

Life Science Standard LS2A

Content Standard:

Matter cycles and energy flows through living and nonliving components in ecosystems. The transfer of matter and energy is important for maintaining the health and sustainability of an ecosystem.

Performance Indicators:

Explain how plants and animal cycle carbon and nitrogen within an ecosystem.

Explain how matter cycles and energy flows in ecosystems, resulting in the formation of differing chemical compounds and heat.

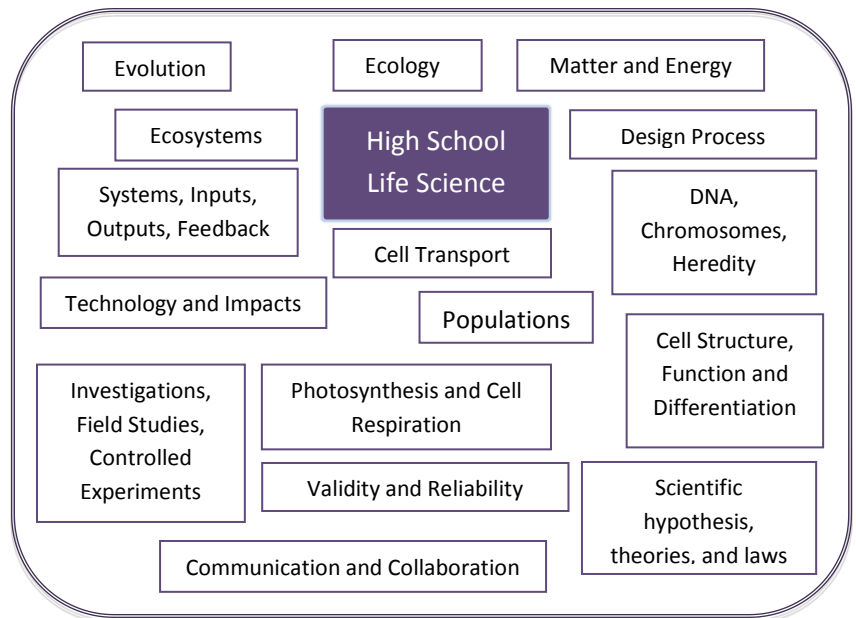
Item Specifications:

Describe the cycle of carbon through ecosystems.

Describe examples of matter cycling that can affect the health of an ecosystem.

Describe the cycle of nitrogen through ecosystems.

Describe the transfers and transformations of matter and/or energy in an ecosystem.



Reflective Questions for Students:

How is carbon important to living things?

How does the carbon cycle connect the environment to living things?

What role does nitrogen play in living things?

How does energy move from the sun through living things? As energy moves through an ecosystem, what transformations can be identified?

When you think about the answers to these questions, think about models that you could develop; diagrams that would demonstrate processes; and functions of parts in relationship to their structure.

Assessment Information

<http://www.k12.wa.us/Science/Assessments.aspx>

Quick Links for Students:

This website provides a diagram of the carbon cycle.

<http://www.teachersdomain.org/resource/tdc02.sci.phys.matter.ccycle/>

This website provides an explanation and diagrams of the nitrogen cycle.

<http://extension.missouri.edu/publications/DisplayPub.aspx?P=WQ252>

This website provides an animation of the nitrogen cycle.

http://www.classzone.com/books/ml_science_share/vis_sim/em05_pg20_nitrogen/em05_pg20_nitrogen.swf

This website provides an explanation of ecosystems.

<http://www.globalchange.umich.edu/globalchange1/current/lectures/king/ecosystem/ecosystem.html>

Teacher Center

Elements of Effective Science Instruction

Disciplinary Core Ideas

Essential teaching components leading to the big ideas:

Student acquisition of the content of science involves opportunities to meet state crosscutting and domain standards and recognize how the big ideas fit within a large conceptual framework. Learning is best achieved through sequencing learning targets into learning progressions that inform teacher's instructional decision making.

