

Unit 5: Stability and Change in Ecosystems

Standard(s):

8.3.1 Plan and conduct an investigation and use the evidence to construct an explanation of how photosynthetic organisms use energy to transform matter. Emphasize molecular and energy transformations during photosynthesis. (PS3.D, LS1.C)

8.3.2 Develop a model to describe how food is changed through chemical reactions to form new molecules that support growth and/or release energy as matter cycles through an organism. Emphasize describing that during cellular respiration molecules are broken apart and rearranged into new molecules, and that this process releases energy. (PS3.D, LS1.C)

8.3.3 Ask questions to obtain, evaluate, and communicate information about how changes to an ecosystem affect the stability of cycling matter and the flow of energy among living and nonliving parts of an ecosystem. Emphasize describing the cycling of matter and flow of energy through the carbon cycle. (LS2.B, LS2.C)

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts
Asking Questions Students engage in asking testable questions to pursue understandings of phenomena. Developing and Using Models Students develop physical, conceptual and other models to represent relationships, explain mechanisms, and predict outcomes.	PS3.D Energy in Chemical Processes and Everyday Life LS1.C Organization for Matter and Energy Flow in Organisms LS2.B Cycles of Matter and Energy Transfer in Ecosystems LS2.C Ecosystem Dynamics, Functioning, and Resilience	Stability and Change Students evaluate how and why a natural or constructed system can change or remain stable over time. Systems and System Models Students use models to explain the parameters and relationships that describe complex systems.
Big Ideas: - Naturally occurring food and fuel contain complex carbon-based molecules, chiefly derived from plant matter that has been formed by photosynthesis. The chemical reaction of these molecules with oxygen releases energy; such reactions provide energy for most animal life and for residential, commercial, and industrial activities. - The energy needed for life is ultimately derived from the sun through photosynthesis. Plants, algae (including phytoplankton), and other energy-fixing microorganisms use sunlight, water, and carbon dioxide to facilitate photosynthesis, which stores energy, forms plant matter, releases oxygen, and maintains plants' activities. Plants and algae—being the resource base for animals, the animals that feed on animals, and the decomposers—are energy-fixing organisms that sustain the rest of the food web.		

- The carbon cycle provides an example of matter cycling and energy flow in ecosystems. Photosynthesis, digestion of plant matter, respiration, and decomposition are important components of the carbon cycle, in which carbon is exchanged between the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.

Preceding Grade Bands:	Target Grade Bands:	Following Grade Bands:
● The energy released by burning fuel or digesting food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). ● All animals need food in order to live and grow. They obtain their food from plants or from other animals. Plants need water and light to live and grow. ● Animals and plants alike generally need to take in air and water, animals must take in food, and plants need light and minerals. ● Food provides animals with the materials they need for body repair and growth and is digested to release the energy they need to maintain body warmth and for motion. ● Plants acquire their material for growth chiefly from air and water and process matter they have formed to maintain their internal conditions. ● Organisms obtain the materials they need to grow and survive from the environment. ● Matter cycles between the air and soil and among plants, animals, and microbes as these organisms live and die. Organisms obtain gasses, water, and minerals from the environment and release waste matter (gas, liquid, or solid) back into the environment.	● The chemical reaction by which plants produce complex food molecules (sugars) requires an energy input (i.e., from sunlight) to occur. In this reaction, carbon dioxide and water combine to form carbon-based organic molecules and release oxygen. ● Plants, algae (including phytoplankton), and many microorganisms use the energy from light to make sugars (food) from carbon dioxide from the atmosphere and water through the process of photosynthesis, which also releases oxygen. These sugars can be used immediately or stored for growth or later use. ● Animals obtain food from eating plants or eating other animals. Within individual organisms, food moves through a series of chemical reactions in which it is broken down and rearranged to form new molecules, to support growth, or to release energy. ● In most animals and plants, oxygen reacts with carbon-containing molecules (sugars) to provide energy and produce carbon dioxide. ● Food webs are models that demonstrate how matter and energy is transferred between producers (generally plants and other organisms that engage in photosynthesis), consumers, and decomposers as the three groups interact—primarily for food—within an ecosystem. ● The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.	● A variety of multistage physical and chemical processes in living organisms, particularly within their cells, account for the transport and transfer (release or uptake) of energy needed for life functions. ● The process of photosynthesis converts light energy to stored chemical energy by converting carbon dioxide plus water into sugars plus released oxygen. ● The sugar molecules thus formed contain carbon, hydrogen, and oxygen; their hydrocarbon backbones are used to make amino acids and other carbon-based molecules that can be assembled into larger molecules ● Cellular respiration also releases the energy needed to maintain body temperature despite ongoing energy loss to the surrounding environment. ● Photosynthesis and cellular respiration (including anaerobic processes) provide most of the energy for life processes. Plants or algae form the lowest level of the food web. At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. ● The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil and are combined and recombined in different ways. At each link in an ecosystem,

		matter and energy are conserved; some matter reacts to release energy for life functions, some matter is stored in newly made structures, and much is discarded. • Photosynthesis and cellular respiration are important components of the carbon cycle, in which carbon is exchanged between the biosphere, atmosphere, oceans, and geosphere through chemical, physical, geological, and biological processes.
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Proficiency Scale:

4 Advanced	3 Proficient	2 Approaching Proficiency	1 Beginning Proficiency
I Can: Develop a model based on evidence and scientific principles that shows how photosynthesis and cellular respiration cause matter to cycle and energy to flow through an <u>ecosystem</u>. AND Ask questions about what would happen to the <u>stability</u> of an ecosystem if there was a <u>change</u> to the availability of energy or matter resources. AND Propose a solution to mitigate the effects of human impact on the <u>stability</u> of an <u>ecosystem</u>.	I Can: Develop a model based on evidence and scientific principles that shows how photosynthesis and cellular respiration cause matter to cycle and energy to flow through an <u>ecosystem</u>. AND Ask questions about what would happen to the <u>stability</u> of an ecosystem if there was a <u>change</u> to the availability of energy or matter resources.	I Can: Develop a model that shows how photosynthesis and cellular respiration cause matter to cycle and energy to flow through an <u>ecosystem</u>. AND Ask questions about the <u>stability</u> of an ecosystem.	I Can: Develop a model that shows relationships between organisms in an <u>ecosystem</u>. AND Ask questions about <u>ecosystems</u>.

Anchoring Phenomenon:**Terrarium??? Biodome**

- <https://www.nytimes.com/2019/03/29/sunday-review/biosphere-2-climate-change.html>
- <https://dartmouthalumnimagazine.com/articles/biosphere-2-what-really-happened>
- <https://biosphere2.org/>
- <https://www.history.com/news/biosphere-2-spaceship-earth>

Essential Question:

What affects the stability of matter cycles and energy flow through an ecosystem?

Learning Goals:**Students will be able to:**

- 5A: Plan and conduct an investigation and use the evidence to explain how plants use energy from the sun to change matter and store energy in glucose molecules.
- 5B: Develop a model that shows how food molecules are changed through cellular respiration to release energy and support growth.
- 5C: Ask questions to obtain information about how a change to an ecosystem might affect the stability of the cycling of matter and flow of energy in an ecosystem.
- 5D: Describe the cycling of matter and flow of energy through the carbon cycle.

	Learning Opportunities	Formative Assessments
Learning Goal: 5A - Plan and conduct an investigation and use the evidence to explain how plants use energy from the sun to change matter and store energy in glucose molecules.		
Engage		

	Teacher:	Student:	
Explore	● Intro to Photosynthesis Student Sheet ● Intro to Photosynthesis Student Sheet-Spanish ● Garden Crest Investigation Student Sheet - Plan and conduct an experiment to eliminate one of the needs for Photosynthesis. ● Garden Crest Investigation Student Sheet-Spanish ● If you are absent, get a seed kit from Bostwick to complete at home. (email me if you need to arrange it getting picked up) ● Link if You Need Help Inserting an Image: ● Link If You Need Help Inserting an Image-Spanish ● Link to Small Printable Ruler: <i>(Not needed in Spanish)</i> ● Garden Cress Make-up Lab ● Garden Cress Make-up Lab-Spanish		
	Teacher:	Student:	
Explain	● Discovering Photosynthesis Student Sheet ● Discovering Photosynthesis Student Sheet-Spanish ● Bead game ● Leaf Discs and Photosynthesis Lab ● Leaf Discs and Photosynthesis Lab-Spanish ● Alternate to the Leaf Discs and Photosynthesis Lab ● Alternate to the Leaf Discs and Photosynthesis Lab-Spanish		

	Teacher:	Student:	
Evaluate	• Photosynthesis Quiz • Photosynthesis Quiz - Spanish		
	Teacher:	Student:	

Learning Goal: 5B - Develop a model that shows how food molecules are changed through cellular respiration to release energy and support growth.

Explore	● Intro to Cellular Respiration Student Sheet ● Intro to Cellular Respiration Student Sheet - Spanish		
	Teacher:	Student:	
Explain	● Why We Eat Student Sheet ● Why We Eat Student Sheet - Spanish ● Visualizing Photosynthesis and Cellular Respiration Student Sheet ● Visualizing Photosynthesis and Cellular Respiration Student Sheet - Spanish ● Respiration and Gummy Bears ● Respiration and Gummy Bears - Spanish		

Elaborate	• Review for Cellular Respiration Student Sheet • Review for Cellular Respiration Student Sheet - Spanish		
	Teacher:	Student:	
Evaluate	• Cellular Respiration Quiz • Cellular Respiration Quiz - Spanish		
	Teacher:	Student:	

Learning Goal: 5C - Ask questions to obtain information about how a change to an ecosystem might affect the stability of the cycling of matter and flow of energy in an ecosystem.			
Explore	• Battle at Kruger Video Student Sheet • Battle at Kruger Video Student Sheet - Spanish • Producers, Consumers & Decomposer Student Sheet • Producers, Consumers & Decomposer Student Sheet - Spanish		
	Teacher:	Student:	
Explain	• Option 1 - Ecosystem World Biome Books - Students will research on their own an ecosystem and evaluate the interconnection between organisms and their environment. • Option 1 - Ecosystem World Biome Books - Spanish • Option 2 - Under the Grassland Sky - Ecosystem Analysis - Students will be guided more directly with specific questions to guide you to the relevant information to consider. • Option 2 - Under the Grassland Sky - Ecosystem Analysis-Spanish		

	• Ecosystem Part 1 -Students are going to learn how these 3 types of living organisms come together to make up an ecosystem. • Ecosystem Part 1- Spanish • Ecosystem Part 2 • Ecosystem Part 2-Spanish • Answers Ecosystems Part 1 • Answers Ecosystems Part 1- Spanish • Answers Ecosystems Part 2 • Answers Ecosystems Part 2- Spanish	
	Teacher: Student:	

Elaborate	• Stability of Yellowstone Ecosystem • Stability of Yellowstone Ecosystem-Spanish • Yellowstone Park • Yellowstone Park-Spanish	
	Teacher: Student:	
Evaluate	• Deer Population Quiz • Deer Population Quiz-Spanish • Data for Deer Population • Data for Deer Population-Spanish	
	Teacher: Student:	

Learning Goal: 5D - Describe the cycling of matter and flow of energy through the carbon cycle.

Explore	● How Earth Recycles? ● How Earth Recycles-Spanish ● Recycling the Dead - Student Sheet - The decay of dead things is simply nature’s way of mining old materials for new uses ● Recycling the Dead - Student Sheet-Spanish ● Carbon Cycle Video Student Sheet - Students need to identify the most likely places carbon was before that point and the most likely places the carbon will go after. ● Carbon cycle video student sheet-Spanish		THIS LINK IS INCORRECT-Add correct one, and add correct Spanish one
	Teacher:	Student:	
Explain	● Carbon Cycle Readings ● Carbon Cycle Readings-Spanish ● Sinks and Sources Reading ● Sinks and Sources Reading-Spanish ● Carbon Cycle Game - Teacher Instructions ● Carbon Cycle Game - Teacher Instructions-Spanish ● Carbon Cycle Game Student Sheet ● Carbon Cycle Game Student Sheet-Spanish ● Alternate - Carbon Cycle Game ● Alternate - Carbon Cycle Game-Spanish		
	Teacher:	Student:	

Elaborate	• Living and Nonliving Carbon Cycle • Living and Nonliving Carbon Cycle-Spanish • Carbon Cycle Review • Carbon Cycle Review-Spanish		
	Teacher:	Student:	
Evaluate	• Carbon Cycle Quiz • Carbon Cycle Quiz- Spanish		
	Teacher:	Student:	