

# Plotting Plants

*Tracking Invasive Species in  
the Local Community*

**by Megan Menker**

Every school day, your students pass through the same neighborhoods, travel on the same roads, and see the same sights on their way to and from class. While the scenery may become routine and dull to them, the battlefields they are traveling through are anything but. Each day, their eyes pass over ruthless territorial feuds, scores of fallen green soldiers, and legions of invaders hidden in plain sight. They are completely unaware of the happenings in these war zones. They do not recognize the uniforms of the different armies. They only see plants.

If you were to ask your students to identify the invading plants, chances are they would not be able to tell which organisms are invasive species. Chances are greater still that most of your students would not even be able to identify the native species that are being attacked. This tendency to overlook the plants in one's own environment, known as "plant blindness," is an unfortunate and common deficit in our students and in the general population (Wandersee and Schussler 1999). Plants—whether native, non-native, or invasive—have typically received little attention in national

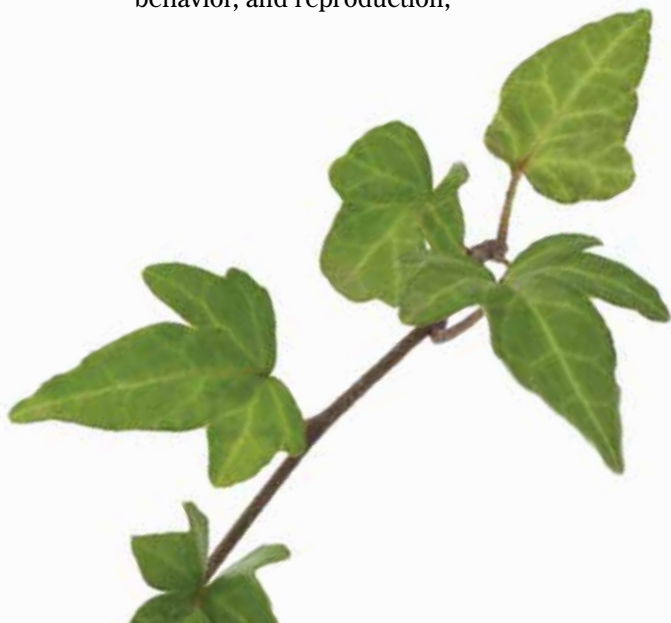
science-content standards. As a result, most middle school students develop only a basic understanding of botany and plant ecology.

Invasive plant species can have catastrophic effects on almost every type of ecosystem, resulting in biodiversity loss and monetary costs to human industry (Messing and Wright 2006). It is estimated that one in eight plant species is under threat of extinction, in part due to invasive plant species and human activity (Allen 2003). Despite the negative impact of invasive plants, most middle school students do not receive direct or formal instruction on this issue, and local governments do not have the resources to adequately address it (Mason et al. 2010). If “plant blindness” continues in our classrooms, then plant research and conservation will likely continue to garner little consideration and support (Allen 2003). As our need for plant-based resources and technology continues to grow with our population, so does the importance of plant and invasive plant–species education in science curricula.

In the 5E–learning-cycle unit described here, middle school students investigate local invasive plant species to reinforce various life-science topics. (Find a list of materials, student worksheets, and rubrics for this unit online at [www.nsta.org/middleschool/connections.aspx](http://www.nsta.org/middleschool/connections.aspx).) Studies and discussions of invasive plants can be used to reinforce the *Next Generation Science Standards* (NGSS) concepts in life science, such as chemical processes and everyday life, plant structures and reproduction, and growth and development of organisms, as well as provide an opportunity for students and their families to connect with local resources in their community.

Prior to this unit, students should have learned that:

- plants get the materials they need for growing chiefly from air and water;
- plants have internal and external structures that serve various functions in growth, survival, behavior, and reproduction;



- organisms depend on their environments for survival and can only survive in environments in which their particular needs are met;
- healthy ecosystems contain multiple species of different types, and newly introduced species can damage the balance of an ecosystem; and
- human activities in agriculture and horticulture can have major effects on ecosystems as well.

### Engage (days 1–2; 50-minute classes)

To begin this two-week unit, establish student understanding of the ways in which scientists classify and organize living things. A system of scientific names, known as *binomial nomenclature*, is used to distinguish species from one another. This phase of the unit prepares students for research in future grades by introducing the concepts of species names and organism classification.

To begin the study of species names, students should first discuss how they think we can differentiate one organism from another and why we should undertake such a task. Prompt the discussion by presenting images of two separate but similar organisms such as a two-toed and a three-toed sloth. Ask students to differentiate between the organisms shown and explain how they are able to classify the organisms. This will most likely lead to a discussion about physical appearance, but encourage students to extend their thinking to behaviors, diets, locations, sounds, and other characteristics.

