Unit 3 - Matter and Energy in Ecosystems

Content Area: **Science**
Course(s):
Time Period: **Full Year**
Length: **Full Year**
Status: **Published**

Unit Overview

The Matter and Energy in Ecosystems unit builds on the understanding developed in the Populations and Resources unit where students learned that the transfer of energy storage molecules, such as starches and fats, is determined by the interactions between consumer and resource populations. While the previous focus was on consumers, this unit expands students' understanding of ecosystems by considering both living and nonliving components—how its producers, consumers, and decomposers meet their energy needs through the processes of photosynthesis and cellular respiration; how carbon, a key component of those processes, moves between nonliving and living matter; and how sunlight and the atmosphere function within the overall system.

Enduring Understandings

During the process of photosynthesis, producers make energy storage molecules, using carbon from carbon dioxide and energy from sunlight.
If one part of a system changes, this affects the rest of the system.
When there is more carbon (in the form of carbon dioxide) in abiotic matter, more carbon is available to producers for making energy storage molecules. When there is less carbon (in the form of carbon dioxide) in abiotic matter, less carbon is available to producers for making energy storage molecules.
When there is more sunlight, producers can make more energy storage molecules from the carbon in carbon dioxide. When there is less sunlight, producers cannot make as many energy storage molecules from the carbon in carbon dioxide.
As organisms release energy during cellular respiration, carbon dioxide is produced from the carbon in energy storage molecules. This process moves carbon from biotic to abiotic matter.
Since carbon cannot be produced or used up, the total amount of carbon in a closed ecosystem does not change. If the amount of carbon increased in abiotic matter, then it also decreased in biotic matter. If the amount of carbon decreased in abiotic matter, then it also increased in biotic matter

Essential Questions

How do all the organisms in an ecosystem get the resources they need to release energy?
Where do the energy storage molecules in an ecosystem come from?
What factors affect how many energy storage molecules producers are able to make
Where does the carbon dioxide in abiotic matter come from?
How do organisms give off carbon dioxide?
If the amount of carbon changed in one part of a closed ecosystem, what happened to the carbon in the rest of the ecosystem?

Learning Objectives

Carbon is part of carbon dioxide, which is abiotic matter. Carbon is also part of energy storage molecules, which are biotic matter.
During the process of photosynthesis, producers make energy storage molecules, using carbon from carbon dioxide and energy from sunlight. This moves carbon from abiotic to biotic matter.
If one part of a system changes, this affects the rest of the system.
When there is more carbon (in the form of carbon dioxide) in abiotic matter, more carbon is available to producers for making energy storage molecules.
When there is less carbon (in the form of carbon dioxide) in abiotic matter, less carbon is available to producers for making energy storage molecules.
When there is more sunlight, producers can make more energy storage molecules from the carbon in carbon dioxide.
When there is less sunlight, producers cannot make as many energy storage molecules from the carbon in carbon dioxide.
As organisms release energy during cellular respiration, carbon dioxide is produced from the carbon in energy storage molecules. This process moves carbon from biotic to abiotic matter.
Since carbon cannot be produced or used up, the total amount of carbon in a closed ecosystem does not change.
If the amount of carbon increased in abiotic matter, then it also decreased in biotic matter. If the amount of carbon decreased in abiotic matter, then it also increased in biotic matter.
Read articles about photosynthesis. Investigate photosynthesis, energy-storage molecules, and carbon in the Sim.
View a video of a photosynthesis experiment and analyze data about the biodome and model their ideas about its collapse.
Get evidence from the Sim and from a video of an experiment to determine which organisms do cellular respiration.
Read a short article about decomposers and dead matter. Students model more complete ideas about the biodome collapse, using evidence about decomposers and dead matter.
Read about carbon dioxide in the whole Earth system.
Use a game-like physical model to investigate carbon cycling.
Create a visual model and write their final explanation of the biodome collapse.

Standards: Content

MS-LS1-6	Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
MS-LS1-7	Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism.
MS-LS2-2	Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-3	Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
MS-LS2-4	Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Standards: Interdisciplinary

Assessment Evidence

Formative	Teacher observations, Class discussions, Lab Activities, Key concepts and vocabulary quizzes, Warm Ups, Open Ended Responses, Modeling, Simulations, Innovators Monthly Research
Summative	In correlation with the NJSLS, students must demonstrate the following as summative assessments: MS-LS 1-6: Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms. MS-LS1-7: Develop a model to describe how food is rearranged through chemical reactions forming new molecules that support growth and/or release energy as this matter moves through an organism. MS-LS2-2: Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. MS-LS 2-3: Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. MS-LS 2-4: Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations Other summative assessments will include but are not limited to: lesson activities, summative tests, lab skills, demonstrations, and vocabulary quizzes
Alternative & Benchmark	Alternative assessments as required by student IEP/504/I&RS - Read to the student and chart oral responses. Word banks, sentence frames, oral responses, graphic organizers, observations, and anecdotal notes. Benchmark – LinkIt Benchmark Assessment, Teacher Generated Assessments
Assessment Evidence Resource	

Instructional Resources

Smartboard, Computers, Websites and digital interactives/models, Multi-media presentations, Video Streaming, Amplify Digital Curriculum, Generation Genius, BrainPop, Mystery Science, Microsoft 365, Primary and Secondary Source Documents, Lab Materials as needed, Amplify Readings, Labs, Simulations

Instructional Resource List

Curricular Mandates

Below are the curricular requirements as defined in NJ Administrative Code and Statute

	Amistad		Diversity, Equity, and Inclusion
	Holocaust		LGBT and Disabilities (Grades 6-12)
	Climate Change		Asian American & Pacific Islander

Social Emotional Learning (SEL) Competencies

NJ Social and Emotional Learning Competencies & Sub-Competencies

	Self-Awareness		Relationship Skills
X	Responsible Decision-Making		Social Awareness
X	Self-Management		

21st Century Skills & Themes

X	Global and Cultural Awareness		Technology Literacy		Planning and Budgeting
X	Creativity and Innovation		Financial Institutions		Risk Management and Insurance
X	Information and Media Literacy		Digital Citizenship		Economic and Government Influences
X	Critical Thinking and Problem Solving		Credit Profile		Career Awareness and Planning
	Civic Financial Responsibility		Financial Psychology		