**Mapping the Spread**

**Topic:** Understanding the history, spread, and impacts of terrestrial and aquatic invasive species.

**Target Grade Range:** Middle and High School (adjustable for younger students)

**Time:** 1-4 hours (research plus additional time if student groups share research with classmates orally or if they, as a group, add to a large class map or share a slideshow–see variations section)

**Category:** Connect, Share (Research optional, see *Variations*)

**Summary:** Students research invasive species, their history in the Great Lakes region, spread/movement to various locations, and impact on ecosystems, economies, or human health. Students use technology to learn more about an invasive species and plot locations on Great Lakes Basin maps to visually see the spread of the species.

**Goals:**

* Students visualize the path of introduced species to the Great Lakes by charting a timeline of their spread and impact throughout the region.
* Students consider how invasive species spread to locations throughout the Great Lakes and possible ways to limit or mitigate the spread.

**Objective(s):**

* Students learn about the process and timeline of the spread of an invasive species.
	+ Students research an invasive species or
	+ Use information from Mapping the Spread Teacher Key reference documents (teacher and students documents are noted in the “Materials” section of “Procedure”).
* Students note the locations and impact of invasive species as they are transferred to new locations.

**Background knowledge:** Students know what invasive species are and why they are a threat to native species in the Great Lakes region.

Resource: Introduction to invasive species video, Michigan Department of Environment, Great Lakes, and Energy (MI EGLE), *Invasive Species: The Basics* (<https://www.youtube.com/watch?v=yIgysZ5Hho8>)

Resource:National Geographic Resource Library, *Introduction to Invasive Species* (<https://www.nationalgeographic.com/environment/article/invasive-species>)

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# **Procedure:**

# *Materials:*

* Technology (tablets, laptops, computers, or mobile devices)
* Worksheet: Mapping the Spread Student Activity Sheet
	+ Maps of the Great Lakes basin (examples included in the Student Activity Sheet)
	+ Student Activity Sheet teacher keys/references: Eurasian watermilfoil;
	Eurasian ruffe; European frog-bit; purple loosestrife; sea lamprey
		- Note: The sea lamprey teacher key has an example of how students might put dates on the map
* Stickers or markers to mark invasive species locations on a map

*Set-Up:*

* Students have access to devices and (or) articles for research.
* Students have copies of Great Lakes maps such as those in the Mapping the Spread Student Activity Sheet

*Activity Description:*

**Invasive Species Mapping Activity** (20-30 minutes)

1. Depending on age, students can either research the questions on their own or use provided data (see teacher keys).
2. Students can choose or be given a specific invasive species to research, either aquatic or terrestrial.
3. Students can work in small groups, large groups, or in pairs. Individual work can also be an option based on the teacher's discretion.
4. The students will use technology to research their assigned invasive species and answer the questions on the Student Activity Sheet.
5. The last four questions of this assignment require students to mark locations on their map

**Discussion:**

* Conclusion (15-20 minutes)
* Students can share their findings with the class.
* Discuss the impact of these invasive species on ecosystems, plants, animals, and human ways of life.

*Sample inquiry questions based on data and observation are below* (allow for open discussion). Example student answers are in red.

* Is there a most common way for invasive species to spread? Why?
	+ Many invasive species spread through water systems or by hitching a ride on another species(i.e.. Birds spreading seeds). Others may spread because of humans, by sticking to boats, shoes and other outdoor equipment.
* What makes it easy for invasive species to take over an ecosystem?
	+ Non-native species become invasive because they don’t have any competition or predators to keep their populations in check. They also might be able to reproduce much easier or faster than in their native environment because they didn’t co-evolve with other species that helped keep the original ecosystem in balance.
* What can you do to help stop the spread of invasive species?
	+ Cleaning equipment, footwear, and other clothing after use is a great way to decrease the spread of invasive species. Learning to identify the invasive species and removing them can also help prevent the species from reproducing and continuing to spread.

**Variations and Extensions:**

* Researching or creating management plans for these invasive species.
* Number each point put on the map so students know where the spread originated from and how it traveled.
* Research invasive species specific to your area.
* Students can work independently, in pairs, or in small groups.
* Students can present their maps and research to the class.

**Additional Resources:**

* The Nature Conservancy, *Aquatic Invasive Species Management* (<https://www.nature.org/en-us/about-us/where-we-work/priority-landscapes/great-lakes/great-lakes-aquatic-invasive-species-/>)

**Research Connections:**

**Lake Superior State University Center for Freshwater Research and Education (LSSU CFRE) *Hydrocharis morsus-ranae (*European frogbit) research:**

CFRE research teams collaborate with EGLE and Three Shores CISMA to conduct field and lab experiments on the invasive plant European frogbit. The goal is to gain more knowledge on the distribution and winter survival of the species as well as how to effectively remove it.

**Lake Superior State University Center for Freshwater Research and Education (LSSU CFRE) *Didymosphenia geminata (*didymo) research:**

CFRE research teams conduct lab experiments and field sampling in order to understand what is causing the growth of the invasive algae. They also conduct eDNA and water quality analyses. University of Wisconsin Oshkosh, Michigan Sea Grant and EGLE all partner with CFRE on this project.

**United States Fish and Wildlife Service (USFWS) sea lamprey (*Petromyzon marinus*) removal**

USFWS biologists use traps to capture and remove invasive sea lamprey from the Great Lakes. Alongside removal, the project also contributes to other aspects of sea lamprey control such as dam and barrier design.

**Michigan Department of Education Standards**

Next Generation Science Standards Performance Expectations

**MS-LS2-4.** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

**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.

**HS-LS2-6.** Evaluate claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.

**HS-LS4-5** Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Social Studies

**5 – P4.2.1** Develop and implement an action plan and know how, when, and

where to address or inform others about a public issue.

**5 – P4.2.2** Participate in projects to help or inform others.

**6 - G1.1.1** Use maps, globes or web based geography technology to investigate the world at global interregional, regional and local scales

**6 - G5.1.1** Describe examples of how humans have impacted and are continuing to impact the environment

**7 – G1.2.3** Use, interpret, and create maps and graphs representing places and

regions in the era being studied.

**7 – G1.2.4** Locate and use information from maps and GIS to answer geographic

questions on the era and region being studied.

**7 – G5.1.1** Describe examples of how humans modified the environment in the era being studied.

**8 – P4.2.3** Participate in projects to help or inform others.

**High School**

**P2.3** Know how to find, organize, evaluate, and interpret information from a variety of credible sources.

**CG2 Resources**

Explain changes in the use, distribution, and importance of natural resources (including

land, water, energy, food; and renewable, non-renewable, and flow resources) on human life, settlement, and interactions by describing and evaluating:

• social, political, economic, and environmental consequences of the development, distribution, and use of natural resources.

• the impact of humans on the global environment.

English Language Arts

Research to Build and Present Knowledge: Conduct research projects that use several sources to build knowledge (and answer questions) through investigation of different aspects of a topic.