Unit Overview	
Content Area: Life Science	
Unit Title: Energy and Matter in Ecosystems	**Unit:** 3
Target Course/Grade Level: 5	**Timeline:**

Unit Summary:

What happens to the matter and energy that are part of each organism?
In this unit of study, students develop an understanding of the idea that plants get the materials they need for growth chiefly from air and water. Using models, students can describe the movement of matter among plants, animals, decomposers, and the environment, and they can explain that energy in animals' food was once energy from the sun. The crosscutting concepts of energy and matter and systems and system models are called out as organizing concepts for these disciplinary core ideas. Students are expected to demonstrate grade-appropriate proficiency in developing and using models and engaging in argument from evidence. Students are also expected to use these practices to demonstrate understanding of the core ideas.
This unit is based on 5-LS1-1, 5-LS2-1, and 5-PS3-1

Learning Targets

NJSLS-Science

5-LS1-1	Support an argument that plants get the materials they need for growth chiefly from air and water.
5-LS2-1	Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.
5-PS3-1	Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.

Disciplinary Core Ideas

LS1.C: Organization for Matter and Energy Flow in Organisms
- Plants acquire their material for growth chiefly from air and water. (5-LS1-1)

LS2.A: Interdependent Relationships in Ecosystems
- The food of almost any kind of animal can be traced back to plants. ORganisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. 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. Organisms can survive only in environments in which their particular needs are met. A healthy ecosystem in one in which multiple species of different types are each able to meet their needs in a relatively stable web of life. Newly introduced species can damage the balance of an ecosystem. (5-LS2-1)

LS2.B: Cycles of Matter and Energy Transfer in Ecosystems
- Matter cycles between the air and soil and and among plants, animals, and microbes as these

organisms live and die. Organisms obtain gases, and water, from the environment, and release waster matter (gas, liquid, or solid) back into the environment. (5-LS2-1)

PS3.D: Energy in Chemical Processes and Everyday Life

- The energy released [from] food was once energy from the sun that was captured by plants in the chemical process that forms plant matter (from air and water). (5-PS3-1)

LS1.C: Organization for Matter and Energy Flow in Organisms

- Food provides animals with the materials they need for body repair and growth and the energy they need to maintain body warmth and for motion. (secondary to 5-PS3-1)

Science and Engineering Practices

Engaging in Argument from Evidence

- Support and argument with evidence, data, or a model (5-LS1-1)

Developing and Using Models

- Develop a model to describe phenomena (5-PS3-1)
- Use models to describe phenomena (5-PS3-1)

NJSLS Connections

Primary Interdisciplinary Connections:

English Language Arts/Literacy:

- Quote accurately from a text when explaining what the text says explicitly and when drawing inferences from the text. (5-LS1-1) RI.5.1
- Draw on information from multiple print or digital sources, demonstrating the ability to locate an answer to a question quickly or to solve a problem efficiently. (5-LS2-1), (5-PS3-1) RI.5.7
- Integrate information from several texts on the same topic in order to write or speak about the subject knowledgeably. (5-LS1-1) RI.5.9
- Write opinion pieces on topics or texts, supporting a point of view with reasons and information. (5-LS1-1) W.5.1
- Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes. (5-LS2-1), (5-PS3-1) SL.5.5

Mathematics:

- Reason abstractly and quantitatively. (5-LS1-1), (5-LS2-1) MP.2
- Model with mathematics. (5-LS1-1), (5-LS2-1) MP.4
- Use appropriate tools strategically. (5-LS1-1) MP.5
- Convert among different-sized standard measurement units within a given measurement system (e.g., convert 5 cm to 0.05 m), and use these conversions in solving multi-step, real world problems. (5-LS1-1) 5.MD.A.1

Unit Essential Questions	Unit Understandings
1. Where do plants get the materials they need for growth? 2. How does matter move among plants, animals,	• Matter is transported into, out of, and within systems. • Plants acquire their material for growth chiefly from air and water. • Science explanations describe the mechanisms for natural events. • A system can be described in terms of its components and their interactions.

decomposers, and the environment? 3. How can energy in animals' food be traced to the sun?	• The food of almost any kind of animal can be traced back to plants. • Organisms are related in food webs in which some animals eat plants for food and other animals eat the animals that eat plants. • 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. • Organisms can survive only in environments in which their particular needs are met. • Energy can be transferred in various ways and between objects. • The energy released from food was once energy from the sun, which was captured by plants in the chemical process that forms plant matter (from air and water). • Food provides animals with the materials they need for body repair and growth and the energy they need for motion and to maintain body warmth.

