

Interdependence in Ecosystems

Topics: Ecosystems, adaptations, food chains, life cycles



Department of
Environmental
Conservation

GRADE LEVEL: High School

Big Ideas:

- Ecosystems are dynamic and interconnected.
- Organisms are dependent on their environmental interactions both with other living things and with nonliving factors.
- A healthy ecosystem is one in which multiple species of different types are each able to meet their needs.

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

- Research interdependent relationships in an ecosystem.
- Interpret organized observations and measurements using data charts and engage in argument from evidence.
- Conduct an experiment to investigate a phenomenon.
- Construct a scientific explanation based on evidence.
- Identify connections between biotic and abiotic components of the ecosystem.
- Examine the effect of tides and water level on wetland plant communities.

New York State Science Learning Standards:

HS-LS2-1. Use mathematical and/or computational representations to support explanations of biotic and abiotic factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-6. Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions but changing conditions may result in a new ecosystem.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity *human activities include the dissemination of invasive species.

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-4. Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5. Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

Key Understandings:

- Ecosystems are dynamic and interconnected systems.
- Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support.
- A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over

Essential Questions:

- How does matter and energy move through systems?
- 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 energy flow within an ecosystem?

long periods of time under stable conditions.

- Matter and energy move through ecosystems through food webs.
- Disruptions to any part of the ecosystem can lead to shifts in all of its populations.
- Variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
- A healthy ecosystem is one in which multiple species of different types are each able to meet their needs in a relatively stable web of life.

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.
- 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.
- 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 a public information campaigns, or planning/implementing 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](#)
 - Introduction to the Hudson: Journey down the River [Student Activity](#)
 - What are Freshwater Tidal Wetlands? [Student Activity](#)
-

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](#)
-

Lesson 3: Disruptions in Ecosystems- Students watch a video, then explore how invasive species have changed the Hudson River food web. Students examine the impact of the zebra mussel on the food web over time.

- Video: [Biodiversity](#)
 - Hudson River Food Webs [Student Activity](#)
 - Aquatic Ecosystem Exploration [Student Activity](#)
 - Hudson River Food Web [Brackish Channel Diagram/With Arrows](#) & [Freshwater Diagram](#)
-

- Optional: Introduction to Zebra Mussels [Student Activity](#) & Exploring Abiotic Changes due to Zebra Mussels [Student Activity](#)
-

Lesson 4: 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](#)
-

Lesson 5: Submerged Aquatic Vegetation (SAV): Influence on the Hudson River System- Students will explore the different SAV in the Hudson, their roles, and their current status through a combination of lessons and activities.

- Submerged Aquatic Vegetation: Influence on the Hudson River System [Lesson Plan](#) & [Student Activity](#)
 - SAV's Role in the Hudson River System [Presentation](#)
 - [SAV Species Cards](#)
 - [Hudson River Map](#)
 - [Stony Point SAV Transects](#)
 - Water Celery [Informational Sheet](#)
 - Extension: [How Does Water Chestnut Impact the Hudson River?](#)
-

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](#)