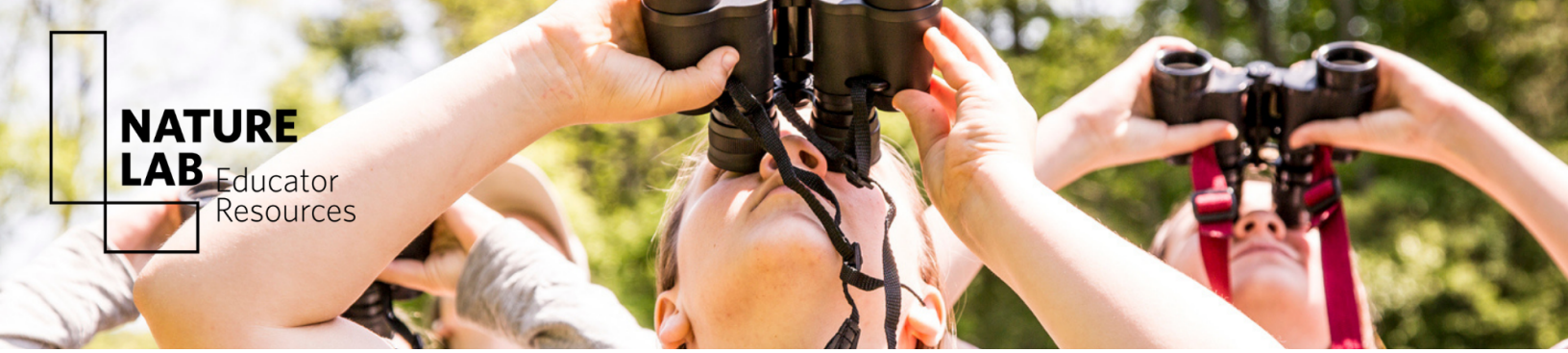

You're the scientist!
Citizen Science, Frogs & Cicadas
TEACHER'S GUIDE

Grades: 3-8 **Subjects**: Science and Geography

Purpose: This guide contains a set of discussion questions and answers for any grade level, which can be used during and after the virtual field trip. It also contains links to additional resources ranging from lessons, activities, videos, demonstrations, experiments, and multimedia presentations.

Essential Question: What is the impact of citizens contributing to scientific inquiries and studies?

Supporting Questions:

- What are the four common features of all citizen science projects?
- Why isn't it necessary for someone to be a student or have a science background to participate?
- How can we contribute to citizen science projects in our communities?

Description:

The conservation community relies heavily on volunteers to not only restore natural areas, but to help gauge the success of restoration efforts. Volunteers team up with experienced stewards and scientists to monitor the recovery of native habitats, or to record data on rare species of wildflowers, butterflies and other wildlife. But can students get involved? In fact, they can!

Citizen science can support science learning in several ways, such as by offering the opportunity to participate in authentic scientific endeavors, encouraging learning through projects conducted in real-world contexts, and supporting rich social interaction that deepens learning, and engaging with real data. Citizen science also includes projects that grow out of a community's desire to address an inequity or advance a priority, so they are a great educational activity that can also connect students directly with an issue in their own community. Citizen science projects can help participants learn scientific practices and content when the projects are specifically designed to support learning.

In this virtual field trip, we introduce students to cicada tracking and amphibian conservation in the Washington D.C. community to explain how citizen science projects work. Students will learn the history of citizen science and see our field trip host volunteer to collect and submit data on calling frogs and toads at wetlands in the Washington D.C. area. Students will have the opportunity to participate in a citizen science project in their own communities.

Materials

Video supporting this lesson plan:

- You're the scientist! Citizen Science, Frogs & Cicadas
  - Vimeo: https://vimeo.com/646170285/493bced1f7
  - YouTube: https://youtu.be/Wpkb3jmXaac

Materials for Teacher:

- Computer with Internet connection, LCD projector, screen

Materials for students:

- Discussion questions

Standards:

Next Generation Science Standards

Disciplinary Core Ideas:

- LS4.C Adaptation
- LS4.D Biodiversity and Humans
- ESS3.A Natural Resources
- ESS3.C Human Impacts on Earth Systems

Crosscutting Concepts:

- Patterns
- Cause and Effect
- Stability and Change
- Influence of Engineering, Technology, and Science on Society and the Natural World

Science and Engineering Practices:

- Asking Questions and Defining Problems
- Planning and Carrying Out Investigations
- Constructing Explanations and Designing Solutions
- Engaging in Argument from Evidence

Common Core Standards

3rd-5th Grade ELA Reading: Informational Text

- CCSS.ELA-LITERACY.RI.3.4 Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a *grade 3-5 topic or subject area.*
- CCSS.ELA-LITERACY.RI.3-5.9 Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably.

