

Interdependences in Ecosystems

Topics: Ecosystems, adaptations, food chains, life cycles



Department of
Environmental
Conservation

GRADE LEVEL: Middle School

Big Ideas:

- Ecosystems are dynamic and interconnected.
- Organisms are dependent on their environmental interactions both with other living things and with nonliving factors.
- Plants and animals have adaptations to help meet their basic needs.
- A healthy ecosystem is one in which multiple species of different types are each able to meet their needs.
- Maps serve as a representation of a geographic region.

Learning Objectives: *students will be able to...*

- Describe how plants and animals depend on each other and their environment.
- Describe an ecosystem in the Hudson River watershed and most of its biotic and abiotic components.
- Interpret organized observations and measurements using data charts.
- Conduct an experiment to investigate a phenomenon.
- Identify the behaviors and physical adaptations that allow animals to survive in their environment.
- Recognize how the distribution of animals varies geographically based on habitat requirements.
- Compare data to understand graphs and river phenomena.

New York State Science Learning Standards:

MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures.

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.

MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resources availability on organisms and populations of organisms in an ecosystem.

MS-LS2-2. Construct an explanation that predicts pattern of interactions among organisms across multiple ecosystems.

MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

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

Key Understandings:

- Ecosystems are dynamic and interconnected systems.
- Matter and energy move ecosystems through food webs.
- Plant and animal distribution vary geographically based on habitat requirements.
- Disruptions to any part of the ecosystem can lead to shifts in all of its populations.

Essential Questions:

- How does matter and energy move through an ecosystem?
- How can disruptions in one system cause changes in another?
- What is a healthy ecosystem?
- How are organisms adapted to the places that they live?
- How does what an organism eats affect its role in an ecosystem?
- Describe how invasive species affect the environment?

Students will know...

- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with non-living factors.
- When environments change, species adapt, move, or die.
- Key vocabulary terms.
- Energy in animals' food was once energy from the sun.
- Plants and animals have unique and diverse life cycles.
- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers.
- Being part of a group helps some animals obtain food, defend themselves, and survive. Groups may serve different functions and vary dramatically in size.
- Ecosystems are dynamic in nature; their characteristics can vary over time.

Vocabulary:

- Abiotic: non-living components, such as water, soil and atmosphere.
- Adaptation: a change or the process of change by which an organism or species becomes better suited to its environment.
- Biotic: living things within an ecosystem, such as plants, animals, and bacteria.
- Cellular respiration: a series of metabolic processes that take place within the cells of organisms to convert chemical energy from oxygen molecules or nutrients into adenosine triphosphate, and then release waste products.
- Energy: the ability to do work, to power activity; the sun (solar) and food are sources
- Food chain: the path by which energy in food moves from one organism to another
- Food web: interwoven food chains linking organisms to many food sources.
- Invasive: an organism that is not native to a particular area and introduced into a new environment.
- Life cycle: the sequence of forms and activities by which a living thing develops into an adult able to reproduce and restart the cycle.
- Native: a species that originated and developed in its surrounding habitat.
- Non-native: a species that is not indigenous, or native to a particular area.
- Organism: an individual living thing (plant, animal, bacteria, etc)
- Photosynthesis: process used by plants, algae and certain bacteria to harness energy from sunlight and turn it into chemical energy. Photosynthesis takes in the carbon dioxide produced by all breathing organisms and releases oxygen into the atmosphere.
- Predator: an animal that eats other animals.
- Prey: an animal taken as food by another animal.
- Specialized: adapted for a particular function or lifestyle.

Learning Plan: We recommend doing these lessons in sequential order; however, they can be done as individual lessons. Lessons have multiple links (videos, diagrams, activities) that can be used at the teacher's discretion depending on class time.

[Pictures of Hudson River animals, plants, and other organisms](#), & [New York Harbor Species ID Guide](#) are available to expand learning about food chains, habitats, life cycles, and other topics covered in these lessons as well as a Biodiversity [Poster](#).

Pre-assess: Use K-W-L to assess students' prior knowledge, have students write or draw in response to the essential questions. Have students draw/map the Hudson River ecosystem and write down anything they feel like they don't know about the Hudson.

