THE NEW KID ON THE BLOCK (1.5 Hours)

Addresses NGSS
Level of Difficulty: 1
Grade Range: 3-5

OVERVIEW

In this activity, students will learn how non-native species can damage the balance of an ecosystem. Students will use the web to explore various examples of invasive non-native plants and animals being introduced into an ecosystem. Some examples include Kudzu, Cane Toads, and Zebra Mussels. Students will also look at the impact invasive species have on humans as well as ecosystems.

Topic: Interdependence in Ecosystem and Ecosystem Dynamics

Real-World Science Topics

- Exploring the impact of invasive species on ecosystems as well as on human health and economics.
- Encouraging a responsible and sustainable relationship with the natural world around us.

Objective

After completing this activity, students will be able to explain how newly introduced species can damage the balance of an ecosystem. They will be able to identify how change in habitats caused by non-native invasive species can affect the native organisms living. Finally, they will be able to describe the importance of preventing and managing invasive species and ways to do this.

NGSS Three-Dimensions

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Developing and Using Models • Modeling in 3–5 builds on K–2 models and progresses to building and revising simple models and using models to represent events and design solutions. • Develop a model to describe phenomena. (5-LS2-1) **Engaging in Argument from Evidence** • Engaging in argument from evidence in 3–5 builds on K–2 experiences and progresses to critiquing the scientific explanations or solutions proposed by peers by citing relevant evidence about the natural and designed world(s). • Construct an argument with evidence. (3-LS4-3)	**LS2.A: Interdependent Relationships in Ecosystems** • The food of almost any kind of animal can be traced back to plants. Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. Some organisms, such as fungi and bacteria, break down dead organisms (both plants or plants parts and animals) and therefore operate as "decomposers." Decomposition eventually restores (recycles) some materials back to the soil. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem is one in	**Systems and System Models** • A system can be described in terms of its components and their interactions. (5-LS2-1) (3-LS4-4) **Connections to Engineering, Technology, and Applications of Science** **Interdependence of Engineering, Technology, and Science on Society and the Natural World** • Knowledge of relevant scientific concepts and research findings is important in engineering. (3-LS4-4)

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- Make a claim about the merit of a solution to a problem by citing relevant evidence about how it meets the criteria and constraints of the problem. (3-LS4-4)

Connections to the Nature of Science

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science explanations describe the mechanisms for natural events. (5-LS2-1)

which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- When the environment changes in ways that affect a place's physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3-LS4-4)

LS4.D: Biodiversity and Humans

- Populations live in a variety of habitats, and change in those habitats affects the organisms living there. (3-LS4-4)

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Background Information

The information in this section comes primarily from the National Invasive Species Council (NISC) at http://www.invasivespecies.gov.

What is an invasive species?

Invasive species are non-native to the ecosystem under consideration and whose introduction causes, or is likely to cause, economic, environmental, or human health harm. Invasive species can be plants, animals, or pathogens. It is important to note that not all non-native species are invasive. Some non-native species are actually beneficial to their new environment.

What are some of the ways that invasive species harm an ecosystem?

Some invasive plants increase the severity and frequency of wildfires. Invasive aquatic species can alter nutrient availability and water quality. They can also interfere with the flow of water. Certain invasive plants withdraw water from deep in the soil and reduce the amount available for other uses. Others do not hold the soil well, making land more prone to erosion. Certain invasive plants alter the amount of nutrients in soils. Some invasive species directly feed upon or make ill fish and wildlife. Invasive plant pathogens kill forest trees and prevent their re-growth. Invasive plants shade out desired plants. Some invasive species harm other species indirectly by competing for food and space. Invasive species interfere with the growth, reproduction, and development of other species. Some invasive species produce toxins that harm other species.

What are some of the ways invasive species harm human health?

The pollen of some invasive plants can increase the severity of respiratory allergies. The sap of some other invasive plants cause skin irritation. Invasive ants cause painful stings. Invasive Brown Tree Snakes and Black Spiny-tailed iguana deliver venomous bites. Invasive rodents, mosquitoes and ticks can transmit deadly pathogens. Diseases carried by non-native animals, such as West Nile Virus, can infect both humans and other animals and can be fatal to humans. The ballast of ships can move cholera and toxic algae.

Where are invasive species found?

Invasive species can be found in every type of habitat. They can be found in oceans, lakes, streams, estuaries, and wetlands. On land, they can be in croplands, rangelands, backcountry areas, fields, and forests. Some invasive species inhabit homes and urban environments. While invasive species are in many places, there are vast resources that need our protection.

What do invasive species cost the economy?

Overall estimates are hard to determine. However, damage from just six invasive species has been estimated at $74 billion a year.

What can be done to help prevent the spread of invasive species?

