



Educator Toolkit

Links to lesson plans and resources
for connecting science to the
environment with K-12 students



Learn more at
NEEFusa.org



Introduction

Student achievement in STEM is key to fostering a new wave of innovators who can creatively address complex 21st century challenges. Environmental education can provide students with opportunities to engage in meaningful and exciting scientific studies that can spark their interest in STEM and empower them to take part in solutions to local environmental challenges.

Science provides the tools required to better understand the environment. Through the scientific process, repeated observation, testing, and analysis advance our knowledge of the world. With so many fields of scientific study that examine the environment, there are endless connections that directly relate to the forefront of real-world scientific research and discovery.

From the front steps to the solar system, science can be found everywhere. NEEF has put together this collection of lesson plans and curriculum guides to help educators introduce students to some of the many ways they can discover more of the science going on around them, both within the classroom and in the field.

Paired with each section are related citizen science opportunities open to anyone! These projects allow everyone to get involved and contribute to the scientific research that is shaping what is known about the planet. Let this toolkit be an invitation to explore and discover how much of our world really is *Surrounded by Science*.

Other Greening STEM Educator Toolkits

Look for other NEEF Educator Toolkits to find additional lesson plans and resources related to Greening STEM.

[Available Here](#)



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Use the pages of this toolkit to find links for quality lesson plans and educational activities from other trusted organizations. Each page title introduces a sense of scale as a way to approach the widespread range of ways scientific study can be applied to the environment, from a close-to-home look at science in our immediate surroundings to a global perspective on larger concepts. This does not mean that the scope of each lesson should be confined to these boundaries however, and in fact, each section features citizen science suggestions to expand student learning to a national or even global community.

Each lesson and activity links directly to the content host site.

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Look for the featured citizen science opportunities on each page!



To learn more about citizen science and NEEF's involvement in these types of projects, visit the [citizen science](#) section of the NEEFusa.org website.

At Home

Seeds, Miraculous Seeds (3-6)

Agriculture in the Classroom

What is inside of a seed? Students may be surprised to find out! In this simple yet enlightening activity, students develop an appreciation and understanding of the natural development of seeds.

Plant Pollination (6-8)

Discovery Education

In this lesson, students will learn to identify the different parts of a flower, the function of each part, and the importance of pollen for plant reproduction and diversity.

Bee Detective - Discover the Culprit Behind Declining Bee Populations (6-8)

Nature Works Everywhere

Bees provide vital benefits to people, including crop pollination and products such as honey and beeswax. But bee numbers are dropping due to colony collapse disorder (CCD). In this lesson, students are put at the cutting edge of research on declining bee populations.

Citizen Science:

Bumble Bee Watch: A collaborative effort to track and conserve North America's bumble bees. Upload photos of bumble bees to help scientists track and identify different bumble bee populations and even locate rare or endangered populations.

Monarch Watch: Get involved in monarch conservation by learning more about migration routes, creating a monarch waystation, or joining one of several ongoing research projects that rely on student-scientist partnerships.



In the Neighborhood

A Single Patch of Earth (K-5)

USDA Forest Service

In this easy outdoor activity, students investigate a square foot patch of earth to record observations and explore what they can find. This lesson explores biodiversity on a small scale and the abundance of life at close proximity.

Oak Woodland Learning Activity (6 and up)

Center for Ecoliteracy

Students learn to look at an ecosystem — the oak woodland — as a system and, by doing so, become aware of relationships among living things, the processes and patterns that drive survival and evolution, and the importance of abiotic characteristics in sustaining life.

Habitat Sweet Habitat (K-5)

Plum Landing

All living things have the same few basic needs. Help students learn about what makes a suitable habitat for different organisms and why living things can only survive in ecosystems that meet their needs. Students will learn to identify features of different habitats nearby and design their own creatures to best suit the habitats they've found.

Natural Inquirer: Invasive Species Lesson Plan (6-8)

Natural Inquirer

In this edition of the USDA Forest Service's Natural Inquirer, students will learn about several different invasive species. Students will learn about how these invasive species spread and the studies that scientists conduct to better understand and stop the spread of invasive species.

Who Can Live Here (9-12)

National Wildlife Federation

Students will learn to assess the fitness of a habitat for a specific species. They will research the needs of native wildlife and evaluate the quality of selected habitat sites based on the animals known to be living there.

Citizen Science:

Cornell Lab of Ornithology's "Investigating Evidence": A free curriculum that uses citizen-science projects and outdoor explorations to generate and share authentic scientific data through the scientific process.



I See Change: Join a global community that posts about what they notice changing in the environment. Each post is synced with weather and climate data and broadcast to the community to investigate bigger picture climate trends.

In Your Region

Understanding the Urban Watershed (All)

Fairmount Water Works, Partnership for the Delaware Estuary, EPA

These lessons and activities take an interdisciplinary, hands-on approach to learning and are designed to help teachers create hands-on as well as project-based learning opportunities for their students. Using this guide with students will lead them to a broader understanding of the complete urban water use cycle.

How to build a Model Watershed (5-8)

Creek Freaks

This model watershed offers a clear visual demonstration of how water picks up sediment and pollutants as it flows, and that simple measures can reduce the amount of polluted runoff that ends up in a watershed. This is a good project for talking with students about water pollution and what they can do to prevent it. It's also a great indoor conservation project.

