

Biodiversity Games

Two games are included here. The first (Game 1-What's At Risk) shows the impact of invasive species while the second (Game 2-Mussel Invasion! What to Do?) allows students to act out ways we can help the ecosystem and our environment.

Game1- What's At Risk?

Overview

This game is based on the Rock-Paper-Scissors game and will allow students to experience the effects of invasive species, both on an ecosystem and the native species within it. The game is adaptable and teachers may desire to include certain Species at Risk from their own locale that students can represent.

Materials Needed

- Large paper clips (a variety of colours is fun), 2 for each student
- Playing area where students are able to move around (Moving desks to outside perimeter of room would suffice, or the gym. Even better, take them outside!)
- Invasive Species cards (Red)
- Species at Risk cards (Green)
- Species at Risk sheet with list of Ontario species that are: species of concern, threatened or endangered
- Medicine Wheel
- If desired (i.e. for mathematics strand) record game data (refer to step 4. below).

Set up:

1. **PRIOR TO THE GAME** - Students are all given a species at risk identity. **They should research their species, preferably before the game so they can identify what is important in their species' habitat and why their species is in trouble.** Students should be made aware their species are Native to Ontario and have adaptations that allow them to survive best in certain areas within North America or Ontario itself. Group sharing is an option to allow students to talk about their fish, bird, amphibian, reptile, mammal or plant. This approach allows the class to internalize the challenges facing native organisms and the variety of organisms affected while making others aware of their species' dilemma.
2. **All** students begin the game as Native Species at Risk. Students each receive a green Species at Risk card with 2 paper clips representing their life and the life of their

offspring (their species' future). Before the game commences have students look around them and visualize the diversity of Native Species.

3. Students should all be familiar with Rock-Paper-Scissors (RPS), but review the rules to this activity (Rock beats Scissors, Scissors beat Paper, Paper beats Rock) and instruct students they will use this throughout the Biodiversity Game. Students may do one round of RPS or more, dependant on the teacher's wishes and time available.
4. **OPTION:** Should the teacher wish to incorporate other curriculum strands such as math, a student or the teacher can record the number of Native and Invasive Species at the start and every couple of minutes after to create a chart from which graphs can be derived.

Time (minutes)	# of Native Species	# of Invasive Species
Start		
2		
4		
6		
8		
10		

Playing the Game:

1. All participants are given a Native Species card and will represent that species to start the game. At a signal from the teacher students begin by choosing an opponent and playing RPS. Winners collect **one** paper clip from the loser.
2. **When a player loses all of their paper clips they become an Invasive Species.** The new Invasive Species must go to the teacher who will hand them an Invasive Species card (red) to hold. Each card will have a picture on it representing an Invasive Species which is a current threat to our North American ecosystems. The student will place this card over their green Native Species card.
3. **Invasive Species players have an advantage.** Should they win RPS over a Native Species player they collect **2** paper clips. Should the Invasive Species player **lose** the RPS they must only take **1** paper clip from the Native Species player.
4. **Invasive vs. Invasive** – winners only receive 1 paper clip.
5. Should an Invasive Species lose all of their paper clips, they must keep playing but can only target Native Species players until they win a paper clip.
6. **The game ends** when all of the players become Invasive Species (teacher must keep track of number of students and number of Invasive Species cards they've handed out). Players can tally their paper clips to find out which Invasive Species had the most impact on the classroom ecosystem.
7. Play the game a few times to allow students to experience how quickly ecosystems can be impacted by Invasive Species if not helped by us. (This data can also be used to create

comparative graphs for your classroom's analyses and opportunities to talk about averages, means, medians etc.)

8. If desired students can research their Invasive Species and introduce them to the class.

Learning Outcomes:

Students should be able to empathize and internalize the challenges facing Native Species, and recognize the threat that Invasive Species pose to our native ecosystems. Results of graphing data can be used to show students how rapidly this Invasive takeover can occur and should stimulate questions as to why this happens and what can be done about it. Classroom research and projects can result with presentations of findings encouraged.

The Human Connection to ecosystems and the environment should be a by-product of this game. We are all connected and linked to the health of our planet. If one ecosystem suffers – we suffer.