6th-8th Grade Science and Technical Subjects

- CCSS.ELA-Literacy.RST.6-8.3 Follow precisely a multi-step procedure when carrying out experiments, taking measurements, or performing technical tasks.
- CCSS.ELA-Literacy.RST.6-8.4 Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context.
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- CCSS.ELA-Literacy.RST.6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g. in a flowchart, diagram, model, graph, or table).

Vocabulary:

- **Crowdsource:** to obtain information by enlisting the help of a large number of people via the internet
- **Citizen Science:** Citizen science is scientific research conducted, in whole or in part, by amateur scientists. Citizen science is sometimes described as "public participation in scientific research"
- **Environmental health:** the branch of public health concerned with monitoring or mitigating those factors in the environment that affect human health and disease.
- **Methodology:** specific procedures or techniques
- **Nature-based solutions**: a broad term that refers to solutions that rely on nature
- **Pollinators**: animals that moves pollen from the male anther of a flower to the female stigma of a flower
- **Locust**: a group of certain species of short-horned grasshoppers in the family Acrididae that have a swarming phase

Discussion Questions: You can use or adapt these questions for a follow-up discussion with your students after viewing the virtual field trip or you pause as you go along.

1. What does it mean to be a scientist?
   Answer: Answers will vary.

2. What are the four common features of all Citizen Science projects?
   Answer: Anyone can participate. Participants use the same protocol or procedure so data can be combined and used properly. The data collected can be used by scientists to reach conclusions. A wide community of scientists and volunteers work together to collect data that is accessible to all.

3. What are some benefits of citizens contributing to science?
   Answer: It helps scientists collect large amounts of data and samples, having engaged citizens could lead to policy changes, and scientific projects benefit from time and dedication from community members.

4. Is it necessary for someone to be a student or have a science background to participate in citizen science projects?
   Answer: No, anyone can participate.

5. What are some challenge scientists might experience when conducting their work?
   Answer: To conduct research, scientists often need vast numbers of observations over a large area and long time, and there simply isn't enough time or resources to collect it all!

6. Why are periodical cicadas a natural phenomenon?
   Answer: After they hatch as tiny nymphs, they stay underground for as long as 17 years.

Take Action!

Citizen Science is the involvement of everyday people in making scientific observations of the world around us which in turn can be used to tackle real world problems. In this portion of the lesson, students will plan an engagement with a citizen science project of their choice. This portion can be done individually or in groups.

Research:

1. Students will research and select a citizen science project to participate in. They may review the list of projects outlined in "Additional Resources" below or find their own.
2. Students may also use the search feature in SciStarter to browse the available Citizen Science projects.

Report:

1. Draft brief report that can be shared with classmates and answers the following questions:
    a. What Citizen Science project did you choose?
    b. A general description of the project
    c. In what locations are the data being collected?
    d. Who can collect data for the project?
    e. What is the goal of the project?
    f. How could this project be adapted to our community to tackle an issue here?
2. Students should share results with classmates in the format of the educator's choice—this can be through a presentation, written report, multimedia product, or others.

Engage:

1. Students should participate in a project of their choice. The project may be the one they presented to the class or an alternative one. Alternatively, the class can engage with a single project together. Suggestions can be found in the "Additional Resources" portion of the guide. Students can also utilize SciStarter.

Optional Extension: Work with data

Citizen Science initiatives provide opportunities for us, regular citizens, to collect data and report findings. This data is widely accessible. Students can collect data, but educators can also leverage this publicly available data to extend learning.

Consider the following:

1. What parts of your students' work (data creation) will they be able to access and work with?
2. Is it possible to access/compare your data to that from another class at your school, another school or even in another country?
3. Does your students' data just get mixed with everyone else's?
4. Does the project share raw data or present data summaries graphically?
5. Do your students already know how to read data graphs? If not, how will you 'teach' your students to be able to interpret and make sense of the data or graphs/images generated?

If opting to work with data, you can use the following resources:

Visit Zooniverse and explore various active and ongoing projects. Visit the "Results" tab within any single project to examine data that has been compiled.

Visit NASA's Citizen Science page and explore collaborations between scientists and interested members of the public.

Use your phone as a magnetic sensor. Be a part of NOAA's research on the geomagnetic field. Install the CrowdMag app and share your magnetic data with scientists. You can also view the maps and graphs shared by other citizen scientists.