A helpful first step is to learn which invasive species are in your local area, and what actions are being done to manage them. Make others aware of invasive species. Avoid unintentional movement of invasive species as hitchhikers on items such as hiking boots, boat trailers, hay, mulch, and firewood. Replace the invasive plants growing in your garden with non-invasive alternatives. Get involved in organized efforts in your area to find and remove invasive species from local parks, playgrounds and campgrounds. Learn how to care for exotic aquarium fish and other pets and plants, so that they don't become a problem.

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Key Vocabulary

Common name – a name that is based on the normal language of everyday life; this kind of name is often contrasted with the scientific name for the same organism
Ecosystem – a biological community of interacting organisms and their physical environment
Food chain – a model showing a series of living things in which each one uses the next lower member of the series as a source of food/energy
Habitat – the natural home or environment of an animal, plant, or other organism
Herbivore – organisms that consumes only plants as their food source
Invasive – tending to spread prolifically and undesirably or harmfully
Native – a species that occurs naturally within a region, either evolving there or arriving and becoming established without human assistance
Scientific name – the proper name of living organisms often used by scientists, especially the taxonomic name of an organism that consists of the genus and species
Species – a group of living organisms consisting of similar individuals capable of exchanging genes or interbreeding.
Vine – a plant that has very long stems and that grows along the ground or up and around something such as walls, trees, and other tall objects

Materials Needed for Activity

- Video: Playing Smart Against Invasive Species (Trailer segment - 6 minutes, 6 seconds)
  http://www.fs.fed.us/invasivespecies/prevention/video/PlayingSmart/PlayingSmart00h06m06s/PlayingSmart00h06m06s.html
- *New Kid on the Block Handout* (see attachment below) and pencils for each student
- *Effect of Non-native Species on Food Chains* Card Set (see attachment below)
- *Invasive Species* Card Set (see attachment below)
- Computer/internet access – each group of 2 students will need access to a computer (or tablet) connected to the internet

Teacher Preparation

- Make copies of the *New Kid on the Block Handout* for each student (or group of two students depending on your preference).
- Queue the Playing Smart Against Invasive Species Trailer Video
- Print and cut *Effect of Non-native Species on Food Chains* Card Set – each student will need either a food web card or a scenario card
- Print and cut one *Invasive Species* Card Set
- Reserve computer lab or other technology to ensure student groups have access to a computer (or tablet) connected to the internet.

STEPS FOR *THE NEW KID ON THE BLOCK*

1. **Warm-up Activity:** Write the term "Invasive Species" on the board. Ask students what they think this term means. Make sure students understand that an invasive species can be any kind of living organism (an amphibian, plant, insect, fish, fungus, bacteria, or even an organism's seeds or eggs) that is not native to an ecosystem or habitat and causes harm.

   Show the US Forest Service Video: Playing Smart Against Invasive Species Trailer to students. After watching ask:

   What is the difference between a native and invasive species?
   What are some ways invasive species move into a new habitat?
   How can invasive species disrupt an ecosystem?
   Why is it important to be educated about invasive species?
   What are some things that can be done to help reduce the threat of invasive species?

2. Take a minute to review food chains with students. Remind them that a food chain is a model used to show how living things in an area are related with each other by the food they eat. Draw the following food chain on the board: Plants ➔ Insects ➔ Frogs ➔ Snakes ➔ Birds. Explain the energy flow that happens as one living thing consumes another. Ask students what would happen if there was disruption that causes the number of frogs to decrease significantly. Make sure students understand that disruptions in the chain cause issues for plants and animals at lower and higher levels in the chain. Discuss how plants and animals living in an area are very interdependent on each other.

3. Pass out either a food chain card or an invasive species scenario card to each student. Explain to students that they must find their corresponding number and pair up with that person. In other words, the student with Food Chain #1 will find the student with the scenario card 1 and pair up.

   Once in pairs, students must analyze the food chain and describe how the invasive species discussed in the scenario might affect the food chain. Once all pairs have analyzed and described, they must trade cards 5 times with various students around the room. Students then find their new partner and repeat the food chain analysis. Repeat this process several rounds as time allows.

4. Pass out the *New Kid on the Block Handout*. Tell students that they are going to research invasive species using the four websites listed on the handout. Allow each student group to draw two cards from the *Invasive Species* Card Set. Students will use the 4 websites to answer the "Research Questions" and complete the information table for each of the species they selected. It maybe helpful to show students the 4 websites and how to navigate and search for specific information on their species as a whole group before beginning individual research.

   As students work online in pairs, make sure to move around the room and help with navigating the websites, as well as explaining terminology that maybe unfamiliar to students.

5. After student groups have completed the handout, inform them that they will be sharing their research with their classmates. Draw a card from the *Invasive Species* Card Set. Ask a student group who researched that plant or animal to quickly share the effects that the non-native species has on the ecosystems it invades. Repeat this process (as time allows) asking a different student group to share each time.

6. **Wrap-up:** Conclude the lesson by facilitating a discussion about the impact invasive species have or can have on humans in the future. Ask:

   In what ways could the invasive species you learned about today affect humans?
   Do you think that invasive animals such as insects, rodents, or birds could pose a health risk to humans? Why or Why not?
   Could plants pose a threat to human health in any way?
   How much money would you guess is spent in the world each year on invasive species and the destruction they cause?

