

Biodiversity – Who Cares?

Chicago River Classroom Activity

Summary

Students play a game that demonstrates why having a rich variety of life is important to the survival of ecosystems and how invasive species are threatening local biodiversity.

Background

Biodiversity is defined as the variety of all life. It includes all the genes, species and habitats in a given area. Across the world, and right here in the Chicago River watershed, we are losing biodiversity at a rapid rate. So why does that matter? Biodiversity is important for a wide variety of reasons. People depend on natural products such as honey, timber and fish. People also tap the genetic biodiversity of the world in search of new drugs to cure and treat diseases and for genes to hybridize with our crops to increase their productivity. Biodiversity also supports the life systems of the earth, filtering water and cleaning air. People enjoy watching, photographing and exploring the rich species and habitat diversity of the world. Nature offers us a wealth of inspiration and opportunities for relaxation. It also inspires our creativity and challenges our minds as we try to understand the way the world works. Biodiversity can also be seen as valuable just because it is there. We do not necessarily have to use it or experience it for it to have some value to us. In addition, biodiversity can be seen as valuable and something needing protection because it is believed to have the intrinsic right to exist.

Another argument for maintaining biodiversity is that it leads to greater ecosystem stability. The argument follows that when there are a variety of species that all provide similar functions and one of them disappears the other species can take over and provide the same function. For instance if 5 different grasses provide food for one type of bird and one of the grasses disappears, the bird is likely to survive because it still has four different grasses it can eat. Research and mathematical modeling into the connection between diversity and stability has often found that diversity does in

Grade Level: 6th-12th

Duration: One class period

Objectives:

1. Students will be able to articulate some of the impacts of loss of biodiversity

Materials:

- ◆ M and M's © (two 1 lb. bags)
- ◆ Junior Mints © (one 1 lb. bag)
- ◆ Chocolate chips (one 1 lb. bag)
- ◆ Raisins (one 1 lb. bag)
- ◆ Small paper cups (2 for each student)
- ◆ Copies of Color Code Key (1 per student)

Standards:

3.B.4a, 3.C.3a, 4.A.3c, 17.B.3b



fact lead to stability, though it does depend on how you define diversity and stability and on some of the assumptions of the models.

Procedure

Before Class

- ◆ Before class, divide out the candy. For each student, place a handful of M&M's © in one cup and about 10 Junior Mints ©, 10 chocolate chips and 10 raisins in another cup.

Introduction and Instructions

- ◆ Tell students that a major threat today to healthy ecosystems, and the Chicago River, is loss of biodiversity. Today they will be modeling how ecosystems lose biodiversity and exploring some of the consequences.
- ◆ Pass out the candy.
- ◆ Tell students that the pile of M and M's © represents the biodiversity of a healthy river ecosystem. Different colors represent different organisms. Have them look at the color code key that you passed out to understand which colors represent which organisms. Have students pour the M&M's © out onto their desks.
- ◆ Tell students that the other types of candy and the raisins represent common river invasive species. (Be sure that students know that invasive species are organisms that do not belong in an ecosystem and compete with native species for resources, causing native species to disappear. Remind them that invasive species usually come from other countries, and are often so successful at taking over because they have no natural predators in the invaded ecosystem.)
- ◆ Have the students look at their color code keys to see what these candies represent. Have students keep these candies in the cup.

Playing the Game

- ◆ Read the invasive species scenarios and have the students follow the instructions at their desks. When they are told to remove M&M's ©, tell students they should put them in the empty cup (not their tummies yet!).
- ◆ If the students are instructed to remove a particular "organism" and do not have any more of that color, tell them to just add what has been instructed to add. It is not necessary to have no native species at the end of the game, there can be a few colored M&M's © left. At the end, each student's pile will be mostly brown, with just a few colored pieces left.

Discussing the Results

- ◆ What can you say about the colors representing your healthy river ecosystem?
A lot of colors, very colorful.
- ◆ What does the variety of all this colors represent?
The biodiversity of the healthy river ecosystem.
- ◆ What can you say about the appearance of the colors after the invasive species had come into the ecosystem?
It became mostly brown and drab.
- ◆ What does this change to mostly brown represent?
A loss of biodiversity.
- ◆ Which ecosystem would you rather visit, the colorful or the drab one?



Though this is a matter of opinion, I would rather visit the colorful one because there would be more interesting things to see.

