



Photo Credit: Francis Benjamin Johnston

Grade Levels

Undergraduate

Overview

Students conduct an investigation using historical photographic records to determine whether the timing of plant phenophases has changed in their own communities. They search for old photos (indicating dates) in their family's or town's records that show sites where plants are in specific phenological stages (i.e., peak flower, 90% leaf out [or 90% lack of leaf cover], fruiting, seasonal festivals, etc.), and that show dates of record. They then visit those sites when plants are experiencing those same phenophases and take pictures to compare the past and present timing of seasonal events.

Real-world Connection

Students infer meaning from the comparisons (e.g., with respect to climate change), engage in speculation, and learn to articulate claims and conclusions. They also evaluate the strength of those claims based on their investigation and the photographic evidence they've compiled. This can be used as a basis for classroom discussion, leading students to explore lines of reasoning and other potential avenues of investigation. Do they think scientists and resource managers could use this information to understand how climate change is affecting plants, animals, and humans, and how to best manage these changes?

Citizen Science Connection

This activity can be completed with or without a *Nature's Notebook* account. Completing it with an account can provide an opportunity to teach students about the importance of citizen science, and how their contributions help us to better understand the world around us.

Estimated Time

1.5-2 hours (or as needed for a field trip or classroom visit) for historical research

20 minutes (or as needed, depending on location) for photographing present-day phenological events

One 30 to 40-minute class period (or as needed) to assemble evidence for any conclusions or claims

20 minutes for presentation and group discussion

Learning Objectives

Participants will be able to:

- Understand that the timing of phenological events can change, particularly as a result of changes in climate
- Identify some of the actual or potential local impacts of changes in phenology

Conducting the Activity

Materials

Resources needed

- Access to historical photographic record — either family, town, library or other
- Dated photos or photos where date can be inferred (holidays, graduation, festivals)
- Photocopier or digital scanner
- Digital Camera
- Optional: hand lenses, binoculars, materials needed to observe a particular phenophases

Suggestions about types of photos to look for: variation can be easier to see in fall or spring scenes; or look for images taken around holidays (e.g., Labor Day, Columbus Day, Rosh Hashanah, Yom Kippur, Veterans Day, Thanksgiving, Easter, Passover, Patriots Day, Memorial Day) or at events that happen around the same time each year (e.g., sports tournaments, hunting or fishing trips, vacations, etc.).

Explore

Hands-on learning

- Before announcing the activity, look at the calendar and think about upcoming seasonal or phenologically-relevant events on the horizon (e.g., fall foliage, leaf dropping or leaf out, alewife run, maple sugaring, or lupine festival, beginning [$<10\%$] or peak [$>90\%$] flowering time for lilacs, apple trees, or other flowering plants, berry seasons, etc). Choose one or more examples for students to focus on.
- Announce and explain the overall activity to the participants/students. Ask the students to think about where they could look for dated photographs depicting those seasonal events in times past. Discuss, as a group, how to research the question and come up with a plan. Review the importance of evaluating the credibility of sources (and how to credit sources), especially if they want to search the Internet.
- Establish a schedule for completing the project and expectations of students who aren't able to find any historic photos. The project may best be conducted in small groups due to the limited number of phenological events to choose from. Also, this could help increase the likelihood of tracking down relevant family photos. Optionally, encourage students to conduct the investigation in other towns where other family members may live, so as to increase options for material and resources.
- Depending on the students' experience using library resources, you may want to schedule a library visit for an orientation to help students get started. You also may want to establish milestones by which students must produce pieces of the project, and check-in points to encourage them to consult with you for advice.
- As phenological events become imminent, make sure students are in the field making observations, taking pictures and notes, until their phenophases are observed and photographed.
- Guide the students in reflecting on their body of evidence and what they think it means. Coach them on how to assemble the pieces to make a clear presentation of their findings (or lack of findings). Schedule a time for each group to give their presentation.
- When the presentations occur, make sure there is ample time for questions, discussion, reflection and debate.

RESOURCES
Adapted from:

Signs of the Seasons: A New
England Phenology Program -
Phenology Snapshots

By: Beth Bisson, Medea
Steinman, Esperanza
Stancioff, Abraham J. Miller-
Rushing

NOTES ON ACTIVITY

Conducting the Activity

Explain

Listening and communicating understanding

- Reflection: Ask participants to describe their research process and reflect on what worked well and what they could do differently next time. Also ask them to reflect on how much can realistically be inferred from the material they have compiled and whether they can make strong conclusions and claims or not. Ask them to explain the difference between a strong claim and a weak one. Can they say that the overall timing of some events is changing, or not? If not, what more evidence/information would they need? How might we document these changes? What might cause changes in phenology? Are the changes likely to be uniform? What are some consequences (actual or potential) of changes in phenology for people, plants, and animals? Offer example(s) of changes in phenology of species, examples of how scientists (or others) have documented these changes, and any consequences that have been noted.

Evaluate

Summarize, check for understanding, assess

- Ask students to take their investigation one step further. If they need other information in order to strengthen a claim, ask them to pursue it (with your guidance and input) and then give an update to the group of their initial presentation. If they were unsuccessful with one investigation, ask them to try again with a different phenological event (in consultation with you). For students who are comfortable with this activity, can they lead their peers in a new or expanded investigation?

Extend

Group projects, real world connections

- If any group has developed a strong investigation, consider having their results presented publicly, at the local library, nature center, education and research center (i.e., associated with a national park), town meeting where a relevant discussion is on the agenda, relevant forum at an academic institution, and consider drawing media attention to the event. Can the students be enlisted to investigate, or participate in an investigation of, a phenological question of strong interest/concern to the local community? For instance, a coastal community might be very interested in understanding how the timing of fish migrations is changing. Some participants in the group may know of records of past fish runs — e.g., town records, newspapers, journals of family members, etc. — that could be used to investigate the changes. Perhaps the students' skills in compiling photographic evidence could enhance the research effort.
- You can also create a group in *Nature's Notebook* to track common plants and animals in your area. If students found historical records of some plant species, you can see how the timing of their phenology is similar or different. If it was difficult to find historic images of phenological events in your area, have your students think of ways to start establishing those records now so that they are available for future researchers.