Students should be made aware that Invasive Species are not all that our Native Species have to deal with. Habitat loss is another major concern worldwide. Climate change and greenhouse gases along with pollution are further concerns. All of these challenges are compounded by lack of human concern and human non-intervention.

What should my class discover about Invasive Species during their discussions/research?

- Invasive Species are non-native and don't belong in the ecosystems they've been brought to.
- Humans are responsible for their introduction (see 2. below).
- Invasive Species have the advantage that nothing in their new surroundings wants to eat or use them, and they are free to reproduce and multiply rapidly.
- Some Invasive Species can out-compete existing native organisms for resources and cause these natives to disappear.
- Some Invasive Species have defences like chemicals or spines that native carnivores and herbivores haven't evolved to overcome. This leaves the Invasives without natural enemies to control their numbers.
- Invasives have a huge effect on native biodiversity.

Some leading questions you may give to students:

1. How do you think Invasive Species affect the Native ecosystem? (A. Caused many/all Native Species to decline and disappear, caused damage to native ecosystems, created "unhealthy" ecosystems.)
2. How do you think these Invasive Species got here? (All arrived due to human activities like: transporting infested products; releasing ship ballast waters; introducing foreign species for agricultural, aesthetic, or sentimental reasons; recreational release of unused bait; transport of non-native species on unclean, contaminated boat hulls, sporting vehicles and equipment; release of pets; releasing non-native predators of agricultural pests.)
3. Who would suffer if Invasive Species were allowed to go unchecked? (A. Many native species [can list those affected in class] and even us!)

4. How could our class better fulfill our role as stewards of the World, North American, Canadian, Ontarian, and Classroom Ecosystems? (**Here you could use the Medicine Wheel** to remind students of their connection to Mother Earth and address the Native Studies curriculum guidelines, also our responsibilities to reduce, reuse and recycle.)
5. What can we do to help our Earth? (A. the 3 R's, respect and enjoy nature, clean up after ourselves (don't pollute), don't transport or release non-native species – clean vehicles and don't dump bait, help a local nature club with projects, support organizations that help the environment, tell adults you care about the Earth's future, learn about your local nature and how it's important to you, get outdoors and appreciate what's around us.)
6. How can we stop the spread and introduction of non-native species of plants and other living organisms? (Students can be encouraged to do research as to how to avoid spreading the Invasive Specie they represented in the game.)

Game 2- Mussel Invasion! What to Do?

Overview

Role Play Activity

This game is a role playing activity that can be used to demonstrate the way aquatic invasive species are transferred from one area to another. The game also serves to show students the impact invasive species have on themselves and their communities. During the game, teachers must guide the students to realize the importance of each of the roles and the parts they play in the “real world.” It is suggested that a brief outline of the role be described by the teacher as parts are assigned to students. Students may then discover ways they can control the spread of invasive species more effectively.

The game is in its simplest form and has the potential for many role additions and activity inclusions. As you read through the roles and the game, you may include other concepts or roles that may better serve your class and desired learning outcomes (i.e. some students could play water travelling through intake pipes, which become blocked by mussels)

Materials Needed

- A clear area where students can travel freely and play their roles safely (a gymnasium or outdoor setting would be best).
- Elastic bands or 1 foot long pieces of string to use as an “attachment point” so students acting as Mussels can be transported to another lake by students acting as Humans. 3 elastics or strings per Human should do.
- Copy of Game 2 Narrative for teacher to read to students during activity (see page 8).

Set up:

Brief outline for different roles in game:

- a) **Human** – main reason invasive species are spread from one area to another. The players representing Humans travel and carry invasive species on their vehicles and