- ◆ Which ecosystem do you think animals would rather visit because they could find more of what they need there?

The colorful one because there are more choices. In addition, since invasive species come from different parts of the world, they often are not tasty to local animals and are not as useful to them for shelter.

- ◆ You are familiar with food chains and food webs. How does the presence of invasive species disrupt a healthy food web?

As native species are displaced by invasive species, other species that depend on them are also affected and lost from the web. Because so many organisms in a food web are connected to each other, disrupting some can cause the collapse of the whole thing.

Reflection

Have students create a pamphlet showing the importance of biodiversity to the river and its watershed and what problems might be associated with a loss of variety. Tell the students to design this pamphlet in a way that would convince any person off the street of the importance of biodiversity.



Biodiversity Who Cares: Invasive Species Scenarios

- Purple loosestrife invades! Replace three Blue Flag Iris, two willow and one sugar maple with purple loosestrife. Blue Flag Iris can't come up through the purple loosestrife, and new willow and maple seedlings cannot grow on the banks as the purple loosestrife is blocking the light.
- Asian carp invades! Replace two largemouth bass and two bluegill with Asian carp. The carp is multiplying. Carp feed by digging in the soil at the bottom of the river. They toss up so much dirt that the water gets very cloudy and other species have trouble seeing and finding food.
- Zebra mussels invade! Replace three algae and two bacteria with zebra mussels. The zebra mussels are becoming so great in number that they are filter- eating large amounts of bacteria and algae.
- Restoration ecologists are able to remove some purple loosestrife. Take out two purple loosestrife and replace them with one willow and one maple. A few seedlings were able to take root.
- More Asian carp invade! Remove two Blue Flag Iris and two dragonflies. The carp have pulled up the roots of the irises while foraging for food and have eaten some dragonfly nymphs.
- Some Asian carp have succumbed to a disease. Replace two carp with one bluegill and one dragonfly nymph.
- Purple loosestrife invades with a vengeance! The city has cut down a few diseased trees leaving plenty of bare space. The loosestrife takes over this bare space. Replace two sugar maples and two willows with four purple loosestrife. Beavers have few trees to eat, so they choose to move on. Remove two beavers.
- The sugar maples, willows and Blue Flag Irises have been outcompeted by invasive species. Muskrats have few native plants to use to build their aboveground homes and to eat. Remove two muskrats.
- Volunteers have been hard at work releasing special beetles that eat purple loosestrife. Some of the plants die. Remove two purple loosestrife and replace them with two Blue Flag Irises.
- More zebra mussels invade! Someone collected them from Lake Michigan and decided that they didn't want them in their fish tank after all so they dumped them in the river. The mussels are eating a lot of bacteria and algae. Remove three bacteria and three algae and replace them with six zebra mussels.
- More Asian carp invades! Someone had a bunch of carp in a backyard pond and decided to dismantle the pond. They threw the carp into the river. The carp are clouding up the water so remove two bluegills, three largemouth bass and replace them with five carp. The carp have



eaten some dragonfly nymphs, remove three dragonfly nymphs and replace them with three carp.

- The amount of dragonfly nymphs in this area of the river is low. Therefore, there isn't much for green frogs to eat. Remove three green frogs.
- Native fish and frogs are becoming rare in this area of the river as more invasive species move in. Great Blue Herons and Belted Kingfishers decide to go to another area to look for food. Remove two Great Blue Herons and two Belted Kingfishers.
- Native fish and frogs are becoming rare in this area of the river as more invasive species move in. The food supply for Eastern Spiny Soft Shelled Turtles, snapping turtles and river otters is getting low. Remove two Eastern Spiny Soft Shelled Turtles, two snapping turtles and two river otters.

Biodiversity: Who Cares?: Color Code Key

Asian carp – Chocolate chips
Bacteria – Yellow
Beaver – Orange
Belted Kingfisher – Blue
Blue Flag Iris – Green
Bluegill – Tan
Dragonfly – Tan
Eastern Spiny Soft Shelled Turtle – Red
Great Blue Heron – Blue
Green frog – Red
Largemouth bass – Tan
Muskrat – Orange
River Otter – Orange
Purple loosestrife – Junior mints
Snapping turtle – Red
Spirogyra algae – Yellow
Sugar maple tree – Green
Willow tree – Green
Zebra mussel – Raisins