NATIVE SCHOOLYARDS TOOLKIT

# Prairie Habitat

NEEF

# Contents




## Acknowledgments

The Native Schoolyards Toolkit was created with support from Arconic Foundation.

# Introduction

**School campuses are versatile spaces, and may include features like parking lots, athletic fields, gardens, and expanses of grass that need regular upkeep. These campuses, whether in urban or rural areas, offer opportunities for place-based student learning, particularly in the realm of environmental education.**

While students often go on field trips to experience the real world, some communities have nearby resources like parks, museums, and businesses that can support this learning. However, organizing these off-campus trips can be both rewarding and challenging.

NEEF's Greening STEM initiative was launched to transform students' understanding of the environment by integrating it into STEM learning in practical contexts. NEEF collaborates with public land agencies and provides grants to help educators take students to where environmental action is happening. Despite financial support and partnerships, arranging off-campus trips can still pose logistical difficulties and disruptions.

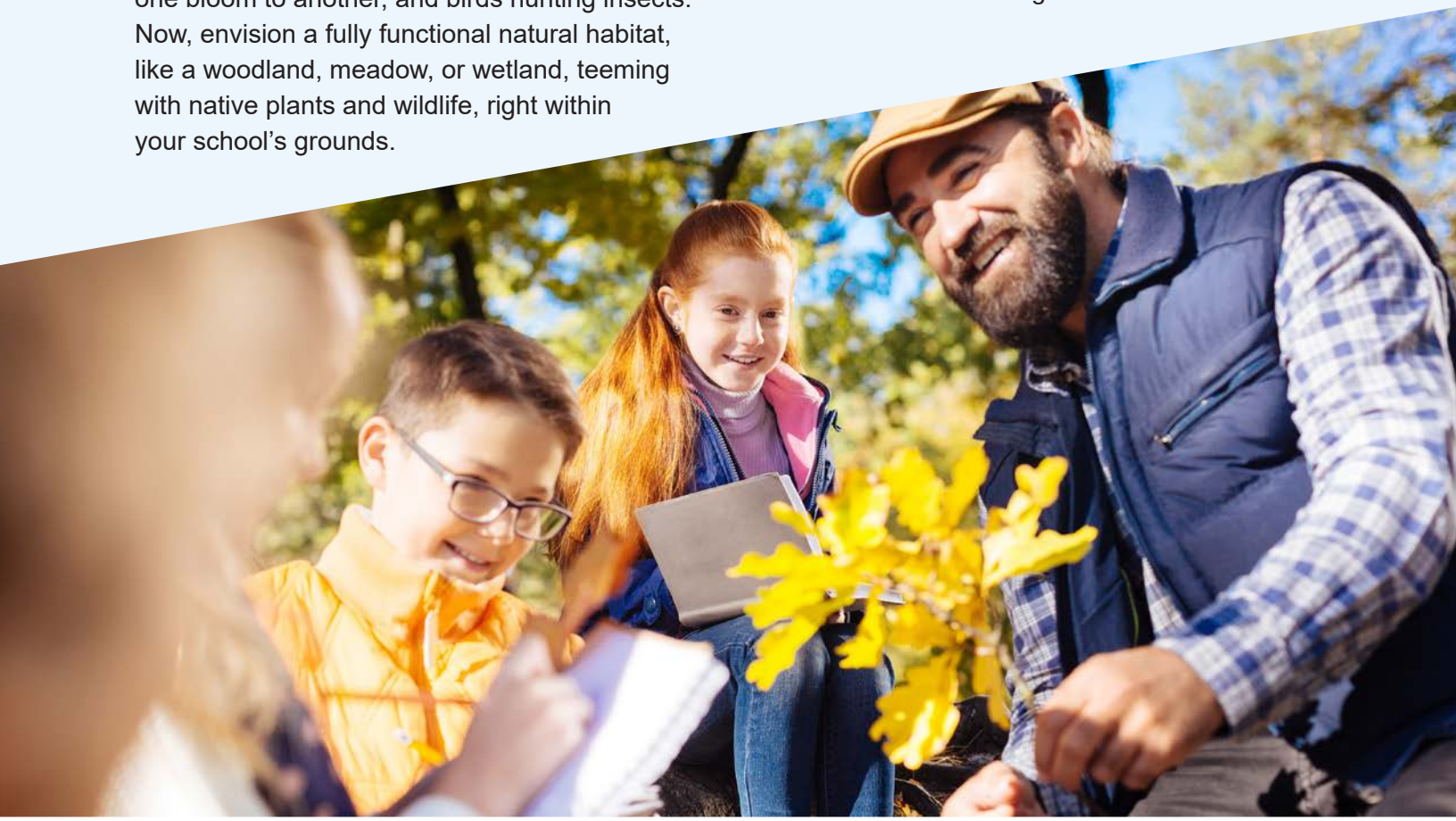
Field trips, despite offering valuable experiential learning, typically remain one-time events and may not provide the depth, richness, and continuity recommended by A Framework for Science Education and the Next Generation Science Standards. To fully maximize the benefits of place-based experiential learning, it is essential to engage students in multiple experiences over time. This approach lies at the heart of the Greening STEM model, which seeks to immerse students in ecosystems and ongoing hands-on activities, fostering exploration and interaction with the environment.

