

# Into the Outdoors

## THE WALLEYE FOOD WEB

Developed by: Rachel Konkle

### In This Activity ...

*Students will research, debate and develop food webs and trophic pyramids for walleyes that live in river and lake ecosystems. Their food webs will consider the direct feeding relationships and flow of energy between walleye and other organisms in differing ecosystems and the effects humans can have on these food webs.*

### Educational Partners



FISH BIOLOGY,  
ENVIRONMENTAL SCIENCE

**GRADE LEVELS**

Middle School - Grades 6-8

**CONTENT AREA**

Ichthyology, Biology, Environmental Science, Life Science

**UNIT THEME**

Ecology

**TOPIC**

Food Webs, Walleye Biology, Predator Prey Relationships, Invasive Species, Natural Resource Management, Trophic Levels

**TIME REQUIRED**

Three, 45-minute sessions



## OVERVIEW

The **food web** is an important ecological tool that fisheries biologists use to uncover the feeding relationships within a biotic community. Simply, a food web charts the transfer of food energy from plants to herbivores to carnivores within the community. Indeed, a food web looks like a “web,” or series of arrows connecting the organisms that feed on each other. One food web contains a multitude of **food chains** to describe this energy transference. A **food chain** is one path that energy travels from micro-organism to plant to herbivore to carnivore. Interconnecting all of the food chains in an ecosystem creates the food web.

**Fisheries biologists** are scientists that specialize in studying fish populations and their aquatic ecosystems. Food webs can tell fisheries biologists a lot about an ecosystem. By revealing predator-prey relationships, scientists can categorize aquatic organisms into different **trophic levels**.

- First trophic level is the **primary producers**, which are usually plants, algae, or plankton that use photosynthesis to gather their own energy from the sun.
- Second level is the **primary consumers**, which are herbivores who consume the primary producers.
- Third level is **secondary consumers**, which are omnivores and carnivores that consume the primary producers and consumers.
- Fourth level is **tertiary consumers**, which are carnivores that eat the secondary consumers.
- Fifth level is **apex predators**, which are the top predators and do not have any natural predators.

Food webs also reveal how organisms depend on several organisms for their survival. When one organism is removed from the food web, other organisms lose a source of energy. This can weaken or break the other links in the food web

since organisms have less energy within the ecosystem to survive on. **The autotrophs or primary producers are the foundation of all ecosystems.** These organisms supply oxygen to environments through photosynthesis and give the largest amount of biomass to the biological community. **Biomass** is the amount of organic matter inside plants and animals that is used for energy production. When an organism consumes this organic material, they receive only 10% of the total energy. Therefore, the biomass decreases with each trophic level, with plants being the highest in biomass. That is why healthy food webs will have an abundance of plants, many herbivores, some omnivores, and very few carnivores. Thus, when primary producers are threatened or die out in a biotic community, the entire ecosystem can be affected as well.

**Apex or top predators can have profound impacts on the ecosystem as well.** If an apex predator were removed from the ecosystem, there is nothing to limit the population growth and consumption of other carnivores and herbivores. With little control, this can lead to overpopulation, habitat degradation, population crashes and other trophic cascades that change ecosystems. **Humans are also an apex predator that can have profound impacts on aquatic food webs.** They can overharvest fish populations, introduce invasive (non-native) species, or pollute aquatic ecosystems.

Walleye are a popular gamefish species that fisheries biologists study. In their lifetime, walleyes can live in both lake and river ecosystems for spawning, foraging, and overwintering areas. In this lesson activity, students will compare the trophic pyramids and food webs of walleyes that live in river and lake ecosystems. Their presentations and group discussions will evaluate the interconnections between organisms and trophic levels as well as the impacts that walleyes and humans can have on food webs and biotic communities.



**ENDURING UNDERSTANDING:**

Students will understand how food webs can determine the feeding relationships and biotic community within different aquatic ecosystems. Students will also understand the value to decoding food webs for the health of humans and ecosystems.

**CONTENT OBJECTIVES:**

Students will decode the organisms, trophic levels, and biomass to develop their food webs. Students will also determine the roles walleyes and humans have in biotic communities and ecosystems through group discussion and debates.

**LEARNER OUTCOMES:**

Students will use video and online research to determine predator-prey relationships to develop their walleye food webs and trophic pyramids of river and lake ecosystems. Students will also debate the merit of food webs by discussing the impacts walleyes and humans have on biotic communities.

**PROCESS OBJECTIVES:**

Students will work in small and large groups to process new information and use evidence to come to conclusions.

**MATERIALS NEEDED:**

(for each group, for each student)

- Access to computers and the internet
- Walleye Biology video and background information at: <http://intotheoutdoors.org/topics/walleye-biology/>
- Pre-lesson Student Worksheet with questions to fill in while watching the video
- Student Worksheets for each group
- Large Paper Roll
- Art supplies for each group: (scissors, markers, string, glue)



## PROCEDURES

### Session 1

Before watching the *Walleye Biology* classroom video or reading the website background information, ask students what they already know about predator-prey relationships between organisms. Then ask the students to brainstorm how they could chart this and why this would be useful for science. Lead a short discussion on who or what career could sample aquatic environments to understand the biological community in an area.

Have students download, or print and distribute the **Pre-Lesson Student Worksheet** (copy contained on the web link). Instruct students to fill in the worksheet while watching the video. Go over the questions with the students before viewing so they know what to look and listen for. After watching the video, review and discuss the answers to the worksheet questions as a class.

Next, divide the class into four large groups. Assign half the class to “river ecosystems” and the other half to “lake ecosystems”. Then evenly assign the following roles to the students in each group:

- **Predator Expert**
- **Trophic Specialist**
- **Biomass Investigator**
- **Environmental Scientist**

Have students download and print, or hand out to each student their respective **Walleye Food Web Worksheet** (copy contained on the web link). Ask them to review the details and assignments of the worksheet in preparation for Session 2.

### Session 2 – Team Research & Fishing Report Development

In their assigned groups, have students perform online research from links provided and from other sources they discover. The worksheets give instructions and research options that will guide students in their information gathering. Then, have the small groups discuss and design their walleye food web and trophic pyramid on two large rolls of paper. Encourage the students to paint or sketch their aquatic ecosystem onto the paper roll, and place organisms in their niche. The students will design their food webs with pictures or drawings of the species, labels, and arrows showing the flow of energy. Inform each group they will present their food web and trophic pyramid to the class. Their presentation must be supported by factual research and consider what food sources are important to the walleye in their ecosystem.



**Session 3 – Fishing Report Presentations and Class Debate**

Have each group present their **food web and trophic pyramid** with supporting research to the class. Limit each group to four-minute presentations followed by two minutes of questions by the other groups.

After all the groups present their food webs, open the floor to discussion on which food sources are important to the walleye in river and lake ecosystems. First, challenge the students to analyze the similarities and differences between the food webs. Then, pose questions about what would happen if certain species or trophic levels were taken away or overpopulated.

**You may use the questions below to guide the discussion:**

1. What are the major differences between river and lake food webs?
2. Are the lake and river food webs similar in any way?
3. What could possibly cause these similarities or differences?

**SIMILARITIES IN FOOD WEBS:**

- Certain feeding relationships between species,
- the trophic levels,
- some species need both ecosystems to survive,
- rivers are connected to lakes meaning certain species can travel between both ecosystems

**DIFFERENCES IN FOOD WEBS:**

- Species may select certain abiotic factors in their habitat, such as water temperatures, depths, oxygen levels, cover, food, space.
  - Over-competition with another species, invasive species, and natural disasters may cause changes in food webs.
4. What role do walleyes have on the community? **Apex predators**
  5. What did you learn about a walleye's food needs in both river and lakes?
  6. What kinds of effects could humans have on these food webs?
  7. What would happen if some of the primary producers were taken away? What would happen to the food web? **Trophic cascade. If the bottom of the food web is disturbed, every organism in the biotic community can be affected, including the walleye.**
  8. What would happen if humans overfished the walleye population? What would happen to the rest of the food web? **Apex predators control fish numbers. If apex predators disappear, other species of fish can overconsume herbivores and other organisms.**
  9. Humans may introduce invasive species to a food chain. What could an invasive species do to a food chain? Are there any invasive species shown in people's diagram? **Invasive species can disturb and alter**

food webs. For example, zebra mussels were introduced by ballast water from ships in the Great Lakes. Zebra mussels over consumed plankton populations that crustaceans and baitfish depended on. The baitfish alewives nearly collapsed due to increased depredation from chinook salmon and less plankton for food. With less alewives to eat, walleye had to prey on yellow perch instead, which is a cause of concern for biologists.

10. How are food webs useful for anglers? Food webs can show organisms that live in an aquatic community and their relationships to each other. Anglers can learn what bait mimic to use by analyzing the food web. They may also discover how pollution, overharvesting, and habitat degradation can alter and have trophic cascades on biotic communities.

Have the students re-evaluate their initial conclusions from their presentations. Then have the students share what new conclusions their groups found. Students should find that all organisms in the food web are important to the walleye because they are all interconnected. Students should also conclude that primary producers are the foundation to the food web.

**Conclude by discussing** why it is important that fisheries biologists study the food web for fish populations ... for humans ... and for ecosystems.

## ASSESSMENT

- Students will be informally assessed based on their participation within their groups and during class presentations and discussions.
- Teachers could collect the Pre-Lesson Student Worksheets and formally assess the discussion notes students took during the video to check for completion.
- Students can be assessed on meeting the formal learning objectives based on how thoroughly students completed their group worksheets and food webs.
- Students can be evaluated on their presentations during Session 3.

## EXTENSION ACTIVITIES

Students can use their food webs to decode the prey that walleye anglers may target to find and catch walleye. Then, they can build a tackle box by researching which live or artificial bait anglers should use in that ecosystem. Students can insert booklets or pamphlets that forewarn anglers about how they can affect the biotic community and food web through overharvesting, pollution, or habitat degradation. Teachers can help students distribute their tackle box to local bait and tackle stores, fishing clubs, or marinas as a reference for anglers.

To build a real food web of an aquatic area, students can take a field trip to a water body and sample for fish, arthropods, and benthic organisms. Some equipment they may use are D-nets, seine nets, or heiss samplers. Fisheries biologists or state wildlife agencies can be contacted to guide the trip or supply resources.

## RESOURCES FOR TEACHERS AND STUDENT RESEARCH

<https://wwwrcamnl.wr.usgs.gov/isoig/projects/fingernails/foodweb/definition.html>

<https://www.fishbase.se/Summary/SpeciesSummary.php?ID=3516&AT=walleye>

<https://www.nationalgeographic.org/encyclopedia/food-web/7th-grade/>

[http://www.biokids.umich.edu/critters/Sander\\_vitreus/](http://www.biokids.umich.edu/critters/Sander_vitreus/)

<https://www.iowadnr.gov/Fishing/Iowa-Fish-Species/Fish-Details/speciescode/wae>

<https://www.fws.gov/fisheries/freshwater-fish-of-america/walleye.html>

## STANDARDS

The following **National Common Core Standards** can be met teaching:

### THE WALLEYE FOOD WEB

#### Grade 6:

CCSS.ELA-LITERACY.RI.6.1	Cite textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
CCSS.ELA-LITERACY.RI.6.2	Determine a central idea of a text and how it is conveyed through particular details; provide a summary of the text distinct from personal opinions or judgments.
CCSS.ELA-LITERACY.RI.6.4	Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings.
CCSS.ELA-LITERACY.RI.6.7	Integrate information presented in different media or formats (e.g., visually, quantitatively) as well as in words to develop a coherent understanding of a topic or issue.
CCSS.ELA-LITERACY.W.6.2	Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
CCSS.ELA-LITERACY.W.6.4	Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
CCSS.ELA-LITERACY.W.6.6	Use technology, including the Internet, to produce and publish writing as well as to interact and collaborate with others; demonstrate sufficient command of keyboarding skills to type a minimum of three pages in a single sitting.
CCSS.ELA-LITERACY.W.6.7	Conduct short research projects to answer a question, drawing on several sources and refocusing the inquiry when appropriate.
CCSS.ELA-LITERACY.W.6.8	Gather relevant information from multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.
CCSS.ELA-LITERACY.W.6.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.



- CCSS.ELA-LITERACY.SL.6.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 6 topics, texts, and issues, building on others’ ideas and expressing their own clearly.
- CCSS.ELA-LITERACY.SL.6.2 Interpret information presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how it contributes to a topic, text, or issue under study.
- CCSS.ELA-LITERACY.SL.6.3 Delineate a speaker’s argument and specific claims, distinguishing claims that are supported by reasons and evidence from claims that are not.
- CCSS.ELA-LITERACY.SL.6.4 Present claims and findings, sequencing ideas logically and using pertinent descriptions, facts, and details to accentuate main ideas or themes; use appropriate eye contact, adequate volume, and clear pronunciation.
- CCSS.ELA-LITERACY.SL.6.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.
- CCSS.ELA-LITERACY.SL.6.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
- CCSS.ELA-LITERACY.L.6.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- CCSS.ELA-LITERACY.L.6.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
- CCSS.ELA-LITERACY.L.6.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- CCSS.ELA-LITERACY.L.6.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 6 reading and content, choosing flexibly from a range of strategies.
- CCSS.ELA-LITERACY.L.6.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
- CCSS.ELA-LITERACY.L.6.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

**Grade 7:**

- CCSS.ELA-LITERACY.RI.7.1 Cite several pieces of textual evidence to support analysis of what the text says explicitly as well as inferences drawn from the text.
- CCSS.ELA-LITERACY.RI.7.2 Determine two or more central ideas in a text and analyze their development over the course of the text; provide an objective summary of the text.
- CCSS.ELA-LITERACY.RI.7.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of a specific word choice on meaning and tone.
- CCSS.ELA-LITERACY.W.7.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- CCSS.ELA-LITERACY.W.7.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-LITERACY.W.7.6 Use technology, including the Internet, to produce and publish writing and link to and cite sources as well as to interact and collaborate with others, including linking to and citing sources.
- CCSS.ELA-LITERACY.W.7.7 Conduct short research projects to answer a question, drawing on several sources and generating additional related, focused questions for further research and investigation.
- CCSS.ELA-LITERACY.W.7.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others



while avoiding plagiarism and following a standard format for citation.

- CCSS.ELA-LITERACY.W.7.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.
- CCSS.ELA-LITERACY.SL.7.1 Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 7 topics, texts, and issues, building on others’ ideas and expressing their own clearly.
- CCSS.ELA-LITERACY.SL.7.2 Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.
- CCSS.ELA-LITERACY.SL.7.3 Delineate a speaker’s argument and specific claims, evaluating the soundness of the reasoning and the relevance and sufficiency of the evidence.
- CCSS.ELA-LITERACY.SL.7.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with pertinent descriptions, facts, details, and examples; use appropriate eye contact, adequate volume, and clear pronunciation.
- CCSS.ELA-LITERACY.SL.7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.
- CCSS.ELA-LITERACY.SL.7.6 Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
- CCSS.ELA-LITERACY.L.7.1 Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
- CCSS.ELA-LITERACY.L.7.2 Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
- CCSS.ELA-LITERACY.L.7.3 Use knowledge of language and its conventions when writing, speaking, reading, or listening.
- CCSS.ELA-LITERACY.L.7.4 Determine or clarify the meaning of unknown and multiple-meaning words and phrases based on grade 7 reading and content, choosing flexibly from a range of strategies.
- CCSS.ELA-LITERACY.L.7.5 Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
- CCSS.ELA-LITERACY.L.7.6 Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

**Grade 8:**

- CCSS.ELA-LITERACY.RI.8.1 Cite the textual evidence that most strongly supports an analysis of what the text says explicitly as well as inferences drawn from the text.
- CCSS.ELA-LITERACY.RI.8.2 Determine a central idea of a text and analyze its development over the course of the text, including its relationship to supporting ideas; provide an objective summary of the text.
- CCSS.ELA-LITERACY.RI.8.4 Determine the meaning of words and phrases as they are used in a text, including figurative, connotative, and technical meanings; analyze the impact of specific word choices on meaning and tone, including analogies or allusions to other texts.
- CCSS.ELA-LITERACY.W.8.2 Write informative/explanatory texts to examine a topic and convey ideas, concepts, and information through the selection, organization, and analysis of relevant content.
- CCSS.ELA-LITERACY.W.8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-LITERACY.W.8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas efficiently as well as to interact and collaborate with others.

CCSS.ELA-LITERACY.W.8.7	Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
CCSS.ELA-LITERACY.W.8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation.
CCSS.ELA-LITERACY.W.8.9	Draw evidence from literary or informational texts to support analysis, reflection, and research.
CCSS.ELA-LITERACY.SL.8.1	Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 8 topics, texts, and issues, building on others' ideas and expressing their own clearly.
CCSS.ELA-LITERACY.SL.8.3	Delineate a speaker's argument and specific claims, evaluating the soundness of the reasoning and relevance and sufficiency of the evidence and identifying when irrelevant evidence is introduced.
CCSS.ELA-LITERACY.SL.8.4	Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.
CCSS.ELA-LITERACY.SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
CCSS.ELA-LITERACY.SL.8.6	Adapt speech to a variety of contexts and tasks, demonstrating command of formal English when indicated or appropriate.
CCSS.ELA-LITERACY.L.8.1	Demonstrate command of the conventions of standard English grammar and usage when writing or speaking.
CCSS.ELA-LITERACY.L.8.2	Demonstrate command of the conventions of standard English capitalization, punctuation, and spelling when writing.
CCSS.ELA-LITERACY.L.8.3	Use knowledge of language and its conventions when writing, speaking, reading, or listening.
CCSS.ELA-LITERACY.L.8.4	Determine or clarify the meaning of unknown and multiple-meaning words or phrases based on grade 8 reading and content, choosing flexibly from a range of strategies.
CCSS.ELA-LITERACY.L.8.5	Demonstrate understanding of figurative language, word relationships, and nuances in word meanings.
CCSS.ELA-LITERACY.L.8.6	Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases; gather vocabulary knowledge when considering a word or phrase important to comprehension or expression.

**Grades 6-8:**

CCSS.ELA-LITERACY.RST.6-8.1	Cite specific textual evidence to support analysis of science and technical texts.
CCSS.ELA-LITERACY.RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
CCSS.ELA-LITERACY.RST.6-8.4	Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 6-8 texts and topics.
CCSS.ELA-LITERACY.RST.6-8.7	Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).
CCSS.ELA-LITERACY.RST.6-8.8	Distinguish among facts, reasoned judgment based on research findings, and speculation in a text.
CCSS.ELA-LITERACY.RST.6-8.9	Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.
CCSS.ELA-LITERACY.WHST.6-8.2	Write informative/explanatory texts, including the narration of historical events, scientific procedures/

- experiments, or technical processes.
- CCSS.ELA-LITERACY.WHST.6-8.4 Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- CCSS.ELA-LITERACY.WHST.6-8.5 With some guidance and support from peers and adults, develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on how well purpose and audience have been addressed.
- CCSS.ELA-LITERACY.WHST.6-8.6 Use technology, including the Internet, to produce and publish writing and present the relationships between information and ideas clearly and efficiently.
- CCSS.ELA-LITERACY.WHST.6-8.7 Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration.
- CCSS.ELA-LITERACY.WHST.6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation
- CCSS.ELA-LITERACY.WHST.6-8.9 Draw evidence from literary or informational texts to support analysis, reflection, and research.

## Next Generation Science Standards for ...

### THE WALLEYE FOOD WEB

- 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. [Clarification Statement: Emphasis is on tracing movement of matter and flow of energy.]
- MS-LS2-1. Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]
- MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. [Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]
- MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. [Clarification Statement: Emphasis is on describing the conservation of matter and flow of energy into and out of various ecosystems, and on defining the boundaries of the system.]
- MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]