The Evolution of the T2L Science Curriculum

Over the last four years, the Teach to Learn program created 20 NGSS-aligned science units in grades K-5 during our summer sessions. True to our plan, we piloted the units in North Adams Public Schools, and asked and received feedback from our science fellows and our participating teachers. This feedback served as a starting point for our revisions of the units. During year 2 (Summer of 2015), we revised units from year 1 (Summer/Fall 2014) and created new units to pilot. In year 3, we revised units from years 1 and 2 and created new units of curricula, using the same model for year 4. Our understanding of how to create rich and robust science curriculum grew, so by the summer of 2018, our final summer of curriculum development, we had created five exemplar units and established an exemplar unit template which is available in the T2L Toolkit.

We made a concerted effort to upgrade all the existing units with exemplar components. We were able to do much, but not all. So, as you explore different units, you will notice that some contain all elements of our exemplar units, while others contain only some. The fully realized exemplar units are noted on the cover page. We did revise all 20 units and brought them to a baseline of "exemplar" by including the Lessons-At-A-Glance and Science Talk elements.

Grade 5 Food Webs

MCLA NAPS Williams

Teach To Learn

A collaboration between MCLA, Williams College, and North Adams Public Schools

Funded by NSF DUE-IUSE Award #1432591

T2L Curriculum Unit

Food Webs

Life Science/ Grade 5

How do different animals (including humans) interact with one another and the world? Why do we need the sun? Why should we care about conserving nature? In this unit, students will further their knowledge of various organisms while exploring the answers to these questions. Students will be able to categorize organisms into groups of producers, consumers, or decomposers, as well as herbivores, carnivores or omnivores. Students will also explore various predator-prey relationships.

After completing this unit (and CEPA), students may reach some of the following conclusions: (1) the depletion of one food source can affect multiple animals, (2) the depletion of one food source usually affects primary consumers more than higher tier consumers, (3) animals that have more than one food source are not as affected by the extinction of certain prey in the ecosystem, and (4) deforestation is a significant problem because it results in change in habitat and therefore available resources. Students will further their scientific knowledge by using technology and engaging in hands on artistic and kinesthetic activities. This unit provides opportunities for students to engage with partners to help solidify their learning.

This unit was developed with National Science Foundation funding (Grant #1432591). It is a DRAFT document that will be revised as the unit is piloted and feedback received.

Unit Creation and Revision History

Authors, Summer 2014

Veronica Gould, Undeclared major, Williams College
Cindy Le, Asian Studies and Economics major, Williams College
Lindsay Osterhoudt, Science Coordinator, North Adams Public Schools
Lisa Tanner, Grade 5 Math/Science Teacher, North Adams Public Schools
Katie Swoap, Undeclared major, Williams College
Dvivid Trivedi, Economics major, Williams College

Revisions, Summer 2015

Dylan Caples, Chemistry major, Massachusetts College of Liberal Arts
Michael R. Smith, Elementary Education and English major, Massachusetts College of Liberal Arts
Grace Sullivan, English and Women's Studies major, Williams College
Darla M. Torres, Undeclared major, Williams College

Revisions, Summer 2018

Matthew Rowchowdhury, Physics major, Williams College

Project Manager, Leslie Rule, Massachusetts College of Liberal Arts

License/Copyright Information

This unit was developed with funding from the National Science Foundation DOE-IUSE Award No. 1432591
This unit is downloadable at http://mcla.edu/teach-to-learn

Table of Contents

Lesson at a Glance 5
Lesson Feature Key 7
Unit Plan 8
Tiered Vocabulary List 13

Lesson Plans

Lesson 1: How Plants Make Food 14
Lesson 2: Explore an Ecosystem 22
Lesson 3: Producers Get Energy From the Sun 28
Lesson 4: Consumers Eat Producers 33
Lesson 5: Decomposers 40
Lesson 6: Food Web Models 46
Lesson 7: Not Those Pyramids 52
Lesson 8: Trophic Levels in the Ocean 59
Lesson 9: Complex Interactions 64

Unit resources

Curriculum Embedded Performance Assessment (CEPA) 71
Science Talk and Oracy in T2L 72
List of Unit Resources 74

Teach To Learn
A collaboration between MCLA, Williams College, and North Adams Public Schools
Funded by NSF DUE-IUSE Award #1432591

Lessons at a Glance

 Accessing internet

 Technology integration

 YouTube Video

 Outdoor education

 Movement

 Lab work

Lesson	Core Activities	Extensions	Aspects of Lesson
1.How Plants Make Food	• Set Up Plant Experiments	•	
2.Explore an Ecosystem	• Observe Animals in the Field • Producers, Consumers, and Decomposers	•	
3.Producers Get Energy From the Sun	• Photosynthesis Video and Web Activity • Discussion	• Photosynthesis Theatre	 (in extension) 
4. Consumers Eat Producers	• Food Chain Cards • Food Chain Tag	• Panther Hunt	

5. Decomposers	• Decomposition Video • Decomposing Bags Activity	•	
6. Food Web Models	• *Life In A Meadow* Reading • Building Food Webs	•	
7. Not Those Pyramids	• Trophic Level Videos • Modeling Energy Loss • Packing Peanut Pass	•	
8.Trophic Levels in the Ocean	• Marine Food Webs • Build Your Own Web	•	
9. Complex Interactions	• Population • Unbalanced Ecosystem Scenarios	•	

Lesson Feature Key

Lessons in this unit include a number of features to help instructors. This key is a quick guide to help identify and understand the most important features.

Icons

Talk science icon: Look for this icon to let you know when to use some of the talk science strategies (found in the unit resources of this unit)

Anchor phenomenon icon: Indicates a time when an anchoring scientific phenomenon is introduced or when an activity connects back to this important idea.

Text Formatting:

[SP#: ....] Any time you see a set of brackets like this, it indicates that students should be engaged in a specific science or engineering practice.

Underlined text in the lesson: This formatting indicates important connections back to the central scientific concepts and is useful to note these connections as an instructor, as well as for students.

Callouts

Teaching Tip

In these call out boxes, you'll find tips for teaching strategies or background information on the topic.

Student Thinking Alert

Look out for common student answers, ways in which students may think about a phenomenon, or typical misconceptions.

UNIT PLAN

Stage 1 Desired Results		
5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment: a. show that plants produce sugars and plant materials; b. show that some animals eat plants for food and other animals eat the animals that eat plants; and c. show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. [Clarification Statement: Emphasis is on matter moving throughout the ecosystem. Waste includes matter in the form of gasses (such as air), liquids (such as water), or solids (such as minerals or nutrients).] [Assessment Boundary: Assessment does not include molecular explanations.] 5-PS3-1. Use a model to describe that the food animals digest: a. contains energy that was once energy from the sun, and b. provides energy and materials for body repair, growth, motion, body warmth, and reproduction.	***Meaning***	
	UNDERSTANDINGS **U** ***Students will understand that…*** ● **Plants acquire their resources for growth chiefly from air and water. (5-LS1-1)** ● **Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. (5-LS2-1)** ● **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.** ● **Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gases, and water, from the environment, and**	**ESSENTIAL QUESTIONS** **Q** 1. **How do different animals (including humans) relate to each other and the world? What role do humans play?** 2. **Why do we need the sun?** 3. **Why should we and how should we care about conservation?**

[Clarification Statement: Examples of models could include diagrams and flow charts.] [Assessment Boundary: Details of photosynthesis or respiration are not expected.] 5-LS1-1. Support an argument with evidence that plants get the materials they need for growth and reproduction chiefly through a process in which they use air, water, and energy from the sun to produce sugars and plant materials. [Assessment Boundary: The chemical formula or details about the process of photosynthesis is not expected. 3-5 LS-2 Identify the structures in plants (leaves, roots, flowers, stem, bark, wood) that are responsible for food production, support, water transport, reproduction, growth, and protection. 3-5 LS.11 Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers. **ELA Reading Standard:** 2. Determine one or more main ideas of a text and explain how they are supported by key details; summarize a text.	**release waste matter (gas, liquid, or solid) back into the environment. (5-LS2-1)** ***Student Learning Targets*** ***Students will be able to say:*** • I can list the resources that plants need to grow. • I can record observations about *Brassica* plants. • I can identify consumers, producers and decomposers in your environment. • I can describe why sunlight is necessary for plants. • I can provide evidence that plants make their own food from water, air, and energy from the sun captured by their green leaves. • I can identify and categorize primary, secondary and tertiary consumers. • I can give evidence of the changes that might occur when the number of producers or consumers (primary, secondary, or tertiary) changes. • I can describe how organisms are connected using the words omnivore, herbivore and carnivore. • I can develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment. • I can show that some animals eat plants for food and other animals eat the animals that eat plants. • I can trace the flow of materials through a food web and support an argument that plants get materials they need for growth through air, water and energy from the sun. • I can explore the interactions (through a model) between a producer and two consumers and how they might change over time. • I can trace the flow of energy in a food chain.	

ELA Writing Standard: 1.Write opinion pieces on topics or texts, supporting a point of view with reasons and information. a. Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped in paragraphs and sections to support the writer's purpose. b. Provide logically ordered reasons that are supported by facts and details. **ELA Writing Standard (2017)** 3.Write narratives in prose or poem form to develop experiences or events using effective literary techniques, descriptive details, and clear sequences. d. Use concrete words and phrases and sensory details to convey experiences or events precisely.	
Stage 2 – Evidence	
Evaluative Criteria	**Assessment Evidence**
Pre-unit Assessment (if any) ● Optional Pre-unit Assessment	**Show What You Know!** Many lessons contain MCAS style questions and open response questions to assess students understanding of the concepts presented in the lesson. The classroom teacher should administer the questions sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering. Unit Assessment: CEPA- Model a Food Web Each student will pick an animal or plant to model and identify the role of his or her chosen

	species in the given food web (for example: primary consumer, secondary consumer, producer, decomposer, herbivore, omnivore, carnivore). Students must incorporate a given set of factors into their food web model, such as the sunlight, water, or habitat. Must include five animals or plants that their chosen organism eats or is eaten by, and be well sketched, labeled, and colored. After students are finished with this part, tell them that the animal or plant goes extinct, and should be "crossed off" the food web. Students should then write three paragraphs about the impact of this extinction, and what happens to everything else in their food web, they should also write about the impact on the environment and the importance of conservation. More advanced students can elaborate on how their animal might adapt.

Stage 3 – Learning Plan

Students may have the following background knowledge from previous grade levels that will support their learning in this unit.

Kindergarten: Knowledge that plants need food, water, and air to survive. Animals get their food from plants or other animals and that plants make their own food.

First Grade: Knowledge that plants have roots, stems, leaves, flowers and fruits that are used to take nutrients, water, and air. Students also learn that plants produce food (sugar).

Second Grade: Experience building and/or using models to show how plants and animals meet their needs, and that different living things live in different habitats.

Third Grade: Knowledge that humans have the capability to take steps to reduce impacts of environmental situations. They should be introduced to the term organism in this grade and have learned that some plants and animals have become extinct. They will have also had opportunities to interpret data about changes in the environment and describe how the changes affect the ability of organism to survive and reproduce.

Fourth Grade: Students will have knowledge about plant structures and how those structures support their survival.

Lesson Sequence

Lesson 1: How Plants Make Food: Students plant *Brassica* seeds and observe them growing under different conditions.

Lesson 2: Explore an Ecosystem: Students conduct fieldwork to explore an ecosystem, after exploring the ecosystem they will have an opportunity to categorize the organisms they observed into producers, consumers and decomposers.

Lesson 3: Producers Get Energy from the Sun:
Students use laptops to access two web-based activities that show how plants make their own food.

Lesson 4: Consumers Eat Producers: Students explore the relationship between consumers and producers and identify the different types of consumers.

Lesson 5: Decomposers: Students record the weight of decomposing food.

Lesson 6: Food Web Models: Students work in groups, with partners and individually to trace the flow of a food web.

Lesson 7: Not Those Pyramids: Students trace the flow of energy through a food web and demonstrate the loss of one trophic level to the next with a hands-on activity.

Lesson 8: Trophic Levels in the Ocean: Students review previous information about food webs and trophic levels on land before applying that knowledge to analyze marine food webs and their respective trophic levels.

Lesson 9: Complex Interactions:
Students will see what happens to a food web when one species is removed.

Tiered Vocabulary List

Tier One	Tier Two	Tier Three
Plants	Conclusion	Brassica
Soil	Hypothesis	Decomposer
Animal	Variable	Photosynthesis
Leaves	Observation	Herbivore
Sunlight	Investigate	Carnivore
Bacteria	Categorize	Omnivore
Energy	Manufacture	Decomposition
Matter	Oxygen	Trophic Levels
Recycle	Tertiary	Biomass
Primary	Hypothesize	Population
Secondary	Interaction	Extinct
Highway	Consumer	Overpopulation
	Producer	
	Food Web	
	Scenarios	
	Depend	
	Brainstorm	

Teach To Learn
A collaboration between MCLA, Williams College, and North Adams Public Schools
Funded by NSF DUE-IUSE Award #1432591

Lesson 1: How Plants Make Food

BACKGROUND

Overview of the Lesson

In this lesson, students will plant *Brassica* seeds and observe them growing under different conditions.
Follow the instructions for planting the *Brassica* seeds in your binder (following this lesson). These directions come from a Foss Kit binder and are numbered 14-21. ***Note that pages 14-17 contain the prep work you will need to do ahead of time to get ready for the planting activity.*** Divide students into small groups (3-4 students per group) and make sure that each group plants four plants so they can selectively deprive each plant of water, light, water and light, or nothing.

After students complete their planting, have them make day 1 observations in their science journal, plan on having them complete an observation every 2-3 days for the next 7-20 days.

Focus Standard

5-LS1-1. Support an argument with evidence that plants get the materials they need for growth and reproduction chiefly through a process in which they use air, water, and energy from the sun to produce sugars and plant materials. [Assessment Boundary: The chemical formula or details about the process of photosynthesis is not expected.]

ELA Reading Standards

- Determine one or more main ideas of a text and explain how they are supported by key details; summarize a text.
- Write narratives in prose or poem form to develop experiences or events using effective literary techniques, descriptive details, and clear sequences. Use concrete words and phrases and sensory details to convey experiences or events precisely.

Learning Targets

- I can list the resources that plants need to make their own food (light, water, air).
- I can record observations about *Brassica* plants.

Assessment

- Classroom teachers should listen to student observations and check science journals frequently. Give students a copy of the rubric, so they know what you are looking for in a journal entry (it would be beneficial to model for the students what you expect a "4" to look like).
- At the end of the observation cycle students will use their observations to draw conclusions about what resources plants need in order to make their own food. Using the notes from their experiment, students will make conclusions about what plants need to survive. Students should use their journal entries as evidence.
- If you would like to use sentence frames, some options include:
    - My plants need ___ to survive, and I know this because of ___.
    - The plants exposed to ___ are ___ in comparison to the plants exposed to ___. This implies that my plants need ___.

Targeted Academic Language

Tier 1: plant, soil
Tier 2: conclusion, hypothesis, variable
Tier 3: *Brassica*

RESOURCES AND MATERIALS

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per student	Science Journal Rubric	Binder
1	Opaque box to deprive some of the developing plants of light	Classroom Teacher

	(example: a copy paper box turned upside down)	
1	**Grow light setup**	**Bin/Classroom Teacher**
3	**Plant trays**	**Bin**
4 per group	**Planting cups**	**Bin**
1 bag	Potting soil	Bin
6	**Cups for watering**	**Bin**
8 per group	*Brassica* Seeds	Bin
1 set per group	Condition label set Label 1: water & light Label 2: water & no light Label 3: no water & no light Label 4: light & no water	Bin
1	*Brassica* growing directions/information (pg. 1-31 FOSS)	Bin/CMC Website

****Items in bold should be returned to the bin for use next year****

LESSON DETAILS

Lesson Opening

1. Engage students in a discussion about what they think plants need to grow.

2. Explain to students they will now start an experiment to determine which of these things is most important for the *Brassica* plants.

3. Discuss the concept of an investigation: What do they think an investigation is? Who conducts investigation? How do you think you do an investigation?

4. Read Variable and Hypothesis Worksheet with Questions.

5. Let the students know that they will be gathering data and making observations while conducting this experiment; this data will be recorded in their science journal. Show the students how they should set up each science journal entry. Each entry should include the date and a title.

6. Have the students set aside 10 pages (at the front of their journal) to record all their plant observations, make sure they leave enough room for about 10 observations done over the course of 20 days. Ask students to make a hypothesis at the beginning of the experiment.

7. When the students make their plant observations every few days remind them to put the date, a title, and ask them to draw a picture or diagram to show what they are observing, they can also write a few sentences to verbally explain what they are observing.

8. Students will need to know what variables are (the things that changes in an experiment) and that a hypothesis is an educated guess or prediction. In this lesson, students will make an educated guess or hypothesis about which variables plants grow best under. What is changing in this experiment is the plant's access to light, water, or both.

During the Lesson

Set Up Plant Experiment:

1. Review the growing conditions that have been present for all the plants (light, water, and air).

2.  Ask the students, "What do you think will happen if our *Brassica* plants don't get water? How could we alter the growing conditions?" Proceed with similar questions to help students design conditions to test the effects of light and

water. Explain to students that you will not be depriving any of the plants of air. Perhaps suggest using boxes to deprive the plants of light. The intention is to guide the students through questions to come up with the idea that instead of leaving all the plants under light and giving them access to water and nutrients, that you can move them around the room or outside (e.g., place some under the box) and selectively deprive them of water or light to see what will happen.

3. Teachers should guide students in creating these varied growing conditions and ask probing questions such as, "Where will we put the plants? How much water will they give them? How will they deliver nutrients, but no water?". Possibly do this as a "Think Pair Share" activity.

4. Split the students into small groups to create the new growing environments. This activity should ideally happen outside, weather permitting. Once outside, have the groups set up their experiments. The environment setup will be 1: water & light, 2: water & no light, 3: no water & no light, 4: light & no water.

5. In groups have students create labels (blank labels are in the bin) to affix to the plant pots to indicate what is being deprived. Each group should have four labels, which say water/light, water/no light, no water/no light, light/no water. **[SP3: Investigation]**

Careful Observations

Have students in each group draw and describe (including a size measurement) their plant at this stage in their science journals, then have them place their plants into the appropriate growing conditions. As the plants grow, record size and plant condition (number of leaves, color of leaves, presence of flowers, dead, etc.) at regular intervals (every 2-3 days).

Lesson Closing

1. Ask student groups to come up with predictions about what will happen to the *Brassica*s without light, without water, or without both light and water and record these on chart paper. You may have to ask some prompting questions such

as "Do you think the color of the plant will change?" "Do you think the plant will grow faster or slower?" "Which plant will be the weakest?" "Which element is most critical for a healthy plant?" Explain that everyone will be observing the plants for a couple of weeks to see what happens and if their predictions were accurate.

2. Plan to record observations every 2-3 days for about 20 days.

3. Tell students this is one lesson in a larger study they will do about food webs, or the cycle of energy through organisms as they live and die. As they complete each lesson, they will be trying to gather information to help answer the following questions:
    a. How do different plants and animals, (including humans) relate to each other and the world?
    b. Why do we need the sun?
    c. Why should we and how should we care about conservation?

Assessment

- Classroom teachers should listen to student observations and check science journals frequently. Give students a copy of the rubric, so they know what you are looking for in a journal entry. (it would be beneficial to model for the students what you expect a "4" to look like).
- At the end of the observation cycle students will use their observations to draw conclusions about what resources plants need in order to make their own food. Using the notes from their experiment, students will make conclusions about what plants need to survive. Students should use their journal entries as evidence.
- If you would like to use sentence frames, some options include:
    - My plants needs ___ to survive, and I know this because of ___.
    - The plants exposed to ___ are ___ in comparison to the plants exposed to ___. This implies that my plants need ___.

RUBRIC

CATEGORY	4	3	2	1
Journal/Notebook	Clear, accurate, dated notes are taken regularly.	Dated, clear, accurate notes are taken occasionally.	Dated, notes are taken occasionally, but accuracy of notes might be questionable.	Notes rarely taken or of little use.
Experimental Hypothesis	Hypothesized relationship between the variables and the predicted results is clear and reasonable based on what has been studied.	Hypothesized relationship between the variables and the predicted results is reasonable based on general knowledge and observations.	Hypothesized relationship between the variables and the predicted results has been stated, but appears to be based on flawed logic.	No hypothesis has been stated.
Drawings/Diagrams	Clear, accurate diagrams are included and make the experiment easier to understand. Diagrams are labeled neatly and accurately.	Diagrams are included and are labeled neatly and accurately.	Diagrams are included and are labeled.	Needed diagrams are missing OR are missing important labels.

Variables	All variables are clearly described with all relevant details.	All variables are clearly described with most relevant details.	Most variables are clearly described with most relevant details.	Variables are not described OR the majority lack sufficient detail.
Summary at the end of the 20 days	Summary describes the skills learned, the information learned and some future applications to real life situations.	Summary describes the information learned and a possible application to a real life situation.	Summary describes the information learned.	No summary is written.

Lesson 2: Explore an Ecosystem

BACKGROUND

Overview of the Lesson

In this lesson, students conduct fieldwork to explore an ecosystem. If weather is not permitting, students will explore an ecosystem using a live stream camera feed. After exploring the ecosystem, they will have an opportunity to categorize the organisms they observed into producers, consumers and decomposers. This lesson was adapted from http://serc.carleton.edu/sp/mnstep/activities/26565.html and uses resources from PBS Learning Media.

Focus Standard

5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment- a: show that plants produce sugars and plant materials, b: show that some animals eat plants for food and other animals eat the animals that eat plants, and c: show that some organisms, (including fungi and bacteria), break down dead organisms and recycle some materials back to the air and soil. [Clarification Statement: Emphasis is on matter moving throughout the ecosystem. Waste includes matter in the form of gasses (such as air), liquids (such as water), or solids (such as minerals or nutrients).] [Assessment Boundary: Assessment does not include molecular explanations.]

ELA Reading Standards

- Determine one or more main ideas of a text and explain how they are supported by key details; summarize a text.
- Write narratives in prose or poem form to develop experiences or events using effective literary techniques, descriptive details, and clear sequences.
- Use concrete words and phrases and sensory details to convey experiences or events precisely.

Learning Target

I can identify consumers, producers and decomposers in your environment.

Assessment

Check science journals to see if producers, consumers, and decomposers are appropriately categorized, or that their reasoning for the classification is strong.

Targeted Academic Language

Tier 1: animal

Tier 2: observation, investigate, categorize

Tier 3: producer, consumer, decomposer

RESOURCES AND MATERIALS

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1	Instructions for 7-step vocabulary process	Binder
1 set per group	**Animal picture cards**	**Bin**
1	Computer projector and access to "Decomposer Video" http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/	Classroom Teacher

****Items in bold should be returned to the bin for use next year****

LESSON DETAILS

Lesson Opening

(Pre-teaching) The classroom teacher needs to present the vocabulary words (producer, consumer, and decomposer) prior to the lesson, using the 7-step vocabulary process found in the classroom binder. We highly suggest that the teacher put up a poster of the Tier 3 vocabulary words that the students can look at to guide them throughout the unit.

1. Explain to students that plants are an example of **producers** because they produce their own food by using sunlight, carbon dioxide, and water to produce plant material. The process that plants use to make their own food is called photosynthesis. Producers make sugar through photosynthesis. Ask students to list examples of producers they can think of. Plants, algae, kelp, and moss are all examples of producers.

2. Explain to students that animals are an example of **consumers** because they cannot make their own food, so they need to consume, or eat, plants and other animals. In another lesson, we will learn about different types of consumers. Ask students to list examples of consumers they can think of. Herbivores, carnivores, and parasites are all examples of consumers.

3. Explain to the students that **decomposers** are organisms that eat dead things from the ground in order to get nutrients. The dead things that decomposers eat are called **detritus**, which means "garbage." Some people call decomposers **detritivores** because they eat detritus. Ask students to list examples of decomposers they can think of. Earthworms, some slugs, some snails, some bacteria, and some fungi (like mushrooms) are all types of decomposers.

4. Inform students that one thing that scientists do is make detailed observations. Let students know they will be going outside to do a scientific observation of food webs in action. Classroom Teachers and SF's should review rules and expectations students should be following when doing fieldwork. You will take students to a wooded area near the school or the playground, any place where they will see plants and animals, or evidence of the presence of animals and their interactions with plants and the environment.

5. If it is too cold to go outside, considering repeating these steps with a live stream camera (Every webcam on this list is active as of print date, but most webcams have short lifespans. It's best that the teacher check every webcam before the class to make sure it is still active):
    - Smithsonian National Zoological Park (DC): http://nationalzoo.si.edu/animals/webcams/
    - Trevor Zoo great blue herons (NY): http://www.millbrook.org/Page/School-Life/Trevor-Zoo/Trevor-Zoo-Live/Trevor-Zoo-Live---Herons
    - Barn owls (UK): https://www.barnowltrust.org.uk/barn-owl-facts/barn-owl-cams/
    - Wisconsin Kestrels: http://cams.allaboutbirds.org/channel/58/American_Kestrels/
    - Or there may be a window from the school where you can get a good view of a local ecosystem nearby.

During the Lesson

Observe Animals In The Field:

Before going outside, have students set up a page in their science notebook to record observations. Have them make a T-chart. On the left side, write the title: *I observe*. On the right side write the title: *I wonder* (these are questions about each observation).

1. Explain that under *I observe*, they are to list all the plants and animals they see. Under *I wonder*, they should write a question about what they observed. Teacher should model what an observation and accompanying wonder question should look like. These questions should be questions a scientist might ask. The models might include:
    - I observe a bird building a nest in a tree. I wonder why the bird builds a nest in a tree, instead of somewhere else?
    - I observe many beetles crawling over a plant. I wonder what about the plant attracts them? Is it the plant's color, scent, or temperature?

2. Students should try to list 10 observations and questions, make sure the students list any organisms they observe. Plan on spending 15-30 minutes outside allowing ample time for students to explore and observe.

Producers, Consumers, and Decomposers:

3. After the outdoor investigation, students should select three questions they would like to investigate. Have them write their three choices in their science journal, the students can share their questions in small groups or with the class. **[SP1: Asking Questions]**

4.  Break students up into groups of 2 and 3 and have the students read a student's perspective on food web and answer questions.

5. Now as a class, create a question together. Examples might include: How do producers, consumers, and decomposers affect each other in a food web? Another option would be for the class to come with a testable question.

6. Now split students into small groups and give each group a set of animal picture cards from different ecosystems in Massachusetts, ask them to categorize the cards into three groups: consumers, producers, and decomposers. Students should talk amongst their group and decide where each picture belongs. (This can also be done as a class. We suggest using the organizational plot found below.) Ask some of the groups to share how they categorized their cards.

7. Now, the students should organize their outdoor observations into the three groups: producers, consumers, and decomposers. Share with their group how they organized the data and discuss if they agree. Make sure the students write down how they categorized their observations into their science journal. **[SP4: Analyzing Data]**

Organizational Table for Animal Sorting Activity

Producers	Consumers	Decomposers
Wheat Sunflowers Plant growing in ocean or lake	Deer Cow Bobcat Raccoon Bear	Fungi (mushrooms) Crab Sea snail Snail Worm Bacteria

Lesson Closing

Students should be made aware they will be learning much more about producers, consumers and decomposers. To connect this lesson to the previous lesson, ask students what category the *Brassica* plants fall into. Today we grouped living organisms into three groups: producers, consumers and decomposers.

Literacy Follow-up

After the science lesson, the teacher can choose to add the vocabulary words (producers, consumers, decomposers, and food web) to their journals. Create vocabulary 4 squares for each word or use another strategy from your Academic Language PD.

Assessment

Check science journals to see if producers, consumers, and decomposers are appropriately categorized, or that their reasoning for the classification is strong.

Lesson 3: Producers Get Energy from the Sun

BACKGROUND

Overview of the Lesson

In this lesson, students will use laptops to access two web-based activities that show how plants make their own food.

Focus Standard(s)

5-LS1-1. Support an argument with evidence that plants get the materials they need for growth and reproduction chiefly through a process in which they use air, water, and energy from the sun to produce sugars and plant materials. [Assessment Boundary: The chemical formula or details about the process of photosynthesis is not expected.

3-5 LS.11 Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers.

ELA Writing Standard(s)

Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

- Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped in paragraphs and sections to support the writer's purpose.
- Provide logically ordered reasons that are supported by facts and details.

Learning Targets

1. I can describe why sunlight is necessary for plants.
2. I can provide evidence that plants make their own food from water, carbon dioxide, and energy the sun captured by their photosynthetic structures (example: leaves)

Assessment

Check science journals to see that the students have answered the questions asked in the discussion.

Targeted Academic Language

Tier 1: leaves, sunlight
Tier 2: manufacture, oxygen
Tier 3: photosynthesis

RESOURCES AND MATERIALS

Quantity	Item	Source
1	Computer Projector and screen and access to: http://mass.pbslearningmedia.org/resource/tdc02.sci.life.stru.methusweb/illuminating-photosynthesis/	Classroom Teacher
1 per student	Computer or Laptop with access to: http://mass.pbslearningmedia.org/resource/tdc02.sci.life.stru.methusweb/illuminating-photosynthesis/	Classroom Teacher
1 per group	**Photosynthesis question cards**	**Bin**
1 per student	*Show What You Know! Worksheet*	Binder, to be copied by the classroom teacher
1 per student	Photosynthesis question sheet (3 pages)	Binder, to be copied by the classroom teacher

****Items in bold should be returned to the bin for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Ask students to think about the following questions with a partner: Do plants eat? Where do they get the energy they need to stay alive? Ask a few students to share some of their ideas with the class.

During the Lesson

Photosynthesis Video and Web Activity:

1. Remind students that in the last lesson they learned about producers, consumers, and decomposers. Today they will learn how producers get energy from the sun and how plants make their own food from water, carbon dioxide, and sunlight captured by their leaves.

2. Tell students they are going to investigate how plants make their own food. As a class watch the NOVA Photosynthesis video at http://mass.pbslearningmedia.org/resource/tdc02.sci.life.stru.photosynth/photosynthesis/. Let students work on a laptop or computer for 20 minutes to explore the various activities, "Cycle" and "Puzzler" activities in the Illuminating Photosynthesis web activity. These activities are located at: http://mass.pbslearningmedia.org/resource/tdc02.sci.life.stru.methusweb/illuminating-photosynthesis/ Since you have the computer and projector handy, you may want to model how to navigate the illuminating photosynthesis activity.

Discussion:

3. Now, break students into four groups and give each group a different discussion card (it would be beneficial to partner students of varying abilities). Let the groups discuss the questions for 5 minutes and be sure to circulate around the room to make sure everyone is getting a chance to participate. After students discuss the questions they should record the answers in their science journals then ask a member from each group to share their answers. As the students are

reporting out, the teacher should make sure to clear up any misconceptions and add additional information if it is omitted. Below are the questions that students will answer. (These questions are preprinted on cards in your bin).

- Where do plants get the energy they need to grow?
- What ingredients (raw materials) do green plants need for photosynthesis?
- Where do plants get these ingredients?
- In what part of the plant does photosynthesis take place?
- What do plants use the sun's energy to manufacture?
- What do plants use the energy stored in glucose for?
- What gas do animals exhale and plants take in?
- What do plants use this gas for?
- What gas do plants give off and animals inhale?
- What do animals use this gas for?
- Why are plants called producers?

4. *Show What You Know Worksheet:* (in binder): The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

Optional Extension

Have groups create a short skit in which different students play the different parts of photosynthesis and act out the process by which plants create their own food. If the teacher plans on including the extension, it should ideally be inserted after the web activity and before the discussion.

Lesson Closing

Summarize the main idea of the lesson: plants are called producers, they make their own food and some food is used to keep the plant alive. Remind students that they have talked about producers, consumers and decomposers. Today they learned how producers make their own food. Next they will learn about how producers are food for consumers. See if students can add any information to the following essential questions:

1. How do different animals––including humans––relate to each other & the world? What role specifically do humans play?
2. Why do we need the sun?
3. Why should we and how should we care about conservation?

Assessment

Check science journals to see that the students have answered the questions asked in the discussion.

Lesson 4: Consumers Eat Producers

BACKGROUND

Overview of the Lesson

In this lesson students will explore the relationship between consumers and producers as well as identify the different types of consumer, this lesson incorporates the arts and physical education. Be sure to secure a large space to play the game at the end of the lesson. This lesson also requires construction paper, which can be cut beforehand to save time. This lesson has been adapted from: http://mpalalive.org/classroom/lesson/food-chains-kenya.

Focus Standard(s)

5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment: a. show that plants produce sugars and plant materials; b. show that some animals eat plants for food and other animals eat the animals that eat plants; and c. show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. [Clarification Statement: Emphasis is on matter moving throughout the ecosystem. Waste includes matter in the form of gasses (such as air), liquids (such as water), or solids (such as minerals or nutrients).] [Assessment Boundary: Assessment does not include molecular explanations.]

5-PS3-1. Use a model to describe that the food animals digest: a. contains energy that was once energy from the sun, and b. provides energy and materials for body repair, growth, motion, body warmth, and reproduction. [Clarification Statement: Examples of models could include diagrams and flow charts.] [Assessment Boundary: Details of photosynthesis or respiration are not expected.]

ELA Writing Standard(s)

Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

- Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped in paragraphs and sections to support the writer's purpose.
- Provide logically ordered reasons that are supported by facts and details.

Learning Targets

1. I can identify and categorize primary, secondary and tertiary consumers.
2. I can provide evidence that shows the changes that might occur when the number of producers or consumers (primary, secondary, or tertiary) changes.
3. I can describe how organisms are connected using the words omnivore, herbivore and carnivore.

Assessment

Students should be able to say, answer, and/or do:

- I can name a primary, secondary, and tertiary consumer
- I can look at the food web model and tell which of the organisms fit into each category
- I can answer the following: "What do you think might happen if the secondary consumer dies out?
- I can answer the following: What would happen to the primary consumers?
- I can answer the following: What would happen to the tertiary consumers?"
- I can orally describe how each of the organisms in their linking chain are connected and use the words omnivore, herbivore and carnivore while doing so.

Show What You Know Worksheet: Producers and Consumers: The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

Targeted Academic Language

Tier 2: primary, secondary, tertiary

Tier 3: herbivore, carnivore, omnivore

RESOURCES AND MATERIALS

Quantity	Item	Source
1 of each card	**Aphid, ladybug and toad cards**	**Bin**
1	Graphic of food web	Binder
4 per student	Strips of paper	Classroom Teacher, cut before lesson
1 per student	*Show What You Know! Worksheet: Producers and Consumers*	Binder, to be copied by the classroom teacher
As needed	Glue, tape, or stapler	Classroom Teacher
As needed	Crayons	Classroom Teacher
Optional	Panther Hunt Worksheet	Binder, to be copied by the classroom teacher
200 (optional)	**cups (for Panther Hunt activity)**	**Bin**
as needed (optional)	marbles (for Panther Hunt activity)	Classroom Teacher

****Items in bold should be returned to the bin for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Have the students talk about what they have eaten in the last 24 hours and discuss what category their food belongs in (producer, consumer, decomposer).

During the Lesson

1. Hold up the pictures of the aphid, ladybug and toad in front of the class and tell the students these organisms represent the three different types of consumers. Hold up the aphid card and explain to the students that primary consumers (herbivores) eat only plants (no animals). An aphid is an example of a primary consumer because it only eats plants.

2. Secondary consumers eat primary consumers. Secondary consumers are also called carnivores, or meat eaters. Now hold up the picture of the ladybug—the ladybug is an example of a secondary consumer because it eats aphids.

3. In some ecosystems there is a third level consumer called a tertiary consumer, you can hold up the picture of the toad. The toad eats the ladybug, which eats the aphid- therefore it is a tertiary consumer. You can put up the overhead slide and model how you would find the primary, secondary and tertiary consumers it is best to do a few examples as a class and have the students document this in their science journals.

Food Chain Cards:

1. Put the graphic of the food web on the overhead and discuss which organisms are primary, secondary and tertiary consumers.

2. Pass out the four strips of paper and have the students draw the sun on one strip. Then have the students draw a primary consumer on one strip, secondary consumer on one strip and tertiary consumer on one strip. Next, interlocked

the strips to make a chain of species in which one eats the other, they can be hung up in the classroom to illustrate the diversity of a food chain in nature.

3. Show students how to locate a primary, secondary and tertiary consumer on the food web. Students are not limited to using the organisms on the food web.

Food Chain Tag:

1. Before playing this game, set some ground rules for the class. This activity requires a large open area like the playground or gym; try to move this game outdoors if weather permits. In a class of 25, choose 3 predators, 7 herbivores and the remainder of the class is producers, adjust the number of each based on class size to represent a balanced system where producers (plants) are more plentiful than herbivores (plant eaters), herbivores are more plentiful than predators, and predators are the least plentiful.

2. Have students make predictions about why there are more producers than consumers (For the interested students, you could explain that only 10% of the energy from one food web level is passed onto the next level, so there's this rapid decrease in energy available at higher levels. Therefore, you have to eat more to get the same amount of energy.) Students have been working with animals from the food web overhead, so you can play using these animals first. Use organisms from different habitats to show how other organisms interact.

Habitat	**Producer**	**Herbivore**	**Predator**
Grassland	Grass	Zebra	Cheetah
Ocean	Phytoplankton	Krill	Fish

3. To distinguish one group from another, each group selects hand signals that will differentiate them from other groups; for example, plants may hold their hands out to the side to represent leaves. The predators try to tag the herbivores

who try to tag the producers. Since predators decompose when they die and become fertilizer, the plants (producers) try to tag the predators. Once an organism is tagged, it becomes the organism that tagged it.

4. After a period of time, stop the game to see how many of each organism is left. You might ask, "How many producers do we have left, how many consumers do we have now?" Play should resume but stop at regular intervals to see what happens. After a few rounds, select one of the plants to be a human. The human can tag anyone but no one can tag the human. Once the human has tagged someone, they become human too, and, like the original, cannot be tagged back. See how long the game takes until everyone is human. **[SP2: Using Models]**

Lesson Closing

6. Summarize the main points of the lesson, living things can be producers or consumers and consumers can be herbivores, carnivores, or omnivores. Discuss the relationships the game illustrates, asking what happens to the plants and plant eaters after all of the predators have been caught? Try to elicit answers to the essential questions:
    1. How do different animals including humans relate to each other & the world, what role specifically do humans play?
    2. Why do we need the sun?
    3. Why should we and how should we care about conservation?

Assessment

Students should be able to say, answer, and/or do:

- I can name a primary, secondary, and tertiary consumer
- I can look at the food web model and tell which of the organisms fit into each category
- I can answer the following: "What do you think might happen if the secondary consumer dies out?
- I can answer the following: What would happen to the primary consumers?
- I can answer the following: What would happen to the tertiary consumers?
- I can orally describe how each of the organisms in their linking chain are connected and use the words omnivore, herbivore and carnivore while doing so.

Show What You Know Worksheet: Producers and Consumers: The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

Optional Extension: Do the panther hunt activity with your students; use the provided sheets in the binder for directions.

Lesson 5: Decomposers

BACKGROUND

Overview of Lesson

This lesson will span over 2-3 weeks, plan on spending one hour on this lesson the first day and roughly 15 minutes every 2-3 days for 2-3 weeks. In this lesson the students will get into groups and choose a piece of fruit/vegetable (apple core, banana peel, carrot piece, etc.), and weigh the fruit/vegetable every 2-3 days for 2-3 weeks. Students will record weight and qualitative observations about their food item of choice. This lesson is adapted from https://www.teachengineering.org/view_activity.php?url=collection/duk_/activities/duk_decomposers_mary_act/duk_decomposers_mary_act.xml.

Focus Standard(s)

5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment: a. show that plants produce sugars and plant materials; b. show that some animals eat plants for food and other animals eat the animals that eat plants; and c. show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil.
[2006]3-5 LS.11 *Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers.*

ELA Writing Standard(s)

- Write narratives in prose or poem form to develop experiences or events using effective literary techniques, descriptive details, and clear sequences.
- Use concrete words and phrases and sensory details to convey experiences or events precisely.

Learning Targets

- I can record the weight changes that occurred to the food items in science journals and observe that energy and matter is never lost instead it just changes forms.
- I can observe and record the color change in the food items in science journals.

Assessment

- Review science journals looking for observations, data recording, and conclusions to ensure that the appropriate conclusions are drawn from the experiment. Students should state how their fruits/vegetables lost weight due to decomposition from bacteria or microbes and/or energy was returned to the soil through decomposition.

- *Show What You Know Worksheet:* The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

- Address the following questions:
    - Have the students name two types of decomposers (bacteria, fungi, etc.).
    - What do decomposers eat?
    - What do decomposers do with the energy they get from eating dead things and waste material?
    - What role do decomposers play in our environment? (Be sure to point out the role decomposers play in returning nutrients back to the soil.)
    - Prior to beginning lesson 6 the teacher should give the students the practice test questions to ensure they are grasping the concepts in this lesson.

Targeted Academic Language

Tier 1: bacteria

Tier 2: observation, record, conclusion, hypothesize

Tier 3: decomposition

RESOURCES AND MATERIALS

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per group	Piece of fruit or vegetable	Classroom Teacher/ student
1 per student	*Show What You Know! Worksheet*	Binder, to be copied by the classroom teacher
1 per group	Potting soil (roughly 5 lbs. per fruit or vegetable item)	Bin
1 per group	**Balance/Scale accurate to 0.1 grams**	**Bin**
1 per person	Decomposition Worksheet	Binder
2 per group	**Gallon Ziploc bags**	**Bin**
1	Computer projector and access to "Decomposer Video" http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/ http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/	Classroom Teacher

****Items in bold should be returned to the bin for use next year****

LESSON DETAILS

Lesson Opening/Activator

Decomposition Video:

1. Watch the decomposers video before adding vocabulary words to journal. The video can be found at http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/

2. Explain to the students that they will be performing an experiment that models how decomposition occurs in nature, working in small groups. The students will select a food item which can either be something they bring back from the lunchroom, or will be provided by the teacher (banana peel, orange peel, apple core, etc.) Explain to the students that they will be placing this food item into a Ziploc bag filled with soil, and that every couple of days they will check-in to weigh and record observations about their food item.

Extension: Students may add a variable to the experiment, like placing one food item in a Ziploc bag with potting soil, and another buried in the ground outside. (The food items need to be the same and have similar weights). Or, students may compare one food item decomposing in soil and the other in the Ziploc bag without soil, etc. The two variables can be labeled as Experiment A and Experiment B.

During the Lesson

Decomposing Bag Activity:

1. The teacher should begin the lesson by re-introducing decomposers asking what types of organisms are decomposers and what their purpose is. (Decomposers are organisms that eat dead things from the ground in order to get nutrients. The dead things eaten by decomposers are called detritus, which means "garbage." Worms, slugs, snails, bacteria and fungi (like mushrooms) are all types of decomposers. Decomposers are essential to the life cycle process because without them all of the dead plants and animals and their waste (poop) would pile up.)

2. Hand out the decomposition worksheet; have students keep the worksheet in their science journals until completion.

3. The students should write a hypothesis about what they think will happen to the weight and appearance of the food items over the duration of the experiment.

4. Explain to the students they will be weighing their Ziploc bags (with soil and food in it) every other day (this will show the students that weight does NOT change over time, even though the fruit or vegetable looks like they are disappearing).

5. Students should then weigh their food items, record their initial appearances, and place them into the Ziploc bags filled with soil make sure to cover the food item completely with soil.

Lesson Closing

1. After 3 weeks (maximum time) to record data, have the students come to their own conclusions about the weight of the bag. Does the food item look like it is disappearing? Is there discoloration or any other change in appearance? If the teacher wishes to integrate technology into the lesson, have the students average their daily data together. Then, on the overhead, the teacher can graph the data in Excel to show the students how graphing on a computer works.
2. (Allow students to voice their ideas using the A/B talk method). Have the students get into their groups and discuss the results of the experiment. Ask them what they think happened to the food over time? Did this happen to the vegetables on their own? What caused these changes? **[SP6: Constructing Explanations]**

3. After a short group discussion, bring the class together as a whole, and have one representative from each group describe what happened to their food item, and what they thought caused the various changes. Ask the others if they agree with the conclusion each group came up with. Why or why not? **[SP7: Arguments]**

4. Explain to the students the weight loss was due to decomposers (bacteria or fungi) in the soil. Explain that if left long enough, the food item would eventually disappear completely, and that all of the nutrients would be returned to the soil for other plants to use. Review and reiterate the idea decomposers return the nutrients back to the soil, and have students take note of where the food remnants have gone. It is important for students to understand that the matter does not disappear.

Assessment

- Review science journals looking for observations, data recording, and conclusions to ensure that the appropriate conclusions are drawn from the experiment. Students should state how their fruits/vegetables lost weight due to decomposition from bacteria or microbes and/or energy was returned to the soil through decomposition.
- *Show What You Know Worksheet:* The classroom teacher should administer the question(s) after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.
- Address the following questions:
    - Have the students name two types of decomposers (bacteria, fungi, etc.).
    - What do decomposers eat?
    - What do decomposers do with the energy they get from eating dead things and waste material?
    - What role do decomposers play in our environment? (Be sure to point out the role decomposers play in returning nutrients back to the soil.)
    - Prior to beginning lesson 6 the teacher should give the students the practice test questions to ensure they are grasping the concepts in this lesson.

Lesson 6: Food Web Models

BACKGROUND

Overview of the Lesson

In this lesson, students can work in groups, with partners, or individually, students will be tracing the flow of matter in a food web. Students will also make a visual representation of a food web that includes producers, consumers, and decomposers. Students will be expected to use the words herbivore, carnivore, and omnivore when labeling their food web.

Focus Standard

5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment: a. show that plants produce sugars and plant materials; b. show that some animals eat plants for food and other animals eat the animals that eat plants; and c. show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. **Clarification Statement**: Emphasis is on matter moving throughout the ecosystem. Waste includes matter in the form of gasses (such as air), liquids (such as water), or solids (such as minerals or nutrients).] [Assessment Boundary: Assessment does not include molecular explanations.]

ELA Writing Standard(s)

- Write narratives in prose or poem form to develop experiences or events using effective literary techniques, descriptive details, and clear sequences.
- Use concrete words and phrases and sensory details to convey experiences or events precisely.

Learning Targets

1. I can develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, air, and soil.
2. I can show that some animals eat plants for food and other animals eat the animals that eat plants.
3. I can trace the flow of materials through a food web and support an argument that plants get the materials they need for growth through air, water, and sunlight.

Assessment

- Step 3 from the lesson will be used as the assessment: students should each draw their own food web based on the cards they've been given. They should use colors to label each type of animal (green for herbivores, red for carnivores, blue for omnivores)

- *Show What You Know Worksheet:* The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

WIDA Language Objectives

Students will use sequence words when speaking about the flow of energy through a food web.

Targeted Academic Language

Tier 1: animal

Tier 2: interaction

Tier 3: herbivore, carnivore, omnivore, trophic levels

RESOURCES AND MATERIALS

Quantity	Item	Source
1 per student	Science Journals	Classroom Teacher
1	Sample Food Web Overhead from Lesson 4	Binder
1 set per group	**Set of cards with animal names**	**Bin**
4 pieces	Chart Paper	Classroom Teacher
1 per student	*Show What You Know! Worksheet*	Binder, to be copied by the classroom teacher
1	**Laminated Fiddler Crab Picture (for student reference)**	**Bin**
For each student	Colored Pencils or Markers	Classroom Teacher
1 per student	*Life in a Meadow Reading*	Binder, to be copied by the classroom teacher

****Items in bold should be returned to the bin for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Have students sketch a pizza that includes a topping that is a producer, consumer or decomposer.

During the Lesson

1. Write down the names of the life forms included in the overhead food web on various parts of the board. Have students take turns picking an organism, identifying it (producer, consumer, or decomposer) and point to an animal that eats it or is eaten by it. When each student comes of with an eating relationship, draw a line on the board (onto which the web will be projected) between the two animals with an arrow pointing to the eater.

***Life in A Meadow* Reading:** Distribute the Story *Life in A Meadow.* Have students read it alone, and then do a think-pair-share with a partner where they discuss the reading and answer the question "What is a food web?" Then have the class get together as a group and ask each group to briefly summarize their idea.

Building Food Webs:

2. Formally introduce the concept of the food web, using the overhead to explain how a food web works. Explain the direction of the arrows, and how the components connect. Pointing to different organisms in the web, ask students what that animal eats or is eaten by, making sure they understand the concept, explaining the difference between **predator** and **prey**. Point out that some animals have multiple arrows (meaning they eat different things or have multiple predators). Emphasize that food webs are simplifications and animals have *many more* connections than are depicted. The plants in the food web get their energy from the sun. The matter and energy in plants is transferred to the animals that eat them and therefore matter and energy are passed through a food web. The following probing questions might help in guiding the students to an answer:
    - What information does a food web give us?
    - Why do some plants and animals have more than one arrow?
    - How big do you think a food web can be?
    - Why are some organisms in this food web while others are not? (i.e. Why aren't zebras in the sample food web? They don't eat anything in this web and aren't eaten by anything in the web)

3. Separate students into small groups and give each group a set of animal index cards. Now have students make their own food web with the cards given. Teachers should check if the food webs are correct. Have students draw their

own food web based on their cards in their science journal, they should use colors to label (green for herbivores, red for carnivores, blue for omnivores)**. [SP2: Using models]**

4. After finishing their food webs, students should answer the following questions in their Science Journals (The teacher should write the questions on the board or the overhead before the lesson begins so students can refer to them during the activity.
    - Which of the animals are primary consumers, which are secondary consumers, and which are producers?
    - Where does each animal get its energy?
    - Fiddler crabs live on beaches near salt water using their claws to sift through mud and sand, they look for decaying plant and animal parts to eat. What role does the Fiddler crab play in its environment?
    - Students have now studied how energy flows through a food web. The students should understand that snakes gained their energy by eating mice and the mice had gained energy by eating plants. From where did the plants get their energy?
    - Why is the food web an accurate model of the movement of energy/matter? What about it is inaccurate?

Optional Extension

1. Divide students into groups and assign each group to research one of the following ecosystems and the animals that live there online: the tundra, the desert, the rainforest and the grassland. www.animalspot.net is a good place to start. Have the groups put together food webs for each ecosystem. Stress that the webs don't have to be complete but should include several primary consumers, secondary consumer, and producers.

Lesson Closing

1. Allow students to voice their ideas with each other, using A/B talk method). Turn and Talk: Have students work with a partner to orally summarize what they learned today, after students have finished their conversation ask them

to report back to the class.

2. Review the definition of predator and prey discussing how animals play a vital role in the food web as predator and prey. Emphasize that every animal and plant plays an essential role in a food web.

3. Add student to answer the following essential questions:
    - How do different animals (including humans) relate to each other and the world? What role do humans play?
    - Why do we need the sun?
    - Why should we care about conservation? What should we do about it?

Assessment

- Step 3 from the lesson will be used as the assessment: students should each draw their own food web based on the cards they've been given. They should use colors to label each type of animal (green for herbivores, red for carnivores, blue for omnivores)

- *Show What You Know Worksheet:* The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

Lesson 7: Not Those Pyramids

BACKGROUND

Overview of the Lesson

In this lesson students will trace the flow of energy through a food web and explore what happens when one trophic level is lost, this lesson focuses around a hands on activity.

Focus Standard

5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment: a. show that plants produce sugars and plant materials; b. show that some animals eat plants for food and other animals eat the animals that eat plants; and c. show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. **Clarification Statement**: Emphasis is on matter moving throughout the ecosystem. Waste includes matter in the form of gasses (such as air), liquids (such as water), or solids (such as minerals or nutrients).] [Assessment Boundary: Assessment does not include molecular explanations.]

ELA Reading Standard

Determine one or more main ideas of a text and explain how they are supported by key details; summarize a text.

Learning Targets

- I can trace the flow of energy through a food web.
- I can draw a chain on a community chart for leaves, caterpillars, frogs, snakes, and owls.
- I can support an argument of why producers are important in a food web.

Targeted Academic Language

Tier 1: energy, matter, recycle
Tier 2: primary, secondary
Tier 3: trophic levels, biomass

Assessment

Have the students expand the food web. The students must include leaves, caterpillars, frogs, snakes, and owls. Students must be able to demonstrate the energy lost between trophic levels to show understanding of the transfer of energy via a food pyramid. Students should discuss why producers are important in a food web in their science journals. **[SP-2 Developing and using models]**

RESOURCES AND MATERIALS

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per student	Energy Flow and Trophic Level Image, forest community image	Binder, teacher to make copies for students
A pack	Packing peanuts, crayons, or marbles/ collection of fallen leaves, acorns, or sticks	Bin
2	**Bucket**	**Bin**
1	Computer projector to play video: http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/	Classroom Teacher
	https://www.youtube.com/watch?v=mCHdhXMFhcU	CMC Website

****Items in bold should be returned to the bin for use next year****

LESSON DETAILS

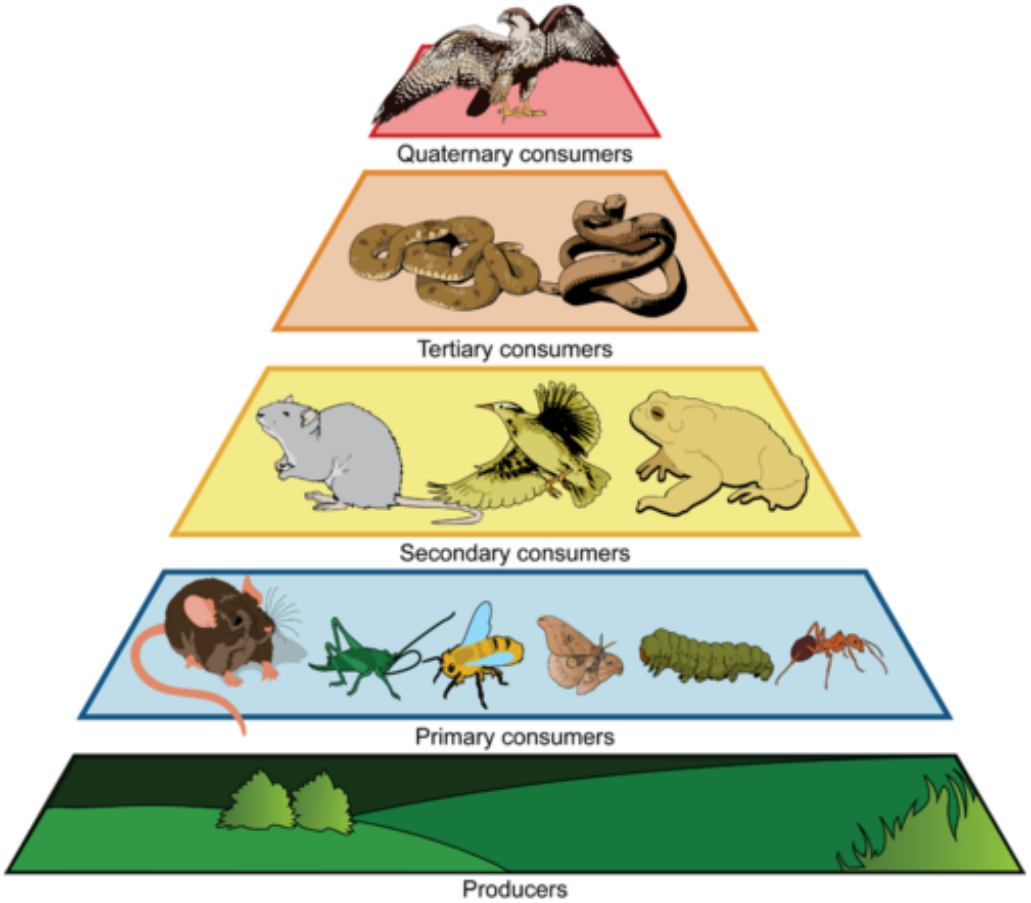
Lesson Opening/ Activator

Give each student a copy of the forest community (the image of the pyramid food chain included later in the packet) and tell them something is missing from the picture (decomposers) and have them sit with a partner to figure out what is missing. If students are stuck, point out that you can see many herbivores and carnivores but the drawing does not show decomposers. Now have the students sketch and label two decomposers. After a few minutes, have students share which decomposers they added to the drawing.

During the Lesson

1. Pass out the worksheet, energy movement through the forest community and read it to the class, explain that this chart shows how energy moves through a food chain. Food chains have different levels called **trophic levels**. Ask the following probing question: Why are there so many more plants than there are animals, and prey than there are predators? The amount of energy at each trophic level decreases as you move up the food chain (and only 10% is passed on). Some energy is "lost" to motion, survival of organisms, and heat. Show the students the two graphics at the end of this lesson (the trophic levels and the forest community). Both pictures represent the energy lost at each trophic level and the concept that energy is spread out among many producers, and gets more concentrated as it goes into the higher trophic level.

2. Watch the video: https://www.youtube.com/watch?v=mCHdhXMFhcU. After watching the video use a basic food chain to introduce the term trophic level, explain how energy enters a food chain via photosynthesis and then moves up the food chain.



http://www.ck12.org/book/CK-12-Earth-Science-Concepts-For-High-School/section/10.3/

Modeling Energy Loss

1. Use the following example to explain how energy is lost at each level of the food chain. line up three students and tell them they are grass, a cow, and a human in that order. Have the person who is grass hold up the 10x10 inch sheet of paper. Explain to the students that the grass gets its food by capturing energy from the sun and converting it to food (by photosynthesis). It has converted energy from the sun into 100 calories of food (represented by the 10 x 10-inch sheet). Now, the cow eats the grass and the person who is the cow takes the paper from the person who is the grass. Describe how the cow needs to stay warm, move around, find food, and give birth as well as grow larger. Since growing larger and adding "more cow" is only one of the things the cow uses its energy for, only 10% of the grass's energy is turned into something that the cow can keep (have the cow tear off a 1/10 inch strip of the paper and hold it up, and put 9/10 of the strip in the recycling to represent the lost energy). When a person eats the cow, the same thing happens. Have the human take 1/10 of the strip of paper from the person who was the cow. **[SP-2 Developing and Using Models]**

2. Explain each trophic level will have only about 10% of the level below it, and 10x as much as the level above it, Therefore, each level of the trophic level reduces the total amount of energy available. Another way to think about this is in terms of human diet and feeding the world's population. If everyone ate only from the producers' trophic level (seaweed, corn, beans, vegetables) we would have 10x as much energy as if we only ate consumers (beef, chicken, pork) .

3. *Make sure the students understand that 9/10 of the energy at each level is not actually lost, but just becomes unavailable to the next trophic level*. If the students ask where the energy goes, guide them to understanding that it turns into heat, and other forms that cannot actually be eaten and passed to a predator. Try asking the students to rub their hands together until they are warm, and show them that they just turned their energy into heat and movement, which cannot be eaten. So if a chicken spends its time moving around, then it will give off energy that will never be eaten either.

Packing Peanut Pass

1. Tell students that the goal of this activity is to pass energy from one person to the next. First have the students stand in a straight-line and place a bucket at either end of the line. One of the buckets is empty, and the other is full of packing peanuts. Tell the students the straight line represents a food chain, and the full bucket represents the sun (energy comes from the sun). This activity can be done with packing peanuts, crayons, markers, marbles, or pieces of torn newspaper, but you may want to use fallen leaves, sticks, or acorns instead (have your students collect them the day before) and move the activity outdoors.

2. Have students pass energy (packing peanuts), hand to hand, up the line and drop it in the empty bucket at the end. Travel up the line signifies organisms being eaten in a food chain. It helps if you have two separate lines of students and turn it into a competition to see who can move their packing peanuts from the full to empty bucket first. Tell them speed is very important and it does not matter if they drop some (this encourages sloppiness). As the activity progresses, students will notice that lot of the packing peanuts (or energy) is dropping on the floor (or being lost in transference). After 1 minute, stop the activity and review with the students what has occurred. It is likely they will see that a lot of the packing peanuts were dropped and very little made it to the other bucket. Students near the sun were probably picking up large handfuls, but students at the end were getting very small handfuls.

3.  Allow students to voice their ideas to each other, using the A/B talk method). Now place students in pairs and ask them to think about how this activity relates to trophic levels, after the pairs have had time to talk ask some students to share their ideas with the class. Hopefully they will reach the following conclusion: because so much energy is lost from one level to the next, there needs to be more primary production than primary consumption, more primary consumption than secondary consumption, etc. Now have students discuss why there are more producers than other organism when we model food webs.

Lesson Closing

Summarize the main ideas: a food chain shows how energy travels in a community. Most food chains include a green plant, a plant eater, and one or more animal eaters and decomposers. Food chains that connect or overlap are called food webs.
[SP-6 Constructing explanations].

Assessment

Have the students draw a food chain that must include leaves, caterpillars, frogs, snakes, and owls. Students must be able to demonstrate the energy lost between trophic levels, since the main topic of this lesson is understanding the transfer of energy a food pyramid, then in their science journal students should discuss why producers are important in a food web. Have them also answer the question, "Where does the energy lost between trophic levels go?"
[SP-2 Developing and using models.

Lesson 8: Trophic Levels in the Ocean

BACKGROUND

Overview of the Lesson

In this lesson students will review information about food webs and trophic levels on land before applying that knowledge to marine food webs and their respective trophic levels. Working in groups, students will identify the trophic levels of the provided marine food web before using research resources to create their own food webs and corresponding trophic levels. **Before teaching this lesson, the Science Fellow and Classroom Teacher should familiarize themselves with marine food webs and trophic levels in order to increase the overall effectiveness of this lesson.**

Focus Standard

5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment: a. show that plants produce sugars and plant materials; b. show that some animals eat plants for food and other animals eat the animals that eat plants; and c. show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. **Clarification Statement**: Emphasis is on matter moving throughout the ecosystem. Waste includes matter in the form of gasses (such as air), liquids (such as water), or solids (such as minerals or nutrients).] [Assessment Boundary: Assessment does not include molecular explanations.]

ELA Reading Standard

Determine one or more main ideas of a text and explain how they are supported by key details; summarize a text.

Student Learning Targets

1. I can identify the different trophic levels found within the ocean.
2. I can trace and describe the flow of energy from producers to primary, secondary, and tertiary consumers.
3. I can recognize that energy loss occurs between each trophic level.

Assessment

Students will be assessed on their participation in class activities and discussions, as well as on their response to the following prompts (which should be answered in their science journals):

- Why do you think energy is lost between trophic levels in the ocean?
- Are the trophic levels in the ocean different from the trophic levels found in an ecosystem on land? If so, why?
- What is the primary source of energy for marine food webs?

1. *Show What You Know Worksheet:* The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

Targeted Academic Language

Tier 1: energy, matter, recycle, primary, secondary
Tier 2: consumer, producer, food web
Tier 3: trophic levels

RESOURCES AND MATERIALS

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per student group	Poster board	Classroom Teacher
1 per class	Marine food web handout	Binder
1 per student group	Computer with internet access	Classroom Teacher
1 per student	*Show What You Know! Worksheet*	Binder, teacher to make copies for students
1 per class	Projector or Elmo	Classroom Teacher

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

This lesson will begin with students breaking into pairs and completing a "think-pair-share" activity in which they list all of the important concepts and ideas (they can remember) about food webs and trophic levels. They will have five minutes to work with their partners to complete this list before sharing their ideas with the class. The Science Fellow will list the shared concepts and ideas on the whiteboard, editing and adding as necessary in order to guide the discussion in the correct direction and to keep the students on-task.

During the Lesson

Marine Food Webs:

1. The class will review the definition of "trophic levels" from the previous lesson, with the Science Fellow emphasizing that energy is lost as you move up the trophic levels. The students will be asked to list some of the reasons why energy is lost **on land**, the Science Fellow will list these reasons on the whiteboard under the header "land-based". The students will then brainstorm some ways an organism could lose energy **in the ocean**, the Science Fellow will list these under "ocean-based" on the whiteboard. The class can discuss how energy can be lost in both similar and different ways on land and in the ocean, this will allow the students to begin to relate the information previously learned with the information that will be presented throughout the course of this lesson.

2. The students will be broken into groups of **no more than 3** and given the provided marine food web, ask them to predict the different trophic levels and record them in their science journals. The groups will then share their predictions with the class.

3. The Science Fellow will lead a guided review with all of the groups to identify the different levels of the food web, creating a comprehensive trophic list (including how energy is lost throughout the food chain) as they elicit information from the students. The Science Fellows guide the students to reaching the correct conclusions about the various trophic levels through discussion and through asking relevant and guided questions (such as which trophic level is the most efficient at gathering energy, which is the least efficient, how some of the energy is lost during the trophic process, etc.…). **[SP6-Constructing Explanations]** After the correct and comprehensive trophic list has been created the groups will be asked if their predictions were either supported or refuted and to come up with some reasons why they were either correct or incorrect.

Build Your Own Web:

4. The groups will then be asked to create a list of different marine organisms (including **at least 1** plant) from those found on the previously discussed food web using prior knowledge or other informational sources. Using those lists and various informational sources (encyclopedias, laptops, or other sources available in the individual classroom) the groups will create their own food webs on poster board. These food webs will be used to identify different trophic levels (producer, primary and secondary consumer, and decomposer) within their respective food webs. This information will also be placed on the poster boards. The Science Fellows, teacher, and other adults in the classroom can circulate during this activity to provide necessary help and assistance. **[SP2-Developing and Using Models]**

Lesson Closing

After the students have completed their posters they will share them with the class. During these presentations the groups will be expected to list the various organisms they chose, how those organisms interact with each other, and to identify the different trophic levels present in their food webs. The groups will also be asked by the Science Fellows to list the different sources that they used to gather information giving the students the opportunity to hear how others completed their research.

Assessment

Students will be assessed on their participation in class activities and discussions, as well as on their response to the following prompts (which should be answered in their science journals):

- Why do you think energy is lost between trophic levels in the ocean?
- What is the primary source of energy for marine food webs?

Show What You Know Worksheet: The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

Lesson 9: Complex Interactions

BACKGROUND

Overview of the Lesson

In this lesson students will see what happens to a food web when one species is removed.

Focus Standard

5-LS2-1. Develop a model of a food web to describe the movement of matter among producers, primary and secondary consumers, decomposers, and the air and soil in the environment: a. show that plants produce sugars and plant materials; b. show that some animals eat plants for food and other animals eat the animals that eat plants; and c. show that some organisms, including fungi and bacteria, break down dead organisms and recycle some materials back to the air and soil. **Clarification Statement**: Emphasis is on matter moving throughout the ecosystem. Waste includes matter in the form of gasses (such as air), liquids (such as water), or solids (such as minerals or nutrients).] [Assessment Boundary: Assessment does not include molecular explanations.]

ELA Writing Standard(s)

Write opinion pieces on topics or texts, supporting a point of view with reasons and information.

- Introduce a topic or text clearly, state an opinion, and create an organizational structure in which ideas are logically grouped in paragraphs and sections to support the writer's purpose.
- Provide logically ordered reasons that are supported by facts and details.

Learning Targets

1. I can explore the interactions between a producer and two consumers and how they might change over time (explore through a model).

2. I can show that some animals eat plants for food and other animals eat the animals that eat plants.

Assessment

Students will be able to discuss these questions verbally or in their science journals and worksheet.

- What can animals do to adapt to a new environment?
- What changes in the food web would result in the extinction of the bears?
- *Show What You Know Worksheet:* The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

WIDA Language Objectives

TBD

Targeted Academic Language

Tier 1: highway
Tier 2 scenarios, depend, brainstorm
Tier 3: population, extinct, overpopulation

RESOURCES AND MATERIALS

Quantity	Item	Source
1 per student	Science Journals	Classroom Teacher
1 set per group	**Set of cards with animal information (from lesson 6)**	**Bin**
1	Sample Food Web Overhead from previous lesson	Binder

1	Ball of yarn	Bin
1	Habitat web lesson from National Wildlife Federation (2001)	CMC Website
1 per student	*Show What You Know Worksheet*	Binder (Teacher to make copies)

****Items in bold should be returned for use next year****

LESSON DETAILS

Lesson Opening/ Activator

Separate students into groups and give each group a set of animal index cards. Have students move around the cards into the general shape of a food web and check that food webs are correct. After each group's food web has been reviewed, students remove one of the organisms from the web and have them predict what will happen if this organism is no longer in the food web. Tell students that today they will find out what happens when a species is removed from a particular ecosystem.

During the Lesson

Population:

1. Introduce the term **population** using a story about a group of deer in the forest. (For example, "There's a group of 50 deer living in the forest, 10 baby deer are born, 3 are eaten by wolves" etc.). The number of deer living in the forest is the population, write the definition on the board as "the number of animals in a species in a certain place." Students should understand that population can get bigger or smaller based on births or deaths. If the number of deaths is higher than the number of births, than the population will decrease. When the population reaches zero, the species becomes (regionally) **extinct––**also known as **extirpated** (write this definition on the board). To become globally extinct, all populations of the species all across the globe would have to die off. Now brainstorm as a class a few possible reasons why animals may become extinct.

Unbalanced Ecosystem Scenarios:

2. Follow the Habitat Web activity found at the end of this lesson plan. This activity can be done in large groups or as a whole class. For part 8 of the activity, use the following scenarios listed below. The scenarios below list a few of the connections present the web, but students can come up with others. Once the class has run through several scenarios, encourage them to develop their own scenarios. Then the class will discuss the significance of each scenario.

- **Scenario 1**: Farmers use extremely potent pesticides to kill all the insects in the area and now there are no more insects. Frogs, fish, and lizards in the area only eat insects, and skunks and birds only eat frogs, fish, lizards, and insects.
    - What dies: frogs, skunks, birds, lizards, fish
    - Take-away: the depletion of one food source can impact multiple animals

- **Scenario 2**: The growing season was very cloudy and cold and none of the nut trees produced any nuts. The mice, chipmunk, and squirrel only eat nuts, the deer eat grass, and the wolves eat mice, chipmunks, squirrels, and deer.
    - What dies: mice, deer, chipmunk, squirrel
    - Take-away: the depletion of one food source usually impacts primary consumers more than higher tier consumers

- **Scenario 3**: Foxes and wolves migrate into the area. The foxes and wolves eat both voles and rabbits, but are really good at hunting rabbits, after a few months all the rabbits are dead.
    - Take-away: red foxes and wolves have more than one food source, so they are not affected by the extinction of rabbits in the ecosystem
    - What dies: only the rabbit dies

- **Scenario 4**: The forest is cut down in order to build a six-lane highway (deforestation occurs and all the blossoms, nuts, bark, and leaves are gone)

80% of the world's land species live in forests, so cutting can lead to massive extinctions. Trees also shelter the ground from the sun and pull moisture up into the air, so logging can turn forests into deserts. Once cut, the trees stop absorbing greenhouse gases and can start releasing them as they rot or burn.

  - What dies: Nearly every animal loses its home and dies. The soil around the trees is no longer protected and dries out, making the area hotter and drier.
  - Take-away: deforestation is a significant problem in many ecosystems

- **Scenario 5:** While bears hibernate during the winter, there is an avalanche on a nearby mountain and all bears die. Before they died, the bears ate too many birds, skunks, and deer for many wolves and red foxes to live in the area.
  - What dies: bears only initially
  - What flourishes: Population of secondary consumers rises (wolves, red foxes, and bees rise), which leads to a decrease in the secondary consumers' prey (e.g. birds, skunks, deer).
  - Take-away: Depletion of the population of a predator can still have long-term effects on the entire ecosystem. Removing one organism may cause an increase in the population of others.

- **Scenario 6:** A chemical used to make grass grow also increases fertility in rabbits and the rabbit population increases dramatically. Rabbits, as well as squirrels, deer, and mice, eat oak, bark, and grass, and wolves and foxes eat all the other animals.
  - What dies: everything

- Take-away: the increase in the population of rabbits causes them to eat a large portion of oak, bark, grass etc., which is a major food source for many other animals, and leads to the decline of lots of other species. The death of the other species will decrease the food source of animals even higher up in the food web. It is important that students understand that overpopulation could lead to extinction.

- **New Scenario:** Now have students make up their own scenario.

3. Students should summarize the take-away from each scenario in the lesson. More general take-aways include:
   a. The depletion of one food source can impact multiple animals.

   b. The depletion of one food source usually impacts primary consumers more than higher-order consumers, but this effect does travel up the food chain. This effect can also travel "down" the food chain.

   c. Some organisms like red foxes and wolves have more than one food source, so they are not entirely impacted by the disappearance of one of their food sources in the ecosystem. For example, if red foxes eat both rabbits and voles, if rabbits die, red foxes could still survive just on voles (though likely with smaller population numbers).

Lesson Closing

1. Ask students the following questions: If animals and plants adapt certain type of environment and that environment changes in a big way, what happens? Why is population control important?

2. Have students reflect again on the essential questions:
   - How do different animals (including humans) relate to each other and the world, what role specifically do humans play?
   - Why do we need the sun?
   - Why should we and how should we care about conservation?

Assessment

- What can animals do to adapt to a new environment?
- What changes in the food web would result in the extinction of the bears?
- *Show What You Know Worksheet:* The classroom teacher should administer the question(s) sometime after the completion of the lesson. The results can be used to plan additional lessons on concepts that students need help mastering.

Curriculum Embedded Performance Assessment (CEPA)

Each student will pick an animal or plant and identify the role their chosen species plays in a given food web (for example: primary consumer, secondary consumer, producer, decomposer, herbivore, omnivore, carnivore). Students must incorporate a given set of factors into their food web model, such as the sun or habitat factors. Their model must include five animals or plants and it must be drawn, labeled, and colored. After students are done tell them their animal or plant they first chose goes extinct, and should be "crossed off" from the food web.

Students should then write three paragraphs about the impact of this extinction and what happens to everything else in the food web and should also write about the impact on the environment and the importance of conservation. More advanced students can elaborate on how their animals might adapt long-term.

Some potential conclusions are:

- *The depletion of one food source can impact multiple animals*
- *The depletion of one food source usually impacts primary consumers more than higher tier consumers*
- *Animals that have more than one food source are not as impacted by the extinction of certain prey in the ecosystem*
- *Deforestation is a significant problem in many ecosystems*

RUBRIC:
Students with be graded on the accuracy and design of their model, the successful inclusion of given factors, their analysis of the impact of extinction, and completion of independent work.

Science Talk and Oracy in T2L Units

Science talk is much more than talking about science. In line with the science and engineering practices, students are expected to make a claim that can be supported by scientific evidence. The MA STE Standards (and the NGSS) value the importance of engaging in an argument from evidence. NGSS defines how this practice takes form in the real world: *"In science, reasoning and argument are essential for identifying the strengths and weaknesses of a line of reasoning and for finding the best explanation for a natural phenomenon. Scientists must defend their explanations, formulate evidence based on a solid foundation of data, examine their own understanding in light of the evidence and comments offered by others, and collaborate with peers in searching for the best explanation for the phenomenon being investigated."*

Students are asked to participate in articulate and sensible conversations in which they are able to communicate their ideas effectively, listen to others to understand, clarify and elaborate ideas, and reflect upon their understanding. These forms of talk can be developed using scaffolds such as the A/B Talk protocol (below) and strategies for class discussions (from the Talk Science Primer, link below). Oracy is developed in the physical, linguistic, cognitive, and social-emotional realms; each of these realms can be expanded upon over time in order to develop a thoughtful speaker. Being able to display appropriate body language, use proper tone and grammar, be thoughtful and considerate thinkers, and allow space for others thoughts and opinions are all important facets of oracy to work on and through with students. Incorporating the appropriate scaffolding is an important aspect of fostering these skills. Techniques for teaching effective science talk often include modeling, discussion guidelines, sentence-starters, and generating roles, while gradually putting more responsibility on students to own their thinking and learning.

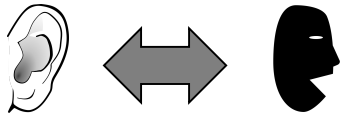
Part of creating a safe school environment for students is allowing them a space that is comfortable enough for them to express ideas and ask questions, while being validated for their thoughts and questions; students should be feel comfortable and confident when speaking and listening for understanding. Effective talk is an important part of being an active, intelligent member of a community and society. Successful development in oracy is important for future employability and general well-being of adults.

The following resources should be helpful examples of how to employ effective use of progressive oracy and science talk in your classrooms.

- Oracy in the Classroom: https://www.edutopia.org/practice/oracy-classroom-strategies-effective-talk
- Science Talk Primer: https://inquiryproject.terc.edu/shared/pd/TalkScience_Primer.pdf

A/B Talk Protocol

Adapted from https://ambitiousscienceteaching.org/ab-partner-talk-protocol/

1. Share your ideas **Partner A**  ● I think _____ happened because… ● Evidence that supports my idea is… ● The activity we did with _____ helps me know more about _____ because… ● One thing I'm wondering about is…	2. Listen to Understand **Partner B**  ● I heard you say _____. What makes you think that? ● I heard you say _____. What if _____? ● Can you explain the part about _____ again? ● What do you mean when you say _____?
3. Clarify and elaborate **Partner A**  Answer partner's questions or ask for clarification in order to understand a question.	4. Repeat steps 2 & 3 until all questions are answered 
5. Switch roles and repeat steps 1-4 	6. Reflect on your understanding in writing ● My idea about _____ changed when my partner said _____. ● I will add _____ to my idea about _____ because… ● I still have questions about… ● I may be able to answer my question(s) if I could investigate _____.

List of Unit Resources

Lesson 1

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per student	Science Journal Rubric	Binder
1	Opaque box to deprive some of the developing plants of light (example: a copy paper box turned upside down)	Classroom Teacher
1	**Grow light setup**	**Bin/Classroom Teacher**
3	**Plant trays**	**Bin**
4 per group	**Planting cups**	**Bin**
1 bag	Potting soil	Bin
6	**Cups for watering**	**Bin**
8 per group	*Brassica* Seeds	Bin
1 set per group	Condition label set Label 1: water & light Label 2: water & no light Label 3: no water & no light Label 4: light & no water	Bin
1	Brassica growing directions/information (pg. 1-31 FOSS)	Bin/CMC Website

Lesson 2

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1	Instructions for 7-step vocabulary process	Binder
1 set per group	**Animal picture cards**	**Bin**
1	Computer projector and access to "Decomposer Video" http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/	Classroom Teacher

Lesson 3

Quantity	Item	Source
1	Computer Projector and screen and access to: http://mass.pbslearningmedia.org/resource/tdc02.sci.life.stru.methusweb/illuminating-photosynthesis/	Classroom Teacher
1 per student	Computer or Laptop with access to: http://mass.pbslearningmedia.org/resource/tdc02.sci.life.stru.methusweb/illuminating-photosynthesis/	Classroom Teacher
1 per group	**Photosynthesis question cards**	**Bin**
1 per student	*Show What You Know! Worksheet*	Binder, to be copied by the classroom teacher
1 per student	Photosynthesis question sheets (3 pages)	Binder, to be copied by the classroom teacher

Lesson 4

Quantity	Item	Source
1 of each card	**Aphid, ladybug and toad cards**	**Bin**
1	Graphic of food web	Binder
4 per student	Strips of paper	Classroom Teacher, cut before lesson
1 per student	*Show What You Know! Worksheet: Producers and Consumers*	Binder, to be copied by the classroom teacher
As needed	Glue, tape, or stapler	Classroom Teacher
As needed	Crayons	Classroom Teacher
Optional	Panther Hunt Worksheet	Binder, to be copied by the classroom teacher
200 (Optional)	**Cups**	**Bin**
as needed (optional)	marbles (for Panther Hunt activity)	Classroom Teacher

Lesson 5

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per group	Piece of fruit or vegetable	Classroom Teacher
1 per student	*Show What You Know! Worksheet*	Binder, to be copied by the classroom teacher
1 per group	Potting soil (roughly 5 lbs. per fruit or vegetable item)	Bin
1 per group	**Balance/Scale accurate to 0.1 grams**	**Bin**
1 per person	Decomposition Worksheet	Binder

2 per group	**Gallon Ziploc bags**	**Bin**
1	Computer projector and access to "Decomposer Video" http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/ http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/	Classroom Teacher

Lesson 6

Quantity	Item	Source
1 per student	Science Journals	Classroom Teacher
1	Sample Food Web Overhead from Lesson 4	Binder
1 set per group	**Set of cards with animal names**	**Bin**
4 pieces	Chart Paper	Classroom Teacher
1 per student	*Show What You Know! Worksheet*	Binder, to be copied by the classroom teacher
1	**Laminated Fiddler Crab Picture (for student reference)**	**Bin**
For each student	Colored Pencils or Markers	Classroom Teacher
1 per student	*Life in a Meadow Reading*	Binder, to be copied by the classroom teacher

Lesson 7

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per student	Energy Flow and Trophic Level Image	Binder, teacher to make copies for students
A pack	Packing peanuts	Bin
2	**Bucket**	**Bin**
1	http://mass.pbslearningmedia.org/resource/tdc02.sci.life.oate.decompose/decomposers/	Classroom Teacher
1	https://www.youtube.com/watch?v=mCHdhXMFhcU	CMC Website

Lesson 8

Quantity	Item	Source
1 per student	Science Journal	Classroom Teacher
1 per student group	Poster board	Classroom Teacher
1 per class	Marine food web handout	Binder
1 per student group	Computer with internet access	Classroom Teacher
1 per student	*Show What You Know! Worksheet*	Binder, teacher to make copies for students
1 per class	Projector or Elmo	Classroom Teacher

Lesson 9

Quantity	Item	Source
1 per student	Science Journals	Classroom Teacher
1 set per group	**Set of cards with animal information (from an earlier lesson)**	**Bin**
1	Sample Food Web Overhead from previous lesson	Binder
1	**Ball of yarn**	**Bin**
1	Habitat web lesson from National Wildlife Federation (2001)	CMC Website
1 per student	*Show What You Know! Worksheet*	Binder, teacher to make copies for students