Unit Learning Targets (Outcomes) – Formative Assessment:

Students who understand the concepts are able to …

- Describe how matter is transported into, out of, and within systems.
- Support an argument with evidence, data, or a model.
- Support an argument that plants get the materials they need for growth chiefly from air and water. (Emphasis is on the idea that plant matter comes mostly from air and water, not from the soil.)
- Describe a system in terms of its components and interactions.
- Develop a model to describe phenomena.
- Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment. (Assessment does not include molecular explanations.)
- Emphasis is on the idea that matter that is not food—such as air, water, decomposed materials in soil—is changed into matter that is food. Examples of systems could include:
  - ✓ Organisms
  - ✓ Ecosystems
  - ✓ Earth
- Describe how energy can be transferred in various ways and between objects.
- Use models to describe phenomena.
- Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun.
- Examples of models could include:
  - ✓ Diagrams
  - ✓ Flowcharts

Cross Cutting Concepts:

<u>Energy and Matter</u>

- Matter is transported into, out of, and within systems. (5-LS1-1)
- Energy can be transferred in various ways and between objects. (5-PS3-1)

<u>Systems and System Models</u>

- A system can be described in terms of its components and their interactions. (5-LS2-1)

Science Models, Laws, Mechanisms, and Theories Explain Natural Phenomena

- Science explanations describe the mechanisms for natural events. (5-LS2-1)

Integration of Technology: chromebooks, interactive whiteboard, videos

Technology Resources:

- Knowing Science website
  http://knowingscience.com/teacherresources

Opportunities for Differentiation:

Differentiation and support tips, which includes suggestions for ELL, struggling students, and accelerated students are available in the Above and Beyond section of the Knowing Science teacher manual.

Teacher Notes:

Career Ready Practices:

In this unit the following career ready practices are addressed
CRP1: Act as a reasonable and contributing citizen and employee
CRP2: Apply appropriate academic and technical skills
CRP3: Attend to personal health and financial well-being
CRP4: Communicate clearly and effectively and with reason
CRP5: Consider the environmental, social and economic impacts of decisions
CRP6: Demonstrate creativity and innovation
CRP7: Employ valid and reliable research strategies
CRP8: Utilize critical thinking to make sense of problems and persevere in solving them
CRP9: Model integrity, ethical leadership and effective management
CRP10: Plan education and career paths aligned to personal goals
CRP11: Use technology to enhance productivity
CRP12: Work productively in teams while using cultural global competence

Prior Learning:

By the end of Kindergarten, students understand that:

- 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.

By the end of Grade 2, students understand that:

- Plants depend on water and light to grow.
- Plants depend on animals for pollination or to move their seeds around.

By the end of Grade 4, students understand that:

- Living things affect the physical characteristics of their regions.

Evidence of Learning

Summative Assessment:

Food Webs and Energy

1. Written responses from activity sheets may be used as informal assessments to determine students' understanding of science content concepts and nonfiction comprehension skills.
2. The final trading cards research project may also be used as an assessment.
3. Rubric
4. Life Science Unit Test

Owl Pellets

1. Written Responses from activity sheets and packets amy be used as informal assessments to determine students' understanding of science content concepts and nonfiction comprehension skills.
2. Activity Sheet 3: Owl Pellet Food Web may also be used as an assessment.
3. Rubric

Wiggly Worms

1. Written Responses from activity sheets and packets amy be used as informal assessments to determine students' understanding of science content concepts and nonfiction comprehension skills.
2. The composting project from Activity Sheet 4: Spread the Word! may also be used as an assessment.
3. Rubric

Equipment needed:

Whiteboard, laptops, and hands-on materials for lessons

Teacher Instructional Resources (Hyperlinks):

Bottle Biology Terrarium: Students will create a terrarium, make observations of the terrarium, then develop a model to explain how matter transfers within the ecosystem. This resource describes the process of creating a terrarium (which will serve as the phenomena that the students observe), but does not include specific lesson details or instructional strategies.

Biodomes Engineering Design Project: This activity is a culmination of a 16 day unit of study where students explore the biosphere's environments and ecosystems. In this final activity, students apply what they learned about plants, animals, and decomposers to design and create a model biodome. Engaging in the engineering design process, students construct a closed (system) environment containing plants and animals existing in equilibrium. Provided with a variety of materials (constraints), teams of students will use their imagination and culminating knowledge to design a biodome structure following the criteria of the activity that models how plants, insects, and decomposers work together in a system. (The activity can be conducted as a structured or open-ended design. It is recommended to allow students the opportunity to be true engineers and follow the opened-ended design.)

Modifications for ELL's, Special Education, 504, and Gifted and Talented Students:

(Note: Teachers identify the modifications that they will use in the unit. See NGSS Appendix D: All Standards, All Students/Case Studies for vignettes and explanations of the modifications.)

· Structure lessons around questions that are authentic, relate to students' interests, social/family background and knowledge of their community.

· Provide students with multiple choices for how they can represent their understandings (e.g. multisensory techniques-auditory/visual aids; pictures, illustrations, graphs, charts, data tables, multimedia, modeling).

· Provide opportunities for students to connect with people of similar backgrounds (e.g. conversations via digital tool such as SKYPE, experts from the community helping with a project, journal articles, and biographies).

· Provide multiple grouping opportunities for students to share their ideas and to encourage work among various backgrounds and cultures (e.g. multiple representation and multimodal experiences).

· Engage students with a variety of Science and Engineering practices to provide students with multiple entry points and multiple ways to demonstrate their understandings.

