

Great Lakes Invasive Species and Climate Change

What makes a good invader?

Overview:

Students will learn about invasive species in the Great Lakes ecosystem and explore the characteristics that make species good invaders, factors that can influence invasive communities, and the role climate change may play in causing and proliferating invasions. This lesson is most appropriate for the 4th-6th grade, but could be used in higher grades. The activity can complement ecological concepts such as population, community, niche, and invasive species.

Objectives:

At the conclusion of the lesson, students will be able to:

- Provide examples of invasions causing harm in the Great Lakes
- Identify characteristics (traits) that are common among many invasive species
- Present information on the role that climate change can play in the establishment and spread of invasive species
- Recognize some common native and invasive species in the Great Lakes
- Talk about populations, communities, and the niche

Duration:

This lesson can be completed in 1 hour if the activity is played once. Ideally it should be played multiple times so students can observe different outcomes depending on what events were spun on the wheel and to redistribute the species cards so each student can be a new species with different traits than their first. Ideally, a 1.5-hour session would be best.

- 20 minutes - Introduction: Great Lakes Aquatic Invasions PowerPoint
 - What is an invasive species
 - Do you know of any invasive species?
 - Examples of invasive species in the Great Lakes
 - What makes a good invader
 - Climate change and invasive species- Don't release your pets!
- 5 minutes- Summary of introduction: students should now be able to describe characteristics that make a good invader
- 5 minutes- describe the rules of the activity
- 45 minutes- play 2-3 rounds of the activity
- 15 minutes - Summary: have students describe what got them "into the community". Do the characteristics that made them a good invader match the ones we discussed in the introduction? What characteristics of the native species made them successful/unsuccessful? Does the outcome of the activity change between rounds?

Standards:

- Share ideas about science through purposeful conversation.
- Communicate and present findings of observations.
- Identify the needs of native and invasive species
- Relate characteristics and functions of observable parts in a variety of native and invasive species that allow them to live in their environment (leaf shape, thorns, odor, color, etc.).
- Describe helpful or harmful effects of humans on the environment
- (Climate change, habitat destruction, land management, renewable, and non-renewable resources).
- Identify how variations in physical characteristics of individual organisms give them an advantage for survival and reproduction.
- Describe the physical characteristics (traits) of organisms that help them survive in their environment.
- Identify and describe examples of populations, communities, and ecosystems including the Great Lakes region.
- Predict how changes in one population might affect other populations based upon their relationships in the food web.
- Predict how changes in climate might affect species survival and distribution.
- Identify the factors in an ecosystem that influence changes in population size.
- Describe how humans are part of the Earth's system and how human activity can purposefully, or accidentally, alter the balance in ecosystems.

Materials and Preparation

- One species card per student (15 native, 15 invasive species cards provided)
- Event spinner (provided)
- Stage spinner (provided)
- Four stage signs (provided)
- Five event signs (provided)
- PowerPoint presentation- introduction: Great Lakes Aquatic Invasions (provided)
- Red tape to mark start and finish line
- A large room (gym best) to conduct the activity

Prerequisite Knowledge

Aquatic invasive species (AIS) are species that are found outside of their native habitat and cause harm to their new environment. They are highly competitive and

persistent. There are over 185 non-native species in the Great Lakes, and the trend has been one new species every 6-8 months. As the climate continues to warm, and the Great Lakes experience additional stressors, AIS may become an even bigger problem as warming temperatures, changing water quality, and disturbance may allow new AIS to expand their ranges and make their home in the Great Lakes. This illustrates the need to be vigilant and step-up efforts to prevent AIS introductions into the country. Most of those responsible for fighting AIS infestations realize that it is less expensive to prevent their introduction in the first place than to try to control or eradicate them once an infestation has occurred.

To prevent future invasions it would be helpful to know the answers to a few questions: Are there characteristics that are common between different invasive species? How can we tell which habitats are most at risk?

Aquatic invasive species have certain characteristics that tend to make them successful:

- Rapid growth and reproduction: tend to grow quickly and produce a lot of offspring; many reproduce multiple times in one season.
- Asexual reproduction: some species need only one individual to reproduce; especially plants, which may need only a small plant fragment to start a completely new population.
- Adaptability: typically hardy and able to tolerate a wide range of environmental conditions, including degraded and polluted habitats and rapidly changing conditions that native species can't tolerate.
- No predators: Since these species are non-native, they often lack the natural predators that would keep their population numbers in check.

Global climate change may make conditions more suitable for invasive species.

Warming temperatures, increased precipitation, and other climate change impacts predicted by scientists presents a whole new challenge to invasive species management. While it is unknown exactly how AIS may respond to a changing climate, it is predicted that many species will benefit from these changes, expand their ranges, and have exacerbated negative impacts. Due to the characteristics that allow AIS to become successful, these species will most likely have the upper hand at trying to adapt to changing conditions, which may allow them to further outcompete existing native species.