- Describe the cycle of carbon through ecosystems (e.g., carbon dioxide in air becomes large carbon-containing molecules in the tissues of plants through photosynthesis, these molecules can be cycled to animals that consume the plants, then returned as carbon dioxide to the atmosphere through cellular respiration, combustion, and decomposition).
- Describe examples of matter cycling that can affect the health of an ecosystem (e.g., composting to improve soil quality, crop rotation, worm bins, fertilizer runoff, and bioaccumulation).
- Describe the cycle of nitrogen through ecosystem (e.g., nitrogen in air is taken in by bacteria in soil, then made directly available to plants through the soil, and returned to the soil and atmosphere when the plants decompose).
- Describe the transfers and transformations of matter and/or energy in an ecosystem (e.g., sunlight transforms to chemical energy during photosynthesis, chemical energy and matter are transferred when animals eat plants or other animals, carbon dioxide produced by animals by respiration is used by plants and transformed to glucose during photosynthesis).
- <http://www.teachersdomain.org/resource/tdc02.sci.life.oate.energyflow/> Interactive video follows energy from sun through plants to humans. Background and discussion questions included.
- <http://www.teachersdomain.org/resource/hew06.sci.life.reg.foodweb/> Follows energy through a coral reef ecosystem.
- <http://www.teachersdomain.org/resource/lsp07.sci.life.eco.nitrogen/> Animated nitrogen cycle.

Additional supports and extensions for understanding how students grasp the concept:

- http://school.discoveryeducation.com/schooladventures/soil/down_dirty.html These are activities about soil designed to teach students why soil is important.
- <http://sciencespot.net/Pages/classearthday.html> This site has many different lessons on environmental education, Earth Day activities and composting.

Cross Cutting Ideas: *Designing for Learning*

Strategies to reveal student understanding include:

- Paige Keeley's Formative assessments available through nsta.org
- <http://www.teachersdomain.org/resource/psu06-e21.sci.energybasics/> This is a lesson plan for assessing student's understanding of energy, its sources and its flow.
- <http://www.teachersdomain.org/resource/tdpd.sci.mpssc3/> This is a professional development site to help you develop strategies for revealing student pre and misconceptions.

Prerequisite knowledge required:

- Students should have a basic knowledge of chemistry, including an understanding of how carbon bonds with other elements.
- Students should know what photosynthesis is as well as cell respiration.
- Students should understand energy transformations e.g., one kind of energy can be changed into another kind of energy.
- Students should have prior knowledge of what an ecosystem is.
- Students should know and understand the terms predator, prey, producer, consumer, decomposer.

Learning progressions may include:

<http://www.doe.mass.edu/omste/ste/default.html> Scroll to the bottom of the page, click on life science. When the document opens, scroll down to table of contents, Ecology is on page 38. This is very comprehensive.

Scientifically oriented questions focused on clarifying and extending student understanding include:

- How do carbon and nitrogen cycles bring essential elements from the environment to living things?
- How does each of these cycles link living things to each other?
- Can these cycles be interrupted? If so, how? And what happens as a result?
- How does energy move from the sun to living things? What transformations must it go through?
- Where and how can energy be stored in living things?

Activities supporting opportunities for students to make claims, use evidence and communicate reasonings include:

- http://nsta.org/publications/search_journals.aspx?keyword=ecology&journal=TST If you are a member of NSTA, a search of Science Teacher (high school journal) for articles on ecology will bring up numerous examples of lessons, and projects that teachers have used in their classrooms to give students an understanding of how ecosystems work. Many of these are inquiry and application as well.
- http://www.greeningschools.org/resources/view_cat_teacher.cfm?id=73 This site has several different projects for setting up composting programs in a school, combining inquiry with application.

Cross Cutting Ideas:
Sense Making

Planning time in the lessons to support time for students to make sense of what they are learning include:

- http://nsta.org/publications/search_journals.aspx?keyword=ecology&journal=TST An NSTA member can search through articles in The Science Teacher (high school journal) for effective teaching strategies to have access to dozens of teacher written articles about strategies that work.
- <http://www.teachersdomain.org/resource/tdpd.sc.i.hlssc1/> professional development through teachers domain for using inquiry in your science classroom to assess student understanding
- http://www.teachersdomain.org/search/?q=assