**Pollinators vs. Invasive Species**

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**Target Grade:** Middle School Science (6-8)

**Topic**: Invasive Species

**Time:** 2-3 Class Periods (60 minutes per class)

**Lesson Overview:**

Students will investigate the effects that invasive plant species can have on pollinators. They will look closely at how a food web can be affected by the introduction of just one non-native or invasive plant. Students will also learn how important pollinators are to human survival and they will design a plan for gardeners who want to attract pollinators and plant native species gardens.

**Sources Consulted:**

* [Effects of Invasive Plant Species on Pollinators](http://pollinator.org/assets/generalFiles/NAPPC-Invasive-Species-Fact-Sheet.pdf)
* [Pollinator Gardens and Native Species](https://pollinators.msu.edu/resources/pollinator-planting1/pollinator-gardens/)
* [Loss of “Invasive” Could Affect Bees](https://vegetablegrowersnews.com/article/loss-of-invasive-plant-could-hurt-michigan-bees/)
* [Invasive Garlic Mustard](https://garlicmustardjo2013.weebly.com/impact-to-ecosystems.html)

**Learning Objectives:**

*After the lesson, students will be able to:*

1. Give examples of pollinators and their role in ecosystems.
2. Describe the possible effects of non-native and invasive plants on pollinators in an ecosystem.
3. Provide a plan for planting native plant species pollinator gardens and warning for not planting non- native species.

**Michigan Science Standards Addressed:**

**SEP: Science and Engineering Practices**

* Developing and using models
* Constructing responses and designing solutions

**DCI: Disciplinary Core Ideas**

* 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.
* MS-LS2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
* MS-LS2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

**CCC: Cross Cutting Concepts**

* Cause and Effect
* Stability and Change

**List of Materials:**

* Computer access to links or printed articles.

**Room Arrangement or Special Needs**

Students can work individually or can be grouped together for the activities (3-4 students/group max).

**New Vocabulary**

Invasive Species: A non-native species in an ecosystem that may cause harm to the economy, the environment or human health.

Pollinator: an organism that aids in pollination (spread of pollen from one plant to another for reproduction) of plant species.

Native Species: an organism that has historically been in an area, food web or ecosystem for a long time.

Non-Native Species: an organism that has not historically been in an ecosystem. It may have been introduced to an area by humans and may or may not be classified as invasive.

Food Web: A diagram showing the interconnected food chains that exist in an ecosystem

**5E Model Lesson Plan**

***Engage***

***Guiding Question: How do Invasive Plant Species Affect Pollinators? How can we help pollinators by planting native plant pollinator gardens?***

Ask students if they know what a pollinator is. If students do not know, take some time to give examples. If they do, ask students to generate a list of organisms that pollinate flowers. Why is pollination important? What would happen if some plants frequently visited by pollinators disappeared? What would happen if pollinators disappeared? How would this affect a food web?

*Note about prior knowledge:* This lesson relies on a base of knowledge about pollination. The process of pollination and plant reproduction is not the focus of this lesson, but taking time to make sure students understand some of it can be helpful. A base knowledge of food webs and roles within food webs is also helpful, as it is not built into this lesson!

* [Pollination for Kids](https://easyscienceforkids.com/all-about-pollination/) (Website and video)

***Explore - Activities***

1. **Critical Reading Activity**: Students will read this article and use the reading strategy provided to learn more about the potential harm that invasive plants can have on pollinators. [North American Pollinator Protection Campaign](http://pollinator.org/assets/generalFiles/NAPPC-Invasive-Species-Fact-Sheet.pdf) (Worksheet below). Teachers can lead a discussion or create questions from the article if desired.
	1. Students should draw out these facts about the effect of invasives on pollinators and ecosystems:
		1. Alter the species in the community
		2. Reduce food and shelter for all organisms
		3. Non native floral structures may not be adapted to match pollinator’s structures
		4. Non-natives steal opportunities for pollination from native plants
		5. Non-natives spread while natives do not, may be no ecological benefit from non-natives
		6. Diseases can be spread from non native to native plants
		7. Invasive and non-native plants can outcompete with native plants

***Explain - Food Web Investigation***

1. Compare and Contrast the Food webs that include the Garlic Mustard Plant. This is considered an invasive plant species in Michigan, but it is native to some places in Europe. Students should note that in a non native food web, there are no natural consumers that eat the plant like there is in the native food web.
<https://garlicmustardjo2013.weebly.com/impact-to-ecosystems.html>