Next, use print or online materials to inform students about taxonomy and classification systems (see Resources). These sources can be used in multiple ways. Students can conduct a web quest using these materials and then summarize their findings, or the teacher can guide them through the sources in small groups or as a class. Students can also use these materials to take notes, create research reports on specific organisms, or write their own articles and book chapters. Many online sources and websites also feature informative, short videos on this topic that students can use in their research (see Classification Activities in Resources).

To emphasize the impact a single species can have on an ecosystem, students should understand the hierarchy of the *taxon*, or a group of organisms that have been classified together, with domain being the most general and species being the most specific. This knowledge will be useful in later grades as students conduct more complex analyses of organisms.

To further study classification and its purpose, students should research a specific species of organism and explore its interactions with living and nonliving things; food, water, oxygen, and other resource re-

quirements; and adaptations and traits that support successful survival and reproduction. These research reports may be shared with the class or submitted to the teacher. Teachers should encourage students to explain the role that a particular species plays in its ecosystem and how that ecosystem would be affected if that species did not exist. Teachers may ask students questions such as: “What other species does your organism depend on to survive?”; “How would the ecosystem change if your organism was removed?”; “What other species might benefit or suffer without your organism?”; and “How have humans affected your species’s population?” Such questions encourage students to gather, read, and synthesize information from multiple sources in order to determine cause and effect, patterns, and changes.

### Explain (days 3–4; 50-minute classes)

Once students understand that classification is used as a way to organize and group organisms, explain that similar species within the same ecosystems have similar requirements for food, water, oxygen, or other resources and may compete with each other. The focus of the unit can then be shifted to studying the differences between native and invasive plants within a specific ecosystem, such as your local environment.

Start a discussion with students about the meanings of the words *native* and *invasive*. Ask students, “What are some common plants found around our community?” Allow students to work in groups of three or four to compile a list of plants they are familiar with and then share those lists with the class. Once groups have shared those lists, have them categorize the plants they listed by their use. Ask students, “Which plants are used for agriculture?”; “Which plants are used for landscaping?”; and “Which are used for medicines?” Then ask your students if they know which species are *native* and which are *invasive*. If students are unfamiliar with the words, ask them to guess their meanings. Students may make connections to familiar uses of the word *native*, such as “Native American” or “native English speakers.” Once that connection has been made, explain that *native* refers to being associated with or belonging to a specific place. For this reason, *native* plants are ones that naturally belong to an area. Turn next to *invasive* by asking students what they think that word means or to define the word *invader*. Students may make connections to instances in which they have heard the latter: Space Invaders, Invader Zim, etc. From this connection, explain that some plants are *invasive* and can come from other locations to take over a new location, displacing the *native* plants that lived there first.



Because our middle school is located in Ohio, we used an article from the Ohio Department of Natural Resources to begin learning more about these vocabulary words, but this activity can easily be adapted to any state; you can search your state’s Department of Natural Resources site for appropriate articles about native and invasive plant species. Have your students read the headings and subheadings of the article and then predict what the article is about. This can lead to a discussion about plants (local or non-native), gardening, and horticulture. Once you have finished reading the article, have students define the words *native* and *invasive* again, using what they have just learned. Explain that these words can also be used to categorize organisms, but are dependent on local ecosystems: A plant that is considered invasive in one ecosystem might be native in another, so the terms *invasive* and *native* are relative and based on the ecosystem being discussed. Give students an example that applies to your local environment. For example, most invasive plants in the United States were originally from Europe. This can lead to a discussion about why humans might have transported plants to new locations or why some plants might do better in some ecosystems than in others. Connections to social science can also be made as to why people would have immigrated in the first place. You can ask students, “Why do people immigrate from one part of the world to another? What are some push and pull factors that would affect their choices? Why would people go through the trouble of moving a plant from one continent to another? Why might an invasive plant do better here in the United States than a native plant?”

Assess understanding of the invasive plants article and access prior knowledge by asking students to give examples of or ideas about the reasons why invasive plants can be a threat to native plants. The discussion may turn to the possibility of invasive plants dominating resources to the exclusion of native plants or altering natural selection, which could affect local community members and ecosystems. Have students hypothesize ways in which people can manage invasive plants.

### Explore (out-of-class activity)

As a technology extension for the unit, encourage students to engage in their local community through the use of an EarthCache, an outdoor scavenger hunt that uses a GPS device to lead students to an educational objective. Teachers who do not have GPS devices in the classroom can arrange for students to use their own GPS-capable cell phones. Local libraries and state parks may also have devices you can borrow. I used the website *GeoCaching.com* to set up the EarthCache. It is completely free to join *GeoCaching.com* and create caches, and you can post links and instructions for your EarthCache on a school or classroom website. *GeoCaching.com* provides thorough instructions and tutorials to help novices get started.

For my unit, I created an EarthCache in collaboration with a local state park preserve manager as an out-of-class extension activity to teach families about invasive plants in local ecosystems. You can create a geocache or EarthCache in a local state park, nature preserve, or other natural area to direct students to view native or invasive species or observe ecological management techniques. You can collaborate with a local guide, naturalist, or park ranger to help prepare the EarthCache in advance, and this person may serve as an additional, valuable community resource for your classroom. This is a crucial part of the extension because community and family involvement has been shown to reinforce student learning (Collins, Kenway, and McLeod 2000; Rainey and Murova 2004).

In addition to giving students the experience of identifying invasive plants species, this activity also offers an opportunity to incorporate technology into the learning process through the use of the internet and GPS-navigation devices. With the prevalence of GPS-capable devices in modern life, presenting an EarthCache to your students is an easy and engaging way to extend any life- or Earth-science lesson. Have students who participate in this EarthCache share their experiences by bringing in pictures of their EarthCache journey or recording coordinates of additional sites to be added to the EarthCache.

If possible in your schedule, this activity could serve as an optional, out-of-class field trip. You could orga-

nize a specific date and time to meet with students and their families in order to participate in the EarthCache. As an educator, you may have more access to GPS-capable devices that can be lent from local libraries, park offices, or universities. Contact these institutions to see if students can use their resources.

### Elaborate (days 5–8; 50-minute classes)

Students are now ready to begin research on an invasive plant species. For this phase of the unit, you will need to prepare a list of local invasive plant species. Your state's Department of Natural Resources website would be the best place to find this information. You will also need to gather various research materials such as articles, books, informational pamphlets, maps, and websites for students to use. You may want to contact a local library, nature preserve, or state park for literature on this topic. Ideally, all of the information students need will be among the provided print sources. This will make it easier for students to locate the information, allowing them to spend more time processing the research and producing an informative final project.

Working in pairs, students should choose one invasive plant species on which to focus their research. This activity can easily be modified to have students research individually or in larger groups. As an extension to or additional component of the research, you

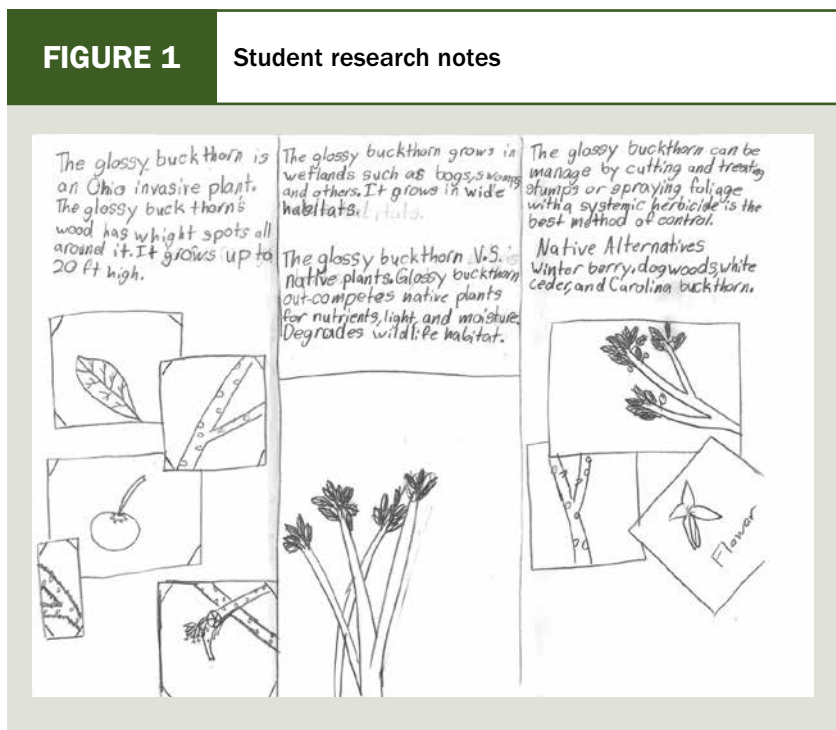
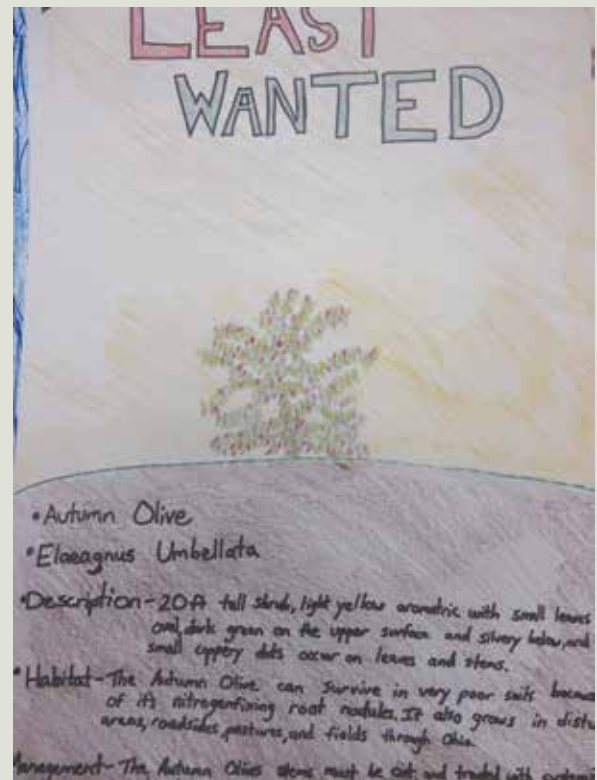


FIGURE 2

Student “Least Wanted” posters



can also assign students a local native plant species. Once student pairs have chosen an invasive species and been assigned a local native plant species, review the requirements for the project. Students are responsible for researching facts about their invasive plant species, including its common name, its scientific name, a description of it, its distribution in the state, its origin, ways to manage it, and native alternatives that should be planted instead (see Figure 1). These components can be modified as necessary. Give students a few days in class to conduct research and create their information artifact, a “Least Wanted” poster or brochure (see Figure 2). This time frame can also be altered as needed.

### Evaluate (days 9–10; 50-minute classes)

Each pair of students is required to explain its research findings to the class through a presentation of its final project. Students should display a thorough understanding of their assigned species by explaining the species’ impact on local ecosystems, locations in your state where the species has been found, its origin, na-

tive alternatives, and relevant management techniques. Assess students on the accuracy of their information, as well as the professionalism and caliber of their presentation and exhibit materials.

Once students have delivered their presentations, ask them to try to locate areas within their communities where they have spotted either their specific invasive plant or others presented in class. You can use a map in the classroom to plot these sightings along with their coordinates and upload that information to the EarthCache for others to access. Formal assessments can be made through the use of research and presentation rubrics. These final projects and assessments encourage students to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem and construct an explanation that predicts patterns of interactions among organisms across ecosystems. Facilitating class discussions after each presentation, with presenters answering peer questions, can be used as a way to further engage students in the content and informally assess learning.

**Reflection**

In my experience, middle school students do well when they are given the chance to work together, use technology, and engage with content in a personal and meaningful way. Involving the community in your classroom encourages student engagement and participation while developing in students a sense of community.

In my first year implementing this unit, there were very few students who actually took the time outside of class to participate in the EarthCache, despite the overwhelming excitement I was greeted with as I introduced the activity. To encourage more student participation, I was later able to involve my students' local Boy Scout group, who taught students how to use the

**Connecting to the Next Generation Science Standards (NGSS Lead States 2013)**

<b>Standard</b> MS-LS2: Ecosystems: Interaction, Energy, and Dynamics <a href="http://www.nextgenscience.org/msls2-ecosystems-interactions-energy-dynamics">www.nextgenscience.org/msls2-ecosystems-interactions-energy-dynamics</a>		
<b>Performance Expectation:</b> The materials/lessons/activities outlined in this article are just one step toward reaching the performance expectation listed below. MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.		
<b>Dimension</b>	<b>Name or NGSS code/citation</b>	<b>Matching student task or question taken directly from the activity</b>
Science and Engineering Practice	Constructing Explanations	Students provide evidence of the effects of resource availability on organisms in an ecosystem and construct an explanation that predicts patterns of interactions among organisms across ecosystems.
Disciplinary Core Idea	LS2.A: Interdependent Relationships in Ecosystems • In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction.	Ask students to give examples or ideas about the reasons why invasive plants can be a threat to native plants. The discussion may turn to the possibility of invasive plants dominating resources to the exclusion of native plants.
Crosscutting Concept	Cause and Effect	Conduct a discussion about why humans might have transported plants to a new location or why some plants might do better in some ecosystems than others.