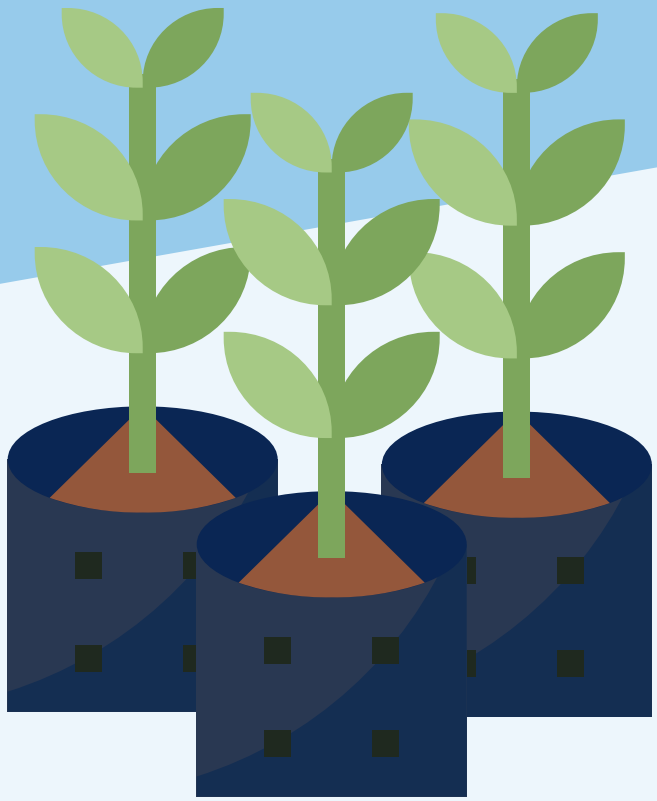
# Possible Solutions

**Imagine an outdoor learning space where teachers bring students regularly to study the cyclic and seasonal natural phenomena in relation to climate, plant, and animal life.**

Picture a campus location where students can witness the wonders of nature unfold: plants putting out buds, flowers becoming seed pods, seeds being dispersed by the wind, rain channeling into bioswales or rain barrels to irrigate an edible garden, pollinators darting from one bloom to another, and birds hunting insects. Now, envision a fully functional natural habitat, like a woodland, meadow, or wetland, teeming with native plants and wildlife, right within your school's grounds.

The transformation of school grounds, shifting from hard or barren surfaces to thriving natural habitats, can take various forms, ranging from container-based pollinator gardens to the creation of schoolyard forests. Even with limited space, it's possible to establish multiple natural habitats through thoughtful planning, collaboration, and securing funding. Whether envisioned as a green schoolyard, community garden project, or an outdoor classroom, embarking on such an endeavor brings forth a multitude of benefits. Supporting the Greening STEM approach to teaching environmental literacy is just one of these invaluable advantages.





# Getting Started

**To thoroughly explore and plan for creating a natural schoolyard habitat, it's most effective to work together as a team.**

Who needs to be on the team? That depends on local circumstances. In most cases there will need to be teachers, technical experts, and groundskeepers. The teachers can identify connections to curriculum and brainstorm learning objectives to guide the design process. Technical experts will contribute to the project's success by bringing specialized knowledge about the needs of native flora and fauna to ensure the selection of plants is appropriate for local conditions. And other factors of success like proper preparation of the land, well-timed planting, and short-term care and long-term maintenance plans will benefit from the input of a master gardener, wildlife biologist, or qualified landscaper. Once the nascent habitat is installed and as it becomes well established groundskeepers will need to oversee and provide much of the year-round care—which is often minimal for native plants—to ensure the habitat thrives.

When looking for team members beyond the faculty a good place to start could be a local nursery, especially one that sells a wide variety of native plant species. Native plant societies (aka wildflower or botanical societies) are another. The American Horticulture Society website provides information on resources and links to native plant societies across the United States. State and federal land management agencies can be another great resource for technical assistance.

With all the adults needed to successfully implement a native schoolyard project there is one overarching priority to remember: Focus on the students. As is the case in a well-designed project-based learning experience (a component of the Greening STEM model), the entire process of research, design, and installation provides myriad opportunities for student involvement with and ownership of a native schoolyard habitat project.