Activities: the lesson has two parts: the introduction and activity

Introduction: Ask the students about their prior knowledge on invasive species. Can they name any invasive species? Do they know the issues caused by those species or

what people are doing to control them? Give examples of aquatic invasions in the Great Lakes (presentation contains slides on zebra mussels, Asian carp, Eurasian watermilfoil, and Sea lamprey). What characteristics did all these invaders share? Ask students to pull together what they can remember from their examples and the ones in the presentation. See if they can come up with their own list before showing the slide with characteristics.

Ask students how they think a changing climate might impact these species? What changes are expected? What kind of species will do better after these changes? What kinds of species might do worse?

Tell students that they will now be participating in an activity to learn about the characteristics of invaders that make them successful, especially in changing conditions.

Activity:

Introduce the rules of the activity. Go over species cards, stages, and events. Describe how students will move backwards or forwards heel-to-toe and that the students who cross the finish line will be “in the community” and will have to describe to the class how they got there.

- Gather students in a large, open room.
- Students line up, shoulder to shoulder on the start line.
- Give each student a species card (you will not use the whole set, ratio of invaders to natives should be about 1:2).
- Explain that students will move forward for stages (growth, reproduction, spread, and climate change benefits) when the appropriate stage sign is held up. They will move backwards when an event is spun on the wheel (ex: drought, flood, adaptation, temperature, or climate change) and the appropriate event sign is held up. Demonstrate how they will take steps (heel-to-toe).
- Explain that climate change can both harm and benefit certain species. That’s why it appears twice on their card. They move forward when the stage sign for climate change with the green “+” is held, and backwards when the event sign for climate change with the red “-“ is held.

Start the activity - 2 stages

- Allow a student that has been paying attention and following directions to spin the stage spinner.
- Spin the stage spinner and hold up the sign for the appropriate stage

- Students move forward the number of steps indicated on their card
- Monitor students closely for too large/many steps. If students are caught not moving heel-to-toe steps, or taking more steps than on their card, they must move back 5 steps.

Continue the activity - 2 events

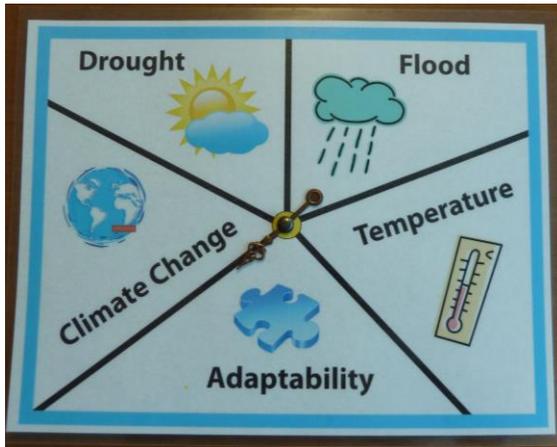
- Allow a student that has been paying attention and following directions to spin the event spinner.
- Students move backward the number of steps indicated on their species card
- Monitor students to make sure they are taking steps backwards.
- Repeat steps (f) and (g) until you have about 10 students across the finish line (these students are “in the community”)
- Have students in the community (the 10 or so that have crossed the red line) line up along the finish line, with invasive and native species on opposite sides.
- Have students that did not make it into the community sit in front of the standing students.
- Have each student in the community read their species name, state whether they are invasive or native, and explain what helped them the most. How is it that they made it into the community? The students should remember which of the events hurt them those most, or which stage allowed them to take the most steps. (This should be different depending on what species they are and what sorts of events were spun for this round).
- Ask some of the sitting students why they did not make it.
- Link the characteristics of the invasive species that made it into the community to some of the themes and invasive species examples brought up in the introduction.

Repeat the activity as time allows (usually 2-3 rounds)

- Point out to students how the outcomes differ between rounds.
- What events caused the outcome to change?
- Did certain things come up more often than others? What events led to a community consisting of mostly invasive species? Native?

Resources (see below for examples)

- Introduction PowerPoint (Great Lakes Aquatic Invasions)
- Invasive and native species cards
- Stage signs (4)
- Event signs (5)
- Event spinner
- Stage spinner



Event Spinner



Stage Spinner



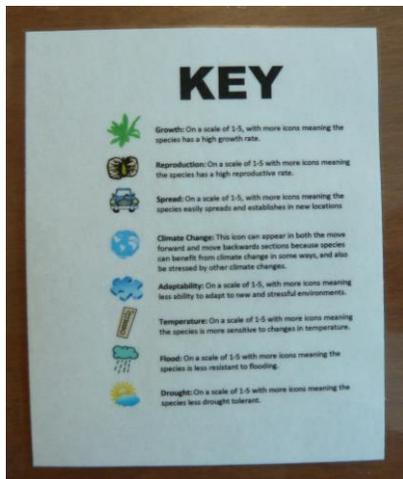
Sample Stage Sign

Species Cards



Front

Back



Key to symbols

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This lesson is one of 10 lessons that focus on climate change and invasive species prepared by the Pennsylvania and New York Sea Grant programs as part of a larger Great Lakes Sea Grant Network initiative funded by the Great Lakes Restoration Initiative.