**Connecting to the Common Core State Standards, ELA (NGAC and CCSSO 2010)**

**CCSS.ELA-Literacy.W.6.2**

Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.

**CCSS.ELA-LITERACY.W.6.7**

Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.

**CCSS.ELA-LITERACY.W.6.8**

Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.

**CCSS.ELA-LITERACY.W.6.9**

Draw evidence from literary or informational texts to support analysis, reflection, and research.

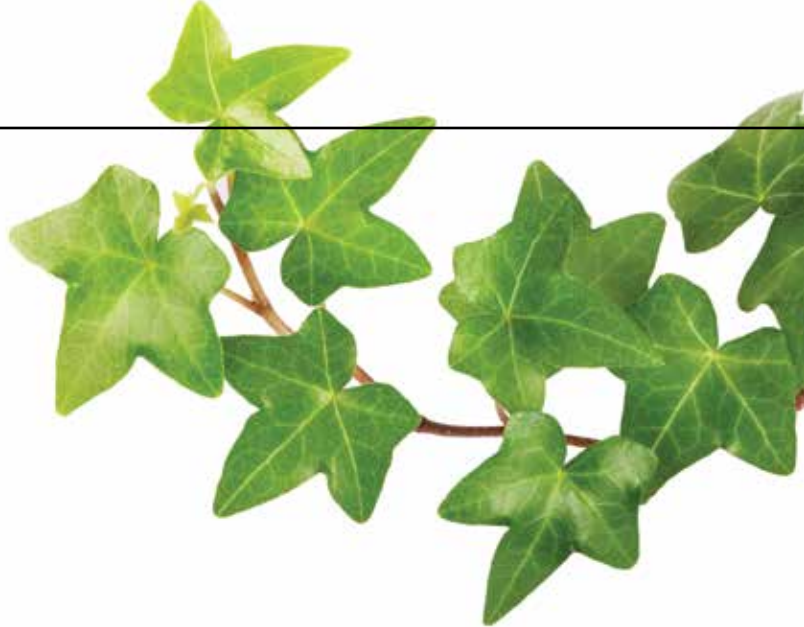
technology *GeoCaching.com* and GPS-capable devices, such as cell phones. In this unit, you can incorporate local print resources for research, collaborate with local naturalists to create the EarthCache, and involve community members in the EarthCaches themselves. Community members can be involved in each step of this activity from creating the EarthCache to helping students navigate the tasks.

From beginning to end, this unit spanned two weeks of class time, although daily teacher check-ins with student groups aided in time management and minimized out-of-class work. This will vary depending on the classroom. The research, preparation of artifacts, and presentations made up the bulk of time spent on this unit. Be sure to take time to address misconceptions or expand upon student-generated questions when they arise. For example, when we introduced the concept of invasive species and discussed possible definitions for *invasive*, many students initially thought we would be dealing with exotic and strange plants like the Venus flytrap or pitcher plants. I explained that, although the Venus flytrap and pitcher plants are interesting, they are not invasive species in Ohio and we would not be researching them. This was a little disappointing to students as they chose from the list I had compiled for them. However, they became increasingly excited about their specific invasive-species plant as they progressed in their research. Many students were eager to share interesting facts, such as the number of seeds produced annually or the plant's origin. One pair of students was shocked to discover that a single multiflora rose could produce more than 500,000 seeds, while another pair found that the common buckthorn could grow to up to 20 ft. tall. Yet another pair was just as surprised to learn that even grass species could be invasive. This excitement continued as students prepared their "Least Wanted" posters and shared their research during the presentations. Several students who had searched for images of their assigned plants during the course of their research were shocked to discover they had seen that specific plant in their own community, a realization that drove home the fact that the concepts and issues we were exploring in class had a direct connection to their daily lives.

I hope this unit will generate a greater appreciation for native flora and a heightened awareness of the ecological issues caused by invasive plants in your community. ■

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### Resources

Animal classification lesson plan (Discovery Education)—[www.discoveryeducation.com/teachers/free-lesson-plans/animal-classification.cfm](http://www.discoveryeducation.com/teachers/free-lesson-plans/animal-classification.cfm)

Classification activities (BrainPOP)—[www.brainpop.com/science/diversityoflife/sixkingdoms/preview.weml](http://www.brainpop.com/science/diversityoflife/sixkingdoms/preview.weml)

Classifying life (NOVA)—[www.pbs.org/wgbh/nova/nature/classifying-life.html](http://www.pbs.org/wgbh/nova/nature/classifying-life.html)

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