# Experiencing Real World Phenomena

***A Framework for K-12 Science Education* and *NGSS* offers research-backed instructional methods and student performance expectations for skill and knowledge acquisition via coherent storylines, guiding questions, and direct investigations.**

A well-designed native schoolyard habitat should motivate learners to engage in exploration of core disciplinary ideas, science and engineering practices, and crosscutting ideas—the three dimensions of the NGSS. How? By utilizing anchoring phenomena and authentic driving questions that make the topics of study accessible, relevant, and connected to learners' daily lives. An illustrative driving question from the Bettendorf Middle School Greening STEM project in Iowa (refer to the Case Study) was as follows: "What caused the loss of over 95% of native prairie habitat, and what were the underlying reasons?" This broad question encourages the integration of various non-science disciplines, such as history, and concepts like environmental justice, to foster a comprehensive conceptual understanding.

Driving questions like this can also come from students themselves. Teachers might interest students with an intriguing artifact or experience, such as a news article, field trip, or demonstration of a unique phenomenon, and have them generate questions based on their own curiosities. While brainstorming questions with students can reveal their interests, it can also surface potential misinformation and lack of deep understanding.
An intentional effort to guide student inquiry can support greater equity among learners with different backgrounds and experiences without losing focus on the project's stated learning objectives and performance expectations.

# Establishing Learning Objectives and Performance Expectations

## To move beyond memorizing facts or doing basic demonstrations, it's essential to have a clear idea of what you want students to learn from their educational experiences in advance.

The NGSS, which is grounded in research on how we learn, should serve as the cornerstone for defining the specific learning objectives and performance expectations in a Greening STEM project. Again, the focus needs to be on the students and the competencies they are to develop by engaging in a native schoolyard habitat project. With the Greening STEM model's focus on learning by doing, it is imperative that students are challenged to adopt real-world roles and do real-world work.

The initial set of learning objectives and performance expectations will be different for the design and installation of native habitat versus the ongoing study of that habitat and ecosystem. A progression of objectives and expectations should evolve as a project matures. An inclusive approach to identifying robust objectives and performance indicators that invites all of the STEM disciplines (and beyond) to be represented will help ensure that a project is comprehensive and coherent.

# Creating NGSS aligned Performance Tasks

**Upon selecting a compelling real-world phenomenon that captures students' interest and serves as a guiding force for their inquiry, you can begin developing performance indicators and assessment tasks.**

Traditionally learning assessments either attempted to measure students' ability to complete a prescribed procedure in order to find an already known outcome or recall on a quiz or test already known commonly accepted facts that comprise a specific body of knowledge. An NGSS aligned approach to instruction and measurement of learning builds on these two types of assessment.

Asking students to complete a prescribed lab procedure (with appropriate safety protocols embedded) may be hands-on but often lacks a robust minds-on component that seeks to develop a deeper conceptual understanding of the topic being studied. To achieve this expansion beyond wrote learning the NGSS focuses on the science and engineering practices (SEP) that are central to the work scientists and engineers actually do. Therefore, NEEF's Greening STEM model is anchored in students learning by doing.

Thus, assessing learner competency with SEPs will be key to ensuring learning objectives are achieved.

Asking students to reflect upon and write an explanation of the outcomes they experience—using disciplinary core ideas (DCIs) and crosscutting concepts (CCCs)—can assess depth of conceptual understanding and reveal any areas of misunderstanding. Combining these two assessment techniques (e.g., a narrative analyzing and interpreting data that is accompanied by a graph) can be the basis for enlarging upon and connecting other SEPs (e.g., developing data collection protocols, carrying out investigations) and their respective subskills. The progression of SEPs can be found in Appendix F of the NGSS and ideas for subskills in the NGSS Evidence Statements.

**Remember that assessment tasks can be embedded in the beginning (i.e., diagnostic), middle (i.e., formative assessment) and/or end (i.e., summative assessment) of a series of learning activities.**

# Prioritizing Learning Outcomes

**To ensure student activity is focused enough to achieve a Greening STEM project's stated learning goals and objectives, will likely require selecting a few learning targets or outcomes to build guided inquiry around while still giving students agency to decide what additional questions to investigate.**

Whether the primary learning outcome is a specific SEP, DCI, CCC or some combination of these (needed to achieve three-dimensionality!), creation of a rubric will help ensure that the purpose for including or even highlighting specific activities is capable of framing what's most important for students to pursue and achieve and creating an authentic context or scenario with a coherent storyline.

With the prioritized learning goals and objectives in mind, the project design team can use the context for the performance indicator or assessment task to develop a narrative storyline and a series of questions to guide the students' inquiries. The series of questions will need to guide the learning in the direction of the desired outcome, building off the vision of proficiency contained in the assessment rubric.