Learning About Acid Rain (6-8)

U.S. Environmental Protection Agency

After reading the guide and doing some of the experiments and activities, students will have a better understanding of acid rain and the problems it causes, as well as a greater interest in its resolution and in applied environmental science.

Wetland Education for Students and Teachers (K-12)

U.S. Environmental Protection Agency

This list of resources contains activities, teaching guides and materials, educational programs, videos and additional resources to understand our wetlands.

Watersheds (9-12)

Science NetLinks

Understanding the hydrologic cycle is basic to understanding all water and is a key to the proper management of water resources. This lesson helps students to understand the role of watersheds in this cycle and to reflect on human impacts on the water cycle by taking a closer look at citizen-based efforts to clean up and protect local watersheds.

Citizen Science:

FreshWater Watch: A global citizen science project investigating the world's freshwater ecosystems while covering curriculum topics such as geography, ecology, data gathering and scientific inquiry.



Journey North: Students and citizen scientists around the globe participate in tracking wildlife migration and seasonal change.

In the World

Meteorology: An Educator's Resource for Inquiry-Based Learning (5-9)

NASA

A basic introduction to meteorology, including inquiry activities and instructions to build and use weather instruments for a weather station, collect data, and predict weather systems.

Weather Maps (K-5)

Discovery Education

Through this lesson, students will understand basic information about weather, learn about different types of weather maps and create and present national weather maps showing different conditions.

Become a Weather Wizard (5-8)

SciJinks

This lesson introduces common weather concepts and terminology. Students identify common weather map symbols and learn to show real weather scenarios by using these symbols on a map.

Melting Ice (6-12)

WGBH

Ice affects the entire Earth system in a variety of ways. It should be no surprise, then, that melting ice is having numerous widespread effects on the planet. In this lesson, students begin to develop an understanding of the planet and how, no matter where they live, they are part of an interconnected system that sustains life.

Using Weather Balloon Data to Map Atmospheric Temperature (9-12)

Science Buddies

Twice a day all over the U.S., the National Weather Service launches weather balloons to collect data on the current conditions of the upper atmosphere. The data are used for weather forecasting, and are available online. This project shows students a way to see how temperature changes with altitude using this data.

Citizen Science:



NASA S'COOL (Students' Cloud Observations On-line): Contributors collect data on cloud type, height, cover and related conditions. Observations help validate satellite data and provide a more complete picture of clouds in the atmosphere and their interactions with other parts of the integrated global Earth system.

Community Collaborative Rain, Hail and Snow Network (CoCoRaHS):

A community-based network of volunteers of all ages and backgrounds working together to measure and map precipitation (rain, hail and snow).

Additional Resources

EPA Teacher Resources and Lesson Plans

Find an array of environmental and science based lesson plans, activities, and ideas from EPA, other federal agencies, and external organizations.

Pollinator Live

Online educational resources for learning and teaching about pollinators through webcasts, lesson plans, citizen science opportunities and more.

SciJinks

A tool designed to help educators build environmental science lesson plans that align with the Next Generation Science Standards.

For Citizen Science



Project NOAH: A tool to explore and document wildlife and a platform to harness the power of citizen scientists everywhere.

SciStarter: A place to find, join, and contribute to science through recreational activities and citizen science research projects.

Zooniverse: A platform that provides opportunities for people around the world to contribute to real discoveries in fields ranging from astronomy to zoology.

Cornell Lab of Ornithology's Citizen Science Central: Through citizen science, volunteer monitoring, and participatory action research, this site supports organizers of all initiatives where public participants are involved in scientific research.

Learn more at: **NEEFusa.org**

or email **EEWeek@neefusa.org** with any questions

Surrounded By Science

From the front door to the solar system, science can be found everywhere.

Explore some of the many ways science connects the world around us. Help increase our understanding of the environment through citizen science.

Record the shape of the moon over several nights to determine whether it is waxing or waning.

NASA.gov

The Moon is very hot during the day but very cold at night. The average surface temperature of the Moon is 224°F during the day and -243°F at night.

Air pressure affects weather patterns all over the world.

Because air tends to rise in a low pressure system, air and water molecules condense as they reach colder higher altitudes, often resulting in clouds and precipitation.

Make your own simple barometer to measure air pressure on different days or during different precipitation events.

CS: TeachEngineering.org

The watershed of the Mississippi River Basin covers over 1,245,000 square miles of land and touches 31 different states.

Locate your watershed to learn more about it and see how you can help protect it.

CS: FreshWater Watch

About 75% of all plants, including those in our yards, gardens and parks, depend on pollinators like bees, butterflies, birds or even bats to reproduce.

Help maintain suitable wildlife habitat in your yard or neighborhood by preserving natural spaces that provide food and shelter for small animals.

CS: Cornell Lab of Ornithology

96% of terrestrial North American birds raise their young on insects. Birds like chickadees do almost all of their foraging within 50 meters of the nest, meaning they need wild, pesticide-free land in your community to survive.

Plant native flowering plants in your yard to help pollinators.

CS: Bumble Bee Watch



Interesting fact to know more.



Simple activity to do more.

CS:

Citizen Science project you can join.



Learn more at NEEFusa.org

Sources: Pollinator Partnership; Audubon; U.S. Environmental Protection Agency Office of Wetlands, Oceans, and Watersheds; Live Science; Science Kids.