Eastern Region*
        - *Michigan Trees & Wildflowers: A Folding Pocket Guide to Familiar Species (A Pocket Naturalist Guide)* by James Kavanagh

Other

- Before this lesson, please alert students that they will be going outside on the specified day and that they should dress accordingly.
- You will need to print enough observation worksheets and reports for students and collect clipboards or other hard surfaces for writing.

How does phenology affect species and ecosystems?: Homework recap and discussion

1. **Split students into groups of 4-6 based on the article that they read for homework. Pass out one article summary worksheet per group. (1st slide)**
    a. After worksheet is completed, have each group present their summary and diagram to the whole class. The articles build off of each other, so we recommend having the "Why is phenology important?" group(s) go first, followed by "Climate change will leave Edith's checkerspot butterfly out of sync," and "Walden warming" last. This last article will lead into our discussion of Citizen Science.

Introduction to Citizen Science and Project Budburst

1. **Click-- Review Citizen Science and Project Budburst**
    a. Review: citizen science is like crowd-sourcing for scientific data—it is scientific research or data collection done by anyone, not just scientists.
    b. Project Budburst is a citizen science project organized by the Chicago Botanical Gardens. The project encourages citizens to collect phenological data on plants throughout the United States. These data are available to anyone and used by researchers and educators across the world!
2. **Click-- Go over how to make observations**
    a. Briefly overview what we'll need to know before, during, and after observations. We'll need to go over the phenological stages we may see (see next step/slide), go outside to make our observations, record the site information and observations in the proper place in the single report sheet, and enter our observations into the database.
3. **Click-- Go over phenological stages**
    a. The phenological stages we'll record are a bit different for the types of plants that you choose to observe. In addition, there are three things we'll look for: the part of the plant, what it is doing, and the proportion of the plant parts doing this. The parts of the plant we'll look for are leaves, flowers, and fruit. Leaves can be unfolding, changing color, or dropping; flowers can be blooming; and fruit can be apparent. Either a few, about half, or about all of the leaves, flowers, or fruit will be in this stage.
4. **Familiarize students with the observation and single report sheet (Slide)**
    a. Pass out the observation and single report sheets. Walk through observation sheet and have students fill in site details on their observation sheets (latitude, longitude, etc.)
5. **Go over rules for going outside and get ready to leave the classroom**

Field Trip!

1. **Bring students to the selected site. Show students different species they can observe or have them identify their own using a guide.**
2. **Have students work individually, in pairs, or in small groups to make observations of their plant. The following questions can be facilitated between you and these smaller groups individually or with the whole class.**

a. *Do you see any other plants around or on their chosen plant? (Vines, understory plants, etc.)*

b. *Any animals or evidence of animals? (Ants, birds' nests, etc.)*

c. After observing any possible interactions, ask students to make their phenological observation. (Use the observation worksheet to guide students' thinking.)

   i. *Would the timing of when the leaves, flowers, etc. bloom have any effects on the interactions that you observed?*

Back Inside: Debrief and evaluations

1. **Last slide-- As a whole class, ask students to share their observations, hypotheses about interactions between their plant and other species, and what they think might happen if their plant's phenology changed.**
2. **Ask students what they think of Citizen Science and if/why they think it is important.**
   a. If this is something they seem to be interested in and you have time during the rest of the semester, you can ask if they'd like to make reports on the same plants throughout the semester. See the "Extensions" section for more information.
3. **Administer Student Questionnaire**

Extensions (Optional)

1. Have students continue to make observations on the same plants weekly, biweekly, etc. throughout the semester.
2. Keep the data gathered for use in subsequent years. Eventually students may be able to use it to make their own graphs.
3. Participate in Project BudBurst's Cherry Blitz campaign.
   a. Cherry trees can be wild trees (black cherry, chokecherry) found on school grounds; or Japanese varieties of cherry trees or agricultural trees (sweet and tart) if you are able to visit an orchard.
4. If you are interested in visiting a larger wooded area, Wheels2Woods is a grant program available to teachers.