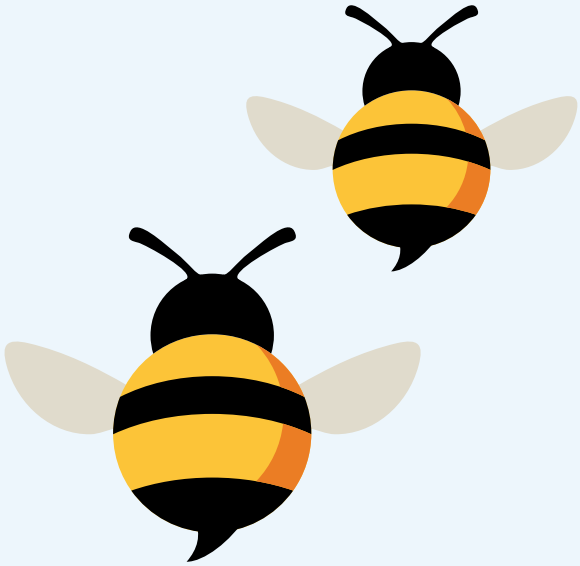
For example, consider a primary learning objective of understanding the role of land use changes and the catalysts for such changes in the loss of native prairie habitat and its impacts on native flora and fauna (i.e., loss of biodiversity). Several starting points for inquiry can be identified in a brainstorming session. Possible suggestions might include ecosystem level changes in wildlife composition (MS-ESS3-4 Earth & Human Activity), and distribution over time (MS-LS2-4 Ecosystems: Interactions, Energy & Dynamics), changes in climate, etc. followed by a series of guided questions that seek to uncover and explain the observed changes (CCC=cause and effect). Asking students to develop a habitat restoration plan (SEP=building a model) that can be tested in the real world (SEP=conducting an investigation). Allowing students some agency as to where they begin their search for answers and selecting which starting point they want to group around would allow for ownership of the learning process.

**What might an anchoring phenomenon and accompanying storyline look like?**

# Building Out a Scenario

**The Greening STEM project design team can use the context for the performance indicator(s) or assessment task(s) to craft a narrative and a series of questions to guide the learning activities.**

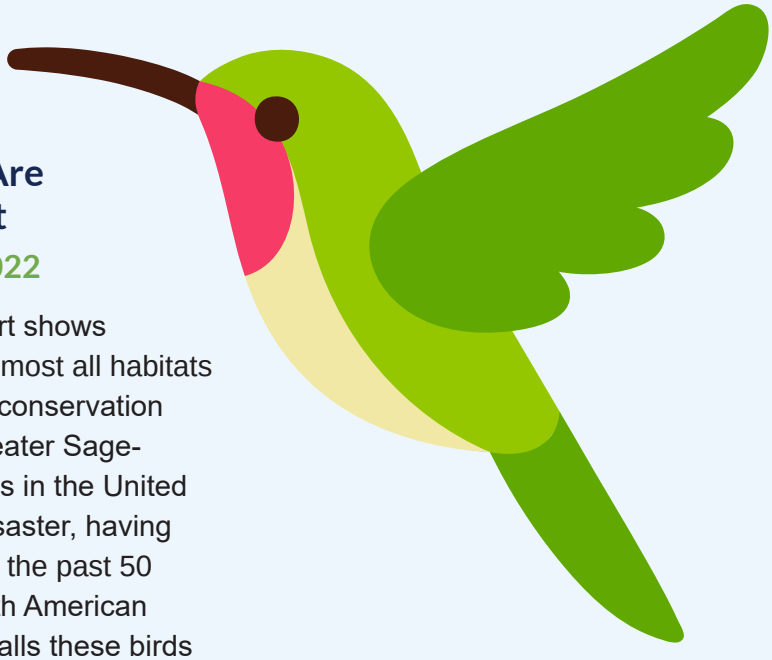
Keep in mind the flow and which part of the narrative—beginning, middle, or end—learners are exploring with the specific task or activity. Appropriate pre- and post-field activities need to fit into the overall narrative to ensure coherence throughout the project. Consider how the following news reports can be woven together into a coherent unit of study of biodiversity, ecosystems, and impacts of human activities.



## Honeybees are not in peril. These bees are.

*Vox.com* | Jan 19, 2023

The bees that many people are familiar with are honeybees, Apis mellifera, a nonnative species that Americans brought over from Europe centuries ago. Beekeepers manage them like any other farm animal, to produce honey and pollinate crops. But all of that attention on honeybees has, some ecologists argue, overshadowed their native counterparts: the wild bees. They're an incredible bunch, found in all sorts of colors and sizes, and they're important pollinators, too — better, by some measures, than honeybees. On the whole, native bees are also at a much greater risk of extinction, in part, because of the proliferation of European honeybees.



## More Than Half of U.S. Birds Are in Decline, Warns New Report

*Audubon Magazine* | October 12, 2022

The 2022 U.S. State of the Birds report shows plummeting bird populations across almost all habitats while highlighting the need for further conservation efforts. The Rufous Hummingbird, Greater Sage-Grouse, Pinyon Jay, and 67 other birds in the United States are teetering on the edge of disaster, having lost at least half of their populations in the past 50 years. A report released today by North American Bird Conservation Initiative (NABCI) calls these birds "Tipping Point" species, on track to lose another 50 percent of their populations in the same time frame if conservation efforts do not improve.

## North America's grasslands are slowly disappearing—and no one's paying attention

*Washington Post* | November 29, 2016

The Great Plains lost more grassland in 2014 than the Brazilian Amazon lost forest, says a recent report from the World Wildlife Fund. The report expresses concern about the impact on natural habitat for pollinators and grassland bird species.

In fact, a recent study indicated that corn and soybean cropland has been increasing in some areas of the Great Plains where beekeepers house their honeybee colonies — a potential problem for the keepers, who generally prefer to avoid those types of crops when selecting suitable locations for their apiaries. But it's unclear whether the expansion of cropland has actually had an impact on the pollination services provided by bees in the area.

# Scenario example

The scenario might read something like this…

**Scientific researchers have been documenting changes, called biodiversity loss, in the numbers and locations of various historically important plant and animal species. While some species are doing fine, with stable or growing populations, other species are in decline, some perhaps facing extinction in the near future. What's causing these changes and why should people care?**

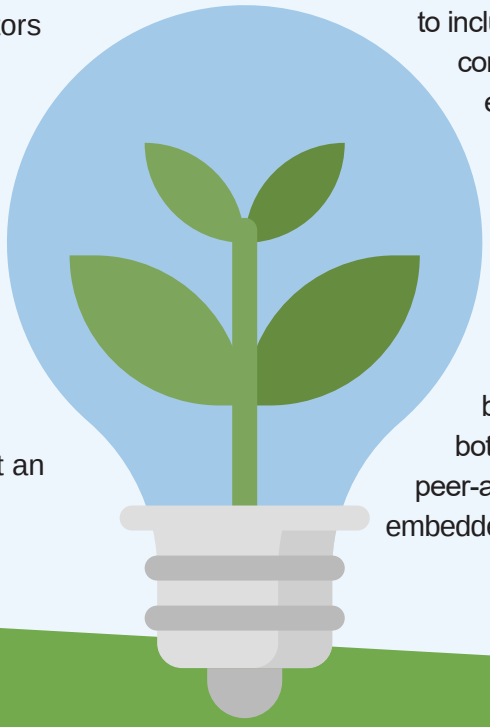
To make this phenomenon relevant one can focus on local examples, especially ones that have strong cultural or economic connections. State departments of natural resources often publish lists of endangered and threatened plants and animals and the environmental pressures responsible for their status.

Understanding the rate of grassland habitat loss and its underlying reasons are a great learning outcome for a native prairie schoolyard habitat project that can lead students to a comprehensive understanding of how connections between changing components of an ecosystem can explain changes occurring to what otherwise might appear as separate unrelated phenomenon.

# Expectations of Proficiency

**Proficiency related to each performance indicator may be vague at first but can be clarified with each iteration of the project.**

If one of the performance indicators is to effectively analyze changes in data sets (e.g., land use conversion, prevalence of native prairie habitat, species abundance and distribution), then developing an ability to recognize patterns in and between data sets can lead to making inferences about future changes. An evaluation of the evidence can be used to support an argument predicting specific future changes.



Another indicator could be related to making connections between changes in ecosystem services and the impacts on flora and fauna. Proficiency could start with the ability to name key services (e.g., water filtration, nutrient recycling, prevention of soil erosion, etc.), then expand to include identifying and mitigating constraints (e.g., scientific, economic, and cultural) associated with possible solutions.

Consideration needs to be given to the difference between individual proficiency versus group work. Important feedback to guide learning activities can be obtained by observation of both. In some instances, self- or peer-assessment of proficiency can be embedded in one or more tasks.

# The Role of Reflection

**Feedback throughout an activity and after its completion has value.**

Some learners need more time and the thoughts of others to help make connections that demonstrate a deep accurate understanding has been achieved. Requiring learners to engage in reflection is a common strategy for assessing progress. Activity facilitators benefit from in-depth reflection on the effectiveness of a performance indicator and its associated assumptions. The key question being, what evidence did the learners demonstrate in relation to the DCIs, SEPs, and CCCs? Careful crafting of reflection prompts should reveal whether or not the desired learning outcomes were achieved.

In addition, beyond the NGSS-aligned content and STEM skills, did learners demonstrate the 4 C's of a 21st century skill set: critical thinking, communication, collaboration, and creativity?