   Students should recognize that invasive species not only pose an ecological threat, but can also pose a significant economic and health threat to humans. Make sure students know that both plant and animal invasive organisms can pose a significant threat to the health of humans. Stress the importance of knowing how to decrease the chances of spreading invasive species and being educated about the local threat of invasive species.

Extension Activity

Now that students know the dangers of introducing non-native species into a well-established habitat, ask them to come up with a plan to prevent this from happening in areas around them. They must come up with 5 specific things that they will do to make sure they do not accidently introduce non-native species into an ecosystem.

Encourage them to visit local or state wildlife and conservation websites to determine what type of invasive species pose a local threat and what, if anything, can be done to help reverse the damage caused by these non-native plants and animals. One good source of information about invasive species in your area is the County's Extension Office, which is supported by the Land Grant University System and the USDA's Cooperative State Research Education and Extension Service (CSREES).

Sources

http://environmentalgovernance.org/research/issues/invasive-species/
http://www.csrees.usda.gov/Extension/index.html
http://www.nwf.org/wildlife/threats-to-wildlife/invasive-species.aspx
http://www.invasivespeciesinfo.gov/index.shtml
http://www.issg.org/database/welcome/
http://www.invasivespecies.wa.gov/priorities.shtml

Effect of Non-native Species on Food Chains Card Set (Page 1)

Grass → Frog → Snake → Hawk
Food Web #1

Grass → Grasshopper → Frog → Snake → Eagle
Food Web #2

Algae → Razor clam → Horseshoe crab → Sanderling bird
Food Web #3

Plants → Rabbit → Fox → Large cat (lynx)
Food Web #4

Plants → Insects → Rodents → Birds
Food Web #5

Phytoplankton → Zooplankton → Sardines → Tuna → Dolphin
Food Web #6

Phytoplankton → Small fish → Large fish → Bald eagle
Food Web #7

Algae → Freshwater shrimp → Dragonfly → Brown trout fish
Food Web #8

Effect of Non-native Species on Food Chains Card Set (Page 2)

1
A non-native herbivore is introduced to the ecosystem. This herbivore is an extremely heavy eater. It can eat almost 5 times as much grass as native herbivores.

2
A non-native fungus is somehow introduced to the ecosystem. This fungus infects amphibians such as frogs and causes them to become weak and unable to move as fast.

3
A non-native type of algae is introduced to the area by a shipping vessel. This non-native algae has chemicals that are very toxic to birds in the area. Clams eat the toxic algae. The toxins are then passed from the clams to the crabs that eat them.

4
Seeds from non-native plants are accidentally spilled in the area. Some of these seeds begin germinating and growing into large plants that produce a flower that is toxic to the native rabbit species.

5
An aggressive vine is introduced to the area. Over a 10-year span the vine has multiplied and spread so much that the other plants in the area are unable to get the sunlight they need to survive. Birds are unable to nest in the trees because the vines have covered many of the branches.

6
A non-native fish that feed only on sardines is released into the waters. The non-native fish eats much more than native fish to the area. The non-native fish only feeds off of sardines and has no other food source in these waters.

7
The small and large fish that live in these waters find shelter in meadows of seagrass. A non-native herbivorous turtle species is somehow introduced into the waters. It begins aggressively feeding on the seagrass because it has no other food source in the area.

8
A type of large shrimp, native to Asia, is being grown in shrimp farms along the U.S. coast. The winds from a hurricane caused many of these large non-native shrimp to escape from the shrimp farm. These shrimp are much larger and more aggressive than the native shrimp. They are now pushing the natives shrimp out of their habitat.

Invasive Species Card Set

Kudzu	Zebra mussels	Cane toads
Asian carp	Cogongrass	Feral pigs
European green crabs	Water hyacinth	Brown stink bugs
Killer bees	Northern snakehead	Starlings

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STUDENT HANDOUT

Name:

Date:

Research Websites:

http://www.nwf.org/wildlife/threats-to-wildlife/invasive-species.aspx
http://www.invasivespeciesinfo.gov
http://www.issg.org/database/welcome/
http://www.invasivespecies.wa.gov/priorities.shtml

Research Questions:

How do invasive species spread?	Why do invasive species pose such a threat?

What can you do to help curb the spread of invasive species?

Species #1: _____

Common Name	Scientific Name	Type of Organism (plant, animal, fungus, etc.)	Native Region(s)	Invaded Region(s)	How was the species introduced?

Describe the effects that the non-native species has had on the ecosystems it has invaded.

Species #2: _____

Common Name	Scientific Name	Type of Organism (plant, animal, fungus, etc.)	Native Region(s)	Invaded Region(s)	How was the species introduced?

Describe the effects that the non-native species has had on the ecosystems it has invaded.