· Use project-based science learning to connect science with observable phenomena.

· Structure the learning around explaining or solving a social or community-based issue.

· Provide ELL students with multiple literacy strategies.

· Collaborate with after-school programs or clubs to extend learning opportunities.

· Restructure lesson using UDL principles (http://www.cast.org/our-work/about-udl.html#.VXmoXcfD_UA)

ACTIVITIES	**MATERIALS**
Unit 3: Life Science	
3.1 Food Webs and Energy	
Session 1: (40-50 minutes) What is interdependency?	• Activity Sheet 1: Animal Sorting Cards • Activity Sheet 2: What is interdependency? • Optional: sticky notes or small index cards
Session 2: (40-60 minutes) What is photosynthesis?	• Activity Sheet 3: The Photosynthesis Equation • Activity Sheet 4: "Seeing Green" • Photosynthesis Kit • Water • 10 green leaves
Session 3: (30-40 minutes) What are the characteristics of the food web?	• Activity Sheet 5: Food Webs

Session 4: (30-40 minutes) How can I show relationships in a food web?	• Activity Sheet 6: Food Web Cards • Construction paper, one sheet per group

Session 5: (30-40 minutes) What role do the decomposers play in an ecosystem?	• Activity Sheet 7: Clean Up Crew
	  ○ optional: rotten bananas investigation (2-3 bananas)
	  ○ dry yeast, ½ tsp per group
	  ○ permanent marker

Session 6: (30-40 minutes) How do limiting factors affect an ecosystem?	• Activity Sheet 9: Energy and Limiting Factors
Session 7: (30-40 minutes) How can we model limiting factors in an ecosystem?	• Activity Sheet 10: Limiting Factors Game • Limiting Factors Game
Session 8+: (30-40 minutes) Ecosystem Trading Cards Culminating Activity	• Activity Sheet 11: Ecosystem Trading Cards
3.2 Owl Pellets	
Session 1: (30-40 minutes) What are the owl's adaptations for obtaining nutrients?	• Activity Sheet 1: Whooo's Coming to Dinner?
Session 2: (40-50 minutes) What is inside an owl pellet?	• Owl pellets, at least one for each group • Owl Pellet Dissection Journal • Owl Pellets Study Kit • Magnifier, one for each group • Digital scale • Rulers (cm) • Disposable gloves
Session 3: (30-40 minutes) How can we make a model of the contents of the owl pellets?	• Bones from owl pellets • Disposable gloves • Activity Packet 2: Owl Pellet Dissection • Activity Sheet 2: Build-a-Skeleton • Construction paper, one sheet per group • Glue

Session 4+: (30-40 minutes per session) How can I show an owl's place in a food web?	• Activity Sheet 3: Owl Pellet Food Web • Construction paper, one sheet per group
3.3 Wiggly Worms	
Session 1: (30-40 minutes) What do we already know and want to know about worms?	• Activity Sheet 1: Wonderings about Worms • Activity Sheet 2: Dirty Decomposers

Session 2: (40-50 minutes) How can we build a suitable worm habitat?	• Wiggly Worms Lab Journal, pgs. 1-2
	• Dishpan, one for each group
	• Disposable gloves
	• Worms
	• Materials for worm habitat:
	  ○ plain newspaper
	  ○ Soil
	  ○ food scraps
	• Water

Session 3: (30-40 minutes) What can we observe about the worm anatomy?	• Wiggly Worm Journal, pgs. 3-4 • Disposable gloves • Viewing containers and absorbent paper towels • Magnifier, one for each group • Ruler • Worms • Water

Session 4: (30-40 minutes) How does a worm move about?	• Wiggly Worm Journal, pgs. 5-6
	• Disposable gloves
	• For Worm Movements:
	  ○ viewing containers & absorbent paper towels
	  ○ magnifier, one per group
	  ○ worms
	  ○ Water
	  ○ copy paper
	• For Worm Reactions:
	  ○ viewing containers and absorbent paper towels
	  ○ worms

	○ water
Session 5: (30-40 minutes) How do worms react to light?	• Wiggly Worm Journal • Cardboard box with lid, one for each group • Absorbent paper towels, moistened • Disposable gloves • Worms
Session 6: (30-40 minutes) How do worms react to touch or vibrations?	• Wiggly Worm Journal • Disposable gloves • Viewing containers • Pencil, one per group • Worms
Session 7: (30-40 minutes) Do a worms have a sense of smell?	• Wiggly Worm Journal • Disposable gloves • Cotton balls • Viewing containers • Pure extract • Worms
Session 8: (30-40 minutes) What are the benefits of composting?	• Activity Sheet 3: Composting
Session 9-10: (40-50 minutes) How can we spread the word about composting?	• Activity Sheet 4: Spread the Word! • Project materials
Session 11: (30-40 minutes) What is happening in the worm bins?	• Wiggly Worms Lab Journal Disposable gloves • Worm bins • Optional: ○ Newspaper or paper plates ○ Absorbent paper towel ○ Cotton swabs ○ Compost thermometer