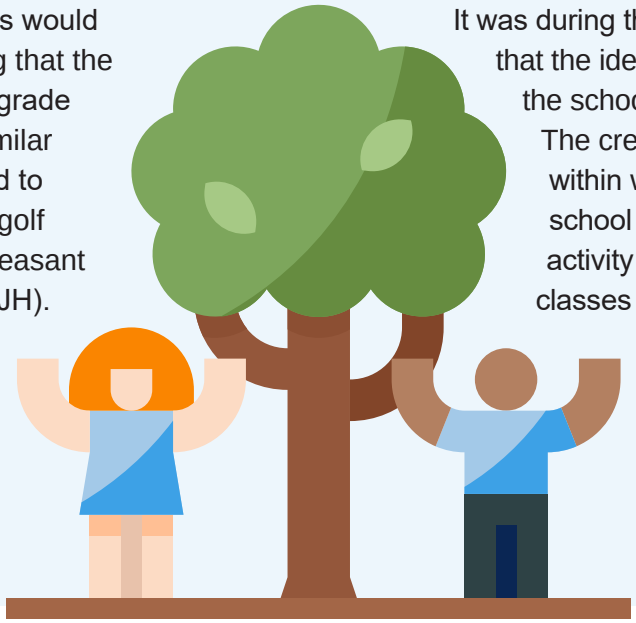
# Case Example

## Outdoor Classroom Project

Pleasant Valley Junior High School, Le Claire, Iowa

### The Problem

Pleasant Valley Community School District was contacted by a neighboring district about participating in a jointly administered National Environmental Education Foundation Grant in September of 2022. During that meeting, the Bettendorf Community School District described a golf course water quality project that their 8th grade students would participate in. Believing that the grant required our 8th grade students to conduct similar activities, we attempted to mirror this project at a golf course located near Pleasant Valley Junior High (PVJH). It quickly became apparent that distance and travel time were going to become participation barriers.



### The Solution

PVJH is located on 58 acres in rural Scott County, Iowa and surrounded by agricultural lands, farms growing corn and soybean mostly. With the nearest golf course five miles away and class periods 45 minutes in length, the logistics of transporting students to and from the site did not allow enough time for meaningful activities. It was during this time of figuring things out that the idea of restoring native habitat on the school grounds began to emerge. The creation of an outdoor classroom within walking distance of the school that would maximize outdoor activity time without disrupting the classes during the day and mitigate transportation barriers became an ideal solution.

## Key Partners

With minimal habitat restoration experience internally, the district contacted the US Fish and Wildlife Service for help in developing two acres of short grass prairie, tall grass prairie, native trees, a pollinator tract and native shrubs for birds and small animals. In addition, a water testing station was discussed to measure the nitrate levels coming from the surrounding farm fields.  PVJH science teachers, school and district administrators, and US Fish & Wildlife advisors laid out defined areas for each habitat. As the design began to emerge, it was decided to involve private business expertise for purchasing the native trees, shrubs, and prairie/pollinator grasses.

A local expert in developing native habitat, Cyndi Diercks, owner of Lawns Unlimited of Iowa, became an invaluable resource to the project. Using her business supply chain she ordered the seed, shrubs, and trees. Following her directions, the different plots were sterilized with a double application of herbicide followed by a controlled burn. Her company borrowed a specially designed agricultural “seed drill” then used it for planting the prairie/pollinator seed mix to exactly the right soil depth. In addition, students planted 34 native shrubs and trees on October 22, 2022. Over the winter months nature did its thing so the seeds would germinate in the spring. Many prairie plants require cold stratification to germinate successfully.

In May, students conducted a nature walk around the grounds and observed all of the fall trees and shrubs blooming and pollinator seeds beginning to emerge. While it will take 3-5 years to fully establish the prairie grasses, students in Grades 7-8 will be able to conduct environmental monitoring activities including wildlife observations, water testing experiments, and plant growth measurements. Future classes will collect and analyze data comparing the previous year’s student generated data allowing future students to measure the successes and challenges of this native habitat restoration project.

## Project Goals

Goals included:

1.) creating a native habitat within walking distance of the school,
2.) maximizing student activity time, and
3.) mitigating loss of instructional time for other discipline areas.

Groups of 24-48 students would need to be able to walk to and from the plot areas (outdoor classroom) within 8 minutes and be able to get started learning immediately. The challenge of how to keep 24-48 students engaged was resolved by dividing them into three groups then rotating between learning stations prepared ahead of time.

## Project Impacts

The Greening STEM program was a catalyst for the creation of an outdoor classroom that supports project-based learning. Being located on school grounds, students and teachers are able to maximize instructional time and minimize loss due to traveling. The outdoor classroom has also acted as a catalyst for supporting the high school AP Environmental Science course and establishing connections with Eastern Iowa Community College's Environmental Studies program.

## Partner Impacts

Local business owner, Cyndi Diercks, of Lawns Unlimited of Iowa and Scott James, Private Lands Biologist at US Fish & Wildlife Service, met with PVJH science teachers, administrators, and students to explain the entire development process including the actual planting. School district central office personnel met with Environmental Studies Community College instructors to discuss further post-secondary PVJH Science teacher training opportunities. Plans are also under consideration to work with the Augustana College Environmental Studies program.

## Educator Impacts

The outdoor classroom and native habitat restoration project provided some unique opportunities for teachers to gain capacity and confidence as environmental educators. PVJH science teachers have begun developing project-based learning activities pertaining to environmental studies. Future collaborations with other schools and educators will continue to offer new professional development opportunities.