***Non-Native Food Web Including Garlic Mustard***



***Native Food Web Including Garlic Mustard***

***Elaborate - Student Share Out***

1. Students should discuss all the potential impacts of the Garlic Mustard to a Non-Native food web using the diagrams above

***Evaluate - Apply Knowledge***

1. Scenario: Right now, scientists are concerned that pollinators like bees are on the decline. There are many reasons for this, but one reason may be that there are fewer food sources for pollinators. Many people are trying to plant gardens to attract more pollinators and help them out! Your job is to help someone plan a pollinator garden and to help them understand why it is important to plant ONLY native species. Teacher discretion can be used to determine how they want students to present their case. Some ideas may include:
	1. Slideshow with suggestions for native plants in a pollinator garden
	2. A garden plan or design on graph paper, showing layouts of different plants (complexity depends on ability of students)
	3. All presentations should include information about WHY native plants are important!
	4. Resource from MSU: <https://pollinators.msu.edu/resources/pollinator-planting1/pollinator-gardens/>
2. **Further Reading: Challenge students to think about whether or not non native or invasive species could actually be good!**

**For further reading, have students explore this article from** [**Vegetable Growers News**](https://vegetablegrowersnews.com/article/loss-of-invasive-plant-could-hurt-michigan-bees/)**. This article discusses possible harm to Michigan Beekeepers if the invasive star thistle is effectively controlled.**

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**THIEVES Reading Strategy:**

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| --- | --- |
| **Article: North American Pollinator Protection Campaign WILDLIFE FACT SHEET INVASIVE SPECIES** | **Complete the Reading Strategy Below** |
| **Effects of Invasive Plant Species on Pollinators** Invasive species affect both pollinating animals and pollinated plants by disrupting the structure and function of ecosystems. Non-native plants can alter the community composition of natural habitats, reducing food and shelter resources available for all species of wildlife. Native pollinators have co-evolved with the plants they visit, such that their physiology is matched to most efficiently exploit the nectar and pollen resources of the flowers upon which they specialize. **Pollinator Adaptations**For pollinators that are physiologically adapted to specialize on particular plants, non-natives may present floral structures that are inaccessible to local pollinating animals, preventing them from reaching the nectar reward that lies within. In such cases, the nonnative plant “steals” the reproductive opportunity to spread its pollen by attracting pollinators that unwittingly transfer pollen grains while visiting flower after flower, seeking nectar that is physically inaccessible to them. The invasives rob the ecosystem by propagating throughout the habitat, while returning no ecosystem benefits to the animals that depend on that habitat for survival. © Steve Javorek, NAPPC **Tempting Invasives**Pollinators visiting invasive species are drawn away from native plant species, which may result in reduced reproductive capacity and degeneration of native plant habitats. Introduced plant diseases can be carried from non-natives to native plants on the bodies of pollinators seeking food, and hybrids can be unwittingly created through the genetic mixing that occurs. **Tough Competition**Invasive plants can also directly impact pollinators, as shown in the case of the invasive species, garlic mustard (Alliaria petiolata). Garlic mustard threatens native plants in forests of the Eastern and Midwestern U.S. by out-competing native species in the mustard family, known as “toothworts” (Genus Cardamine). © H.N. Darrow, NWF Article Adapted from: <http://pollinator.org/assets/generalFiles/NAPPC-Invasive-Species-Fact-Sheet.pdf>  | **T-Title**: Read the title ONLY and predict what you think the text will be about: |
| **H-Heading**:Read just the headings Predict what you think each paragraph will be about.1.2.3.4. |
| **I-Introduction**: Read the first paragraph. What do you think is the article going to be about, based on what you just read? Is this different from what you predicted in “T”? |
| **E-Everything I Know**: Describe how this relates to what we are learning about in science class right now. |
| **V-Visuals:** If you could include a picture at the top of this article to interest readers, what would it be? |
| **E-End:** Summarize the author’s main points at the end of the article. |
| **S-So What?** Why do you think your teacher assigned you this article? |

**We would greatly appreciate your feedback using this lesson plan! Please visit** [**https://www.biaquariumstem.org/survey.html**](https://www.biaquariumstem.org/survey.html) **to complete a short survey about your experience.**