

GLOBE Green-Down Sequence (9-12)

Through the [GLOBE North American Phenology Campaign](#), students monitor tree green-down over the fall season. [Register to participate!](#)

This guide was developed for learners ages 14-18 in collaboration with GLOBE Educator Cheryl Williams (Palmer High School, AK, USA). Cheryl presented on green-down with high schoolers in the second half of this [GLOBE Green-Down Webinar](#). In the webinar Cheryl also describes curriculum connections.

Educator Do-Ahead



1. *If you are new to GLOBE*, [create an account](#) and complete [GLOBE eTrainings](#): Intro to GLOBE eTraining, Intro to the Biosphere, and GLOBE Green-down.
 2. Select your green-down study site. Choose a site that is easily accessible, has trees with branches that students can reach, and (if possible) is away from buildings.
Video Tutorial: [Selecting a Site and a Tree](#) (2 min)
 3. Set up your green-down site on the GLOBE website or the GLOBE Observer app to be ready for data entry.
Video Tutorial: [Create a GLOBE Green-down or Green-up Data Entry Site](#)
 4. *Optional:* Set up anonymous GLOBE student accounts if students will be entering their own data (appropriate for older grades).
Video Tutorial: [GLOBE Student Accounts](#)
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Activities:

1. [GLOBE and Green-down](#) [25-50 minutes]
2. [Study plan](#) [25 minutes]
3. [Data collection](#) [40 minute initial visit, 20 minutes twice a week through the fall]
4. [What story do your data tell?](#)
5. [Scientists communicate!](#)
6. Extension Activities to highlight Satellite data
 - a. [Global Patterns in Green-up and Green-Down](#) [GLOBE, 90 minutes]
 - b. [Observing Annual Vegetation Changes](#) [My NASA Data, 30 minutes]

Activity 1: GLOBE and Green-down (Inside, 25-50 minutes)

Materials Needed:

- Optional: [Photo slides](#) (PDF)
-  What is GLOBE? (2 minutes)
-  GLOBE Learning Expedition (GLE) 2018 – Killarney, Ireland (11 minutes)

Steps:

1. [Optional, 15 minutes] Use the Phenology Phenomena 4-image slideshow to spark questions and thoughts about forests and seasonal change. For each image have them write what they notice and what they wonder.
 2. [20 minutes] Introduce that students are going to be collecting green-down data with the GLOBE Program and uploading data to the GLOBE database which is available to students and scientists around the world.
 - a. Ask: What is green-down? (Green-down marks the end of the growing season for many plants, and is often associated with a change in leaf color)
 - b. Watch “What is GLOBE” and the “2018 GLOBE Learning Expedition” videos to introduce the program and demonstrate that students are contributing to an international effort.
 3. [5 minutes] Why do their data matter? Their data complement data being collected by NASA satellites on seasonal vegetation changes (e.g., [MODIS](#)). On-the-ground data collection is important for ground truthing (are the satellites reporting and interpreting accurately?) and filling in gaps. Local long-term data sets are also important for understanding how ecosystems are changing with a changing climate. They are starting or continuing a long-term data set that can help their community understand these changes better.
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Activity 2: Study plan (Inside, 25 minutes)

Materials Needed:

- [Plant Color Guide](#) (PDF)
- [Selecting and Site and a Tree mini-tutorial](#) (video; same link as page 1)
- [Scientist Q&A videos](#)

Steps:

1. [5 minutes] Watch a Phenology Scientist Q&A video (choose one from the list!).
 2. [15 minutes] Show the Plant Color Guide tool and explain the study plan:
 - a. They will go outside twice a week to collect data.
 - b. Outside, students will go to their assigned tree/site and record the colors of 4 leaves. They should add a sketch of their branch to their data sheet or science notebook that labels the leaf numbers so they can refer to it the next time they come out.
 - c. Have a plan for what students do when they finish data collection.
 - i. Example activities:
 1. If students can use a phone or tablet, have them use the [GLOBE Observer App to measure their tree's height](#).
 2. Make detailed sketches of the tree, leaves, branching pattern.
 3. Print [The Science of Fall Colors](#) (USDA Forest Service) for them to read.
 - d. If students are working independently in different sites, have a plan for how much time they will spend at the site and where a meeting place is.
 - e. Go over safety and expectations
 3. [5 minutes] Watch the “Selecting and Site and a Tree” mini-tutorial together so they know how to determine which branch to choose and how to tag their tree.
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Activity 3: Data collection (Outside, 40 minutes)

Materials Needed (one of each per group):

- Flagging tape or ribbon
- Silver or black sharpie or white out to tag the tree branch
- Tree identification guide or app
- [Plant color guide](#) (PDF)
- [Data sheet](#) (PDF) or science notebook and pencil
- [Tree Green-down Field Guide](#) (PDF)

Steps:

1. [5 minutes] Show students the study site boundaries, revisit safety and expectations while outside.
2. [30 minutes] Give each group a data sheet and the green-down field guide. Students tag their tree branch and record the color of each of their four leaves on their data sheet.
 - a. For the first site visit, check in with each team to make sure they are following the protocol and are entering the color codes correctly on their datasheet.
 - b. [Measuring Green-down mini-tutorial](#) (2 min video)

Tip: *On trees with dark bark use a silver sharpie instead of black to tag the leaves.*

3. [5 minutes] Wrap up. How did data entry go? What did they notice about their tree/leaves? What do they predict might happen this fall?

Repeat Activity 3, steps 3-5 twice a week until the leaves have fallen.

Don't forget to Upload your Data!

- [GLOBE Data Entry Video Tutorials](#)
 - [Using GLOBE Observer to Record Green-down mini-protocol tutorial](#) (4 min video)
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Activity 4: What story do your data tell?

Materials Needed:

- Student data sheets or any data displays made
- [optional] [Local weather data](#)
- [optional] Other data collected by students (e.g., [air temperature](#), [precipitation](#))

Steps:

A good place to start putting data in context is to think of what questions came up before or during data collection. These might be along the lines of:

- What affects the timing of color change?
- How do my data compare to green-down data in another location?
- Do different tree species change colors at different times?

Have students look at the data they collected. What new observations can they make about fall color change? If you have other data types available, what patterns do they notice in those? Do they think these might affect color change?

There are resources, GLOBE data tutorials, and example student projects available on the Phenology Campaign [Analyzing and Communicating Your Data](#) page to support this work.

Activity 5: Scientists communicate!

Share the story with your school

- Example [school display from Moharimet Elementary School](#) (NH, USA; Padlet)
- Have students make a school announcement about their project/observations
- Have students share at a school or community event

Connect with a scientist

- Find a STEM professional from the [GLOBE International STEM Network](#)
- Ask parents, local universities or science organizations if someone could come speak to the class or listen to a class presentation.

Connect with another GLOBE school

- See the [Phenology Campaign Collaboration](#) page for information on how to connect with another GLOBE school studying phenology.

Participate in the Leaf and Learn Exchange

Share the results of your project with the GLOBE community. This can be through a traditional report or poster or you can get creative with a book, slideshow or video. [Register for the Phenology Campaign](#) and we will send you the details.

- See examples from students in the [European Phenology Campaign](#).

Participate in the International Virtual Science Symposium (IVSS) or the U.S. GLOBE Student Research Symposia (SRS)

- Showcase your research virtually through the IVSS and get feedback from scientists. [Learn more about the IVSS](#).
- Present a research poster to peers and STEM professionals at a regional SRS. Events occur in the spring around the United States. [Learn more about the SRS and how to participate](#) (U.S. students in grades 5-12 only).