## Student Impacts

Although student participation was minimal during the planning and field bed preparation stages of the project, their labor was instrumental during the native shrub and tree planting stage of the installation. Some students expressed a sense of pride and partial ownership of what was accomplished. Adoption of supplemental curriculum that supports the NGSS Life Science performance expectations will permit more hands-on study in this unique environment as students explore related careers.

Due to a lack of rain, all six of the native Oak and Bitternut Hickory trees were lost. Students will have an opportunity to replant these trees and other species that didn't take the first year.

Additionally, informational signage will be installed explaining the importance of the short prairie, tall prairie, pollinator, and savanna plots. This signage will be created by the students and submitted to the sign company for creation.

# Starting a Native Habitat Schoolyard Project at Your School

Hopefully the overview of the Pleasant Valley Junior High School project has inspired you to consider pursuing a native habitat or outdoor classroom project. NEEF seeks to support educators interested in making the environment accessible, relatable, relevant, and connected to the daily lives of all Americans. We do this in part through our annual Greening STEM grantmaking program. Currently the grants require partnering with a public lands management agency (e.g., National Park Service, USDA Forest Service, or Bureau of Land Management) or that applicants serve communities where corporate funders have operations. In the future NEEF hopes to offer grants from a pooled fund.

NEEF also makes a number of Greening STEM and other environmental education resources available at NEEFusa.org (see some examples listed in the Resource section that follows). One of the resources are free consultations with NEEF K-12 staff to discuss Greening STEM project design and implementation challenges and solutions. To request a consultation, use the Greening STEM contact form.

## Greening STEM Resources

**Greening STEM StoryMap**
To learn more about NEEF's Greening STEM projects throughout the country.

**Greening STEM Video Collection**
To learn more about past projects and how the Greening STEM model has been applied in different communities.

- Projects with National Park Service throughout the US
- Watershed studies in Teaneck, New Jersey
- Biological Control of Invasive Species in Grand Junction, Colorado

## Native Schoolyard Resources

**Outdoor Classroom/Learning**
https://www.greenschoolyards.org/library

**Schoolyard Forests**
- https://www.greenschoolyards.org/forest-resource-library
- Miyawaki Forest Program—Biodiversity for a Livable Climate (bio4climate.org)
- Shubhendu Sharma: An engineer's vision for tiny forests, everywhere (TED Talk)

**Living Schoolyards Act**
https://www.greenschoolyards.org/living-schoolyards-act

## General Resources

### Asphalt to Ecosystems: Design Ideas for Schoolyard Transformation

By Sharon Gamson Danks, New Village Press, 2010.

A comprehensive, award-winning book on transforming ordinary asphalt and grass schoolyards into vibrant ecosystems that promote hands-on learning, creative play and neighborhood ecology. Filled with lively, colorful pictures, this book is a great way to persuade your school or district to start greening their grounds—or to add depth and breadth to a schoolyard project that is already started.

### Schoolyard Habitat Project Guide (Spanish version)

Published by US Fish & Wildlife Service, a planning guide for creating schoolyard habitat and outdoor classroom projects.

### Schoolyard Habitats™ Planning Guide

Published by National Wildlife Federation, this guide will help you plan, build, and maintain your National Wildlife Federation Schoolyard Habitats® garden, leading you through a clear, step-by-step process.

# Resources by State

## Illinois

### CICADA: Conservation Inclusive Construction and Development Archive

Illinois Department of Natural Resources, Find information on how you can incorporate wildlife habitat into your property or development projects or how to better manage the habitats you have already. Staff at IDNR, along with our partners, will provide regular updates to CICADA, and we are happy to answer questions you may have about building or managing wildlife habitats.

### Green Infrastructure Grant Opportunities

Illinois Environmental Protection Agency, “The new Green Infrastructure Grant Opportunities (GIGO) Program funds projects to construct green infrastructure best management practices (BMPs) that prevent, eliminate, or reduce water quality impairments by decreasing stormwater runoff into Illinois’ rivers, streams, and lakes. …Green Infrastructure Grant Opportunities utilizes funds distributed by the State of Illinois generated under the Build Illinois Bond Fund. Illinois EPA expects to award a total of $5,000,000 annually beginning FY2021–FY2025 and anticipates distributing this amount across two (2) to ten (10) awards per year. GIGO has a set maximum total grant award of $2,500,000 with a minimum grant award of $75,000. No more than 50 percent of the program total, per funding cycle, shall be allocated to any one applicant or project.” (reference) Based on a previous, similar grant program (below) it appears that school districts and their partners are likely to be eligible to apply for these funds.

## Iowa

### Prairies and Native Plantings as Outdoor Classrooms—Sustainable Urban Landscapes

Published by Iowa State University Extension and Outreach, this publication outlines a process and the resources needed to help establish prairie to be used as an outdoor classroom for elementary through high school aged students.

# Resources by State (continued)

## Maryland

**Maryland Urban and Community Forestry Committee Grants Program**

Maryland Department of Natural Resources, grant proposals due February and July 15th each year

This program awards small grants of up to $1,000 per project to help community groups pay for tree planting and education-related projects across the state that enhance Maryland's urban forest. Plantings may be located on school grounds or other public lands.