Explore NOAA's water level reports. Observations shared are used to map water levels (flooded, normal, and low) regionally. Your contributions are used by local, state, and national managers and scientists to learn more about high coastal water levels, their causes, and impacts

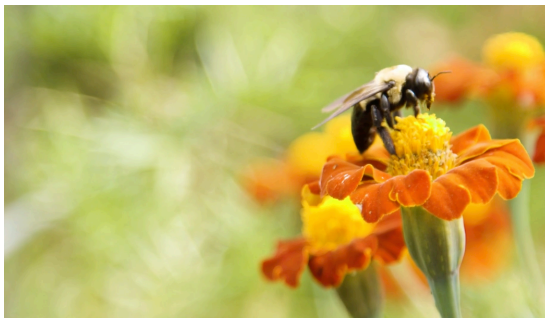
Nature Lab Related Resources: The following lesson plans and videos can be used to supplement the virtual field trip.

Gray, Green, Blue: Water Security and YOU!

Grade Levels: 6-8

Learn how nature can play a role in ensuring water security and what YOU can do to help in this four-part series: Gray, Green, Blue: Water Security and YOU! **You can watch this series in Spanish with subtitles. *Mira la serie con subtítulos en español.***

https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/middle-school-lesson-plans/

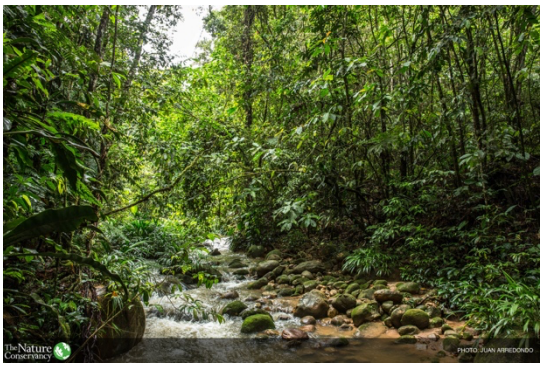


How to Build a School Garden

Grade Levels: 3-8

Want to start a school garden? Our lessons cover planning, building, and caring for your garden, plus a video on overcoming common student fears.

https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/school-garden-resources/



Finding your Flow

Grade Levels: 3-8

Students will use a video about water in Colombia as a jumping off point to explore the issues facing the watershed in which they live and to identify ways they can become involved in protecting their water along its journey.

https://www.nature.org/en-us/about-us/who-we-are/how-we-work/youth-engagement/nature-lab/high-school-lesson-plans/

Other Related Resources

Classroom Resources (All Grades)

- **SciStarter:** Online citizen science hub where more than 3,000 projects, searchable by location, topic, age level, etc, have been registered by individual project leaders or imported through partnerships with federal governments, NGOs, and universities.
  https://scistarter.org
- **iNaturalist:** iNaturalist is an online social network of people sharing biodiversity information to help each other learn about nature
  https://www.inaturalist.org
- **Chronolog:** Chronolog is used by organizations worldwide to create crowd-sourced timelapses that monitor the environment and engage communities in science.
  https://www.chronolog.io
- **Citizen Science.gov:** CitizenScience.gov is an official government website designed to accelerate the use of crowdsourcing and citizen science across the U.S. government.
  https://www.citizenscience.gov/#
- **National Park Service:** "What is citizen science?"
  https://www.nps.gov/subjects/citizenscience/citizen-science.htm
- **National Oceanic and Atmospheric Association (NOAA):** "Citizen Science"
  https://www.noaa.gov/education/resource-collections/education-at-home/citizen-science

Citizen Science Projects

- Budburst is a is a network of people across the United States who monitor the leafing, flowering, and fruiting of plants. This project fosters collaboration among gardeners, scout troops, hikers, botanists, ecologists, government agencies, and educators to monitor climate change and its impacts on plants.
- Globe at Night is an international citizen-science campaign to raise public awareness of the impact of light pollution by inviting citizen-scientists to measure & submit their night sky brightness observations.
- Bumble Bee Watch is a collaborative effort to track and conserve North America's bumble bees.
- connects, trains, and supports young people to act for climate justice on the Colorado Plateau.
- Project Squirrel is a citizen science project in which anyone can participate. Whether squirrels live in your neighborhood or not, you are encouraged to become a squirrel monitor. You can submit as many observations from as many places as you like. It's most effective to submit at least one observation per site per season but the more observations the better.

This virtual field trip and teacher guide was made possible with generous support from

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