Progress Monitoring: Formative assessment and teacher feedback should be ongoing throughout the lessons. Teachers should develop assessments based on their individual class needs. Think-pair share, exit tickets, interactive discussions, questions and listening, informal observations, quizzes and student work samples can all be used. Have students use their science knowledge and skills to write letters to government or business officials, create public information campaigns, or plan/implement a clean-up or tree-planting.

Lesson 1: Ecosystem Explorations- Students watch a video, then explore different ecosystems and learn how animal distribution varies geographically based on habitat and life cycle requirements.

- Video: [Vernal Pools](#)
- [Conservationist for Kids Reptiles and Amphibians](#)
- Pond Ecosystem [Student Reading](#) & [Questions](#)
- Wetlands Are... [Student Activity](#)
- Optional: Mapping Where Animals Live [Student Activity](#) & [Teacher Section](#)
- Optional: These Maps Are For the Birds [Student Activity](#) & [Teacher Section](#) & [Birding on the Hudson Video](#)

Lesson 2: Tracking Migratory Fish- Students will explore the interconnectedness of oceans and rivers by tracking the movement of migratory striped bass.

- River Runners: Tracking Striped Bass [Lesson Plan](#), [Student Reading](#), [Map 1](#), & [Map 2](#)
- Optional: Which Fish Where? [Student Activity](#) & [Teacher Section](#)

Lesson 3: Food Webs- Students watch a video, then learn that animals depend on each other and their physical environment by building Hudson River food chains and webs.

- Video: [Food Chains Compilation](#)
- New York Harbor Food Web [Student Activity](#) (pg. 37- 49)
- Plastics and the Food Web [Student Activity](#)
- Aquatic Ecosystem Exploration Field Study [Student Activity](#)
- Hudson River Food Web [Brackish Channel Diagram/With Arrows](#) & [Freshwater Diagram](#)
- Optional: Dining Out With Fishes and Birds of the Hudson [Student Activity](#) & [Teacher Section](#)

Lesson 4: Disruptions in Ecosystems- Students create a food web diagram and interpret data as they investigate how ecosystems change when new organisms are introduced.

- Introduction to Zebra Mussels [Student Activity](#)

- Exploring Abiotic Changes due to Zebra Mussels [Student Activity](#)
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Lesson 5: The Effect of Tides and Elevation on Wetland Plant Communities- Students watch a video, then study a freshwater tidal marsh to understand how tides impact shoreline plants.

- Video: [Freshwater Tidal Marshes on the Hudson River](#)
 - Wetland Plant Communities [Student Activity](#)
 - Video: [HRPK Pier 26 Tour](#)
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Lesson 6: SAV in (and out) of the Classroom- Students explore the growth and survival of a native plant, *Vallisneria americana*, commonly called water celery. Students will discover why plants, and in particular underwater plants, are important.

- Wild Water Celery [Student Activity](#)
 - SAV in (and out) of the Community Science [Classroom Activity](#)
 - Water Celery [Visual](#), [Fact Sheet](#) & [Sketch](#)
 - Extension: How Does Water Chestnut Impact the Hudson River? [Student Activity](#)
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Lesson 7: Invasive Travelers- Students watch a video, discuss how invasive species adapt to surviving in the environment, and complete a research project.

- Video: [Uninvited: The Spread of Invasive Species](#)
 - Alien Invasion [Student Reading](#)
 - Invasive Travelers [Student Activity](#)
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Teachers: Would you like to visit us at Norrie Point environmental education center, or have an educator visit your classroom in-person or virtually? Contact us to schedule a program: hrteach@dec.ny.gov

Resources:

Websites:

- [Hudson River Estuary Program Lesson Plans](#)
- [Hudson River Park Science at Home](#)
- [Brooklyn Bridge Park Education](#)
- [LDEO Hudson River Educational Resources](#)
- [Billion Oyster Project](#)
- [Hudson River Foundation Educational Resources Guide](#)
- [Hudson River Virtual River Series](#)
- [NYS Department of Environmental Conservation Education](#)
- [Chesapeake Bay Foundation](#)
- [American Museum of Natural History](#)
- [Hudson River Sloop Clearwater](#)