## New York

**School Seedling Program**

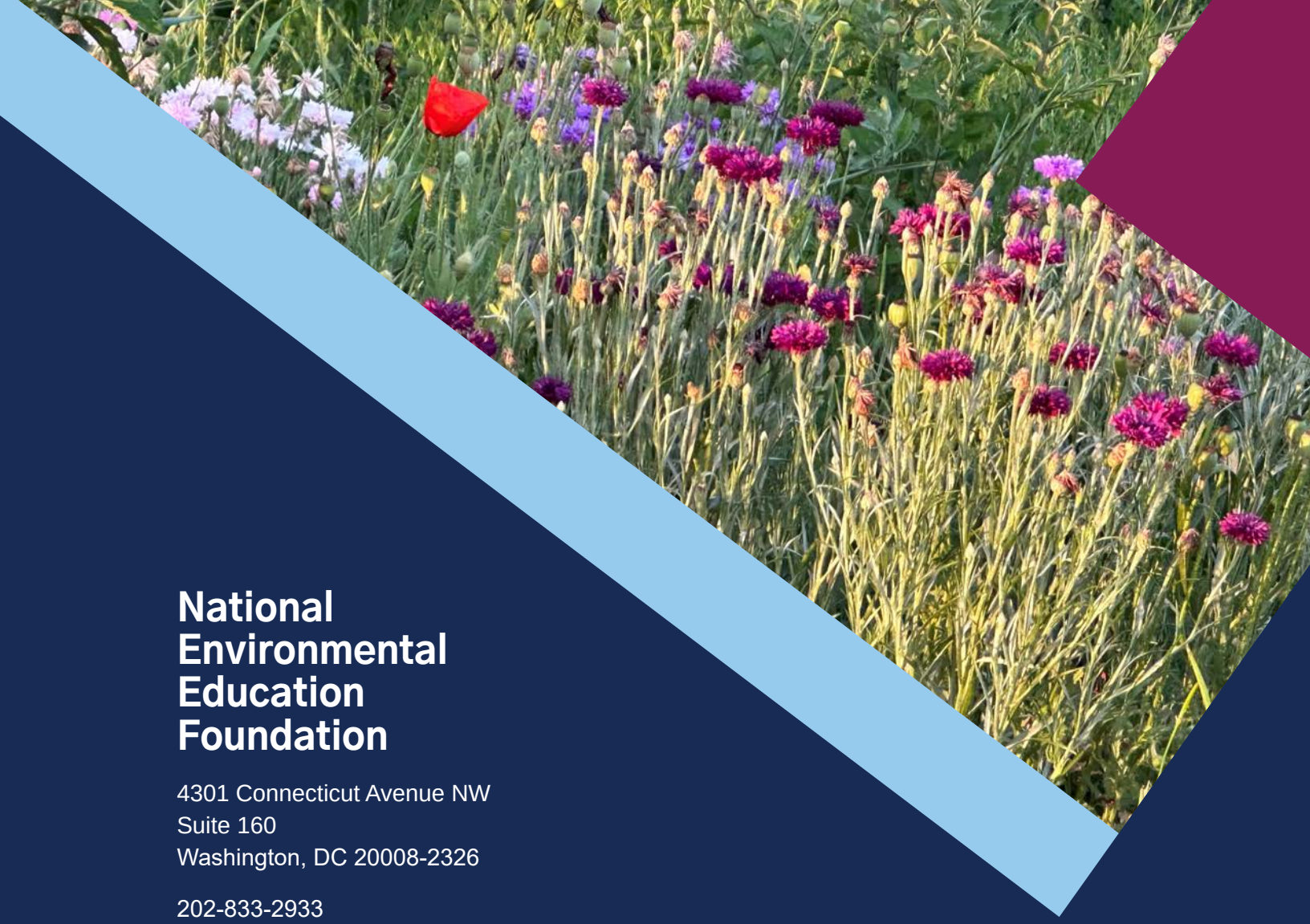
New York State Department of Environmental Conservation, open through March 31

This program offers New York schools two types of young, native tree seedlings and a variety of shrubs that attract wildlife for free. The program is intended to "help young people learn about ecosystems and the valuable role trees play." Schools are encouraged to plant the seedlings they receive on their grounds with their students, and to connect the planning and stewardship process for these plants with standards-based lessons related to Next Generation Science Standards.

## Wisconsin

**Restoration Education Guide**

Published by Earth Partnership at the University of Wisconsin-Madison, this guide contains more than 100 lessons keyed to Common Core Standards and Next Generation Science Standards. Ten chapters outline their 10-step process for building rain gardens and restoring native habitats.




**National Environmental Education Foundation**

4301 Connecticut Avenue NW
Suite 160
Washington, DC 20008-2326

202-833-2933

NEEFusa.org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