- equipment, which if not cleaned, will transfer invasive species from infected areas to new uninfected locations.
- b) **Zebra Mussels** – players will represent an example of invasive species that quickly establishes itself in a new area and causes many problems for existing wildlife populations as well as human endeavours. Invasive species have no predators or natural population control and are free to out-compete native species for resources. They can reproduce at an exponential rate and can cause insurmountable damage to native ecosystems.
- Information on Zebra Mussels: Zebra mussels can survive up to *5 days out of water*. They live only in fresh water and attach themselves to any underwater surface. They are about the size of a fingernail but can grow up to 5 cm. long. They *need flowing fresh water* to thrive so are not as much of a problem in quiet lakes and bays. A female is able to lay up to one million eggs during a single breeding season! The only natural control is a species of diving duck. Zebra mussels spread downstream during their free-swimming larval stage, called a veliger. Dispersal upstream and into inland rivers and lakes occurs with human activity: larvae are dumped from live wells and older ones attach themselves to boats. *Trailered boats* are to blame for spreading the mussels throughout the fresh water lakes and rivers in the Great Lakes basin after their introduction (around 1988).
- c) **Boat** – this player will represent a main vector of spreading invasive organisms from one water body to another. Large seagoing vessels have carried many invasive species in their bilge-water and ballast holds. Small boats carry many invasive species in their bait containers, live wells, engine parts, in their hulls and also their trailer wheels when they are backed into water on boat ramps.
- d) **Clean Team** – term used in the game for the players who represent persons and methods that properly clean and dispose of invasive species to prevent their spread. Methods the Clean Team will use are outlined below in Step 5.
- e) **Municipal Water Intake Pipes** – these players will represent drinking water intakes used by municipalities to obtain water from lakes.
- f) **Lakeshore** – these players will temporarily represent the shoreline of a lake which is the recipient of the invasive mussels (Lake #2). Lakes can serve as sources of invasive contaminants and also are recipients of invasive species.

Playing the Game:

1. Divide the class to play the roles of (approximately, depending on class size) – 2 humans, 5 mussels, 1 boat, 5 members of the “Clean Team,” and 2 “municipal water intake pipes.” The remainder of the class will form the outline of the **2nd** lake. A third lake location will be designated, but will not have any students lining it. **The teacher will provide a narrative throughout the game which students will use to act out their roles (a narrative page is provided below Learning Outcomes).**
2. **Pick 3 corners of the playing area to represent the separate lakes.** Pretending to drive, the humans will guide their boat from the first lake where the mussels will attach, to the second, with the mussels “hanging on” to their boat. Once the boat reaches the 2nd lake, the mussels will release and grab the hands of the students along the lakeshore, who then

become mussels. The mussels will swarm the water intake pipes and surround them (intake pipes can start choking and make gurgling noises).

3. The “Clean Team” will then be introduced to the game. Clean Teamsters take the wrist of individual mussels and remove them from the intake pipes and take them to the side of the play area (shoreline). “Removed” mussels will count to twenty and return to “clog” the intake pipes. Since removal must be done repeatedly, 2 members of the Clean Team need to remain by the pipes to “protect” them. This can be repeated until students get the idea of how labour intensive and costly it is to control zebra mussels from clogging intake pipes.
4. Now the humans and their boat will travel to the 3rd lake, along with the original 5 mussel passengers. They are intercepted by the 3 remaining members of the Clean Team, who show the humans the effects of their actions (clogging of municipal water intakes). **The class can now discuss and contribute their ideas of how the Clean Team can stop the spread of the mussels.** Teachers may guide the students to determine the following methods of controlling the spread of aquatic invasive species:

- Draining water from **bilge, live wells, bait buckets**, trailer and wheels.
- Washing **bait wells** with hot water.
- Not transporting **bait** from an infested area!
- Rinsing the **hull** with hot water, high-pressure washer or dry in the sun for 5 days.
- Flushing the engine **cooling system** with hot water (140F).
- Carefully inspecting **screens and water intakes and drain pipes** for mussels.
- Leave a boat out of the water for 3+ days in hot, dry weather to kill mussels.
- Protect boat hulls with anti-fouling paint.
- Clean water intakes on boats.

To wrap up the game, once the Clean Team has performed the necessary actions and have removed the 5 mussels from the boat, the boat can be driven to the next lake which will remain free of contamination.

Learning Outcomes:

Students should observe and internalize the effects an invasive species can have on themselves and their communities. Students should through discussion determine and explore/discover ways they and other people can deal with and prevent the spread of invasive species.

The Human Connection to ecosystems and the environment should be a by-product of this game. We are all connected and linked to the health of our planet. One ecosystem suffers – we suffer.

What should my class discover about Invasive Species during their game discussions/role play?

- Invasive Species are non-native and don't belong in the ecosystems they've been brought to.
- Humans are responsible for their introduction.
- Humans can prevent the spread of Invasive Species by taking proper preventative measures.
- Invasive Species cause damage and negatively impact human made structures.
- Some Invasive Species can affect our lives and livelihoods.
- Human actions have consequences which affect the environment as well as us.

Some leading questions you may give to students:

1. How do you think many Invasive Species entered our native ecosystems? (A. The transport of materials from other countries without close monitoring of shipping containers or shipping methods (i.e. boats, planes, trucks) has allowed many non-native species to gain a foothold in North America. Releasing bait fish and pets into the wild have also contributed.)
2. How do you think these Invasive Species got here? (A. All arrived due to human activities like: transporting infested products; releasing ship ballast waters; introducing foreign species for agricultural, aesthetic, or sentimental reasons; recreational release of unused bait; transport of non-native species on unclean, contaminated boat hulls, sporting vehicles and equipment; release of pets; releasing non-native predators of agricultural pests.)
3. Who would suffer if Invasive Species were allowed to go unchecked? (A. Many native species [can list those affected in class] and even us! Example – the municipal water intake pipes.)
4. What hobbies or activities can you think of that might spread invasive species?
5. How could you help prevent the spread of invasive species? (A. Student answers will vary according to what hobbies or activities they have chosen. Students could be encouraged to do research on how a variety of terrestrial and aquatic invasive species are spread and how they can be controlled.)

Game 2 Narrative:

1. The **Humans** in the **Boat** are going from one lake where an invasive species called Zebra Mussels live to go fishing in another lake nearby. They don't know that some **Zebra Mussels** have attached themselves to their boat! (students acting as mussels will hang onto one of the elastic bands or pieces of string the Boat is carrying)
2. Once the new lake is reached, the Zebra Mussels release from the boat and lay eggs. Their young – called veligers – swim about and spread all through the lake. (students who are **Zebra Mussels go from the Boat and each tags 2 people from the Lakeshore, who then become Zebra Mussels**)
3. The new Mussels need to find a place to rest and grow. They travel down to the **Municipal Water Intake Pipes** in the lake. There is lots of water travelling through these pipes, and that water is carrying lots of food that the Mussels love to eat, so they settle down around these pipes.
4. The Municipal Water Intake Pipes start to get plugged with all of the Mussels, so they get choked up and start to gurgle because little water is getting through!
5. The people in the community who depend on this water call up the **Clean Team**, who arrive to clear the intake pipes. The **Clean Team members try to remove the Mussels from the Intake Pipes** and must take the wrist of individual mussels and remove them to the side of the play area (shoreline). **“Removed” Zebra Mussels** will count to twenty, then return with another remaining Lakeshore player (who then becomes a Zebra Mussel) to “clog” the intake pipes. The Humans have to “pay” the Clean Team (pretend to hand them money every time they bring a Mussel to shore). Repeat until students get the idea of how labour intensive and costly it is to control Zebra Mussels from clogging Intake Pipes. **2 members of the Clean Team** need to remain by the pipes to “protect” them.
6. Now the **Humans** and their **Boat will travel to the 3rd lake, along with the original 5 Zebra Mussel passengers**. They are intercepted by the **3 remaining members of the Clean Team**, who show the humans the effects of their actions (clogging of municipal water intakes). **How can the Clean Team stop the spread of the Zebra Mussels?**
7. Students should be guided to determine the following methods of controlling the spread of aquatic invasive species:
 - Drain water from **bilge, live wells, bait buckets**, trailer and wheels.
 - Wash **bait wells** with hot water.
 - Don't transport **bait** from an infested area!
 - Rinse the **hull** with hot water, high-pressure washer or dry in the sun for 5 days.

- Flush the engine **cooling system** with hot water (140F).
 - Carefully inspect **screens** and **water intakes** and **drain pipes** for mussels.
 - Protect boat hulls with anti-fouling paint.
 - Clean water intakes on boats.
8. Wrap up - The **Clean Team** has performed the necessary actions and removed the Zebra **Mussels** from the **Boat**. Now the **Humans** can drive the **Boat** to the next lake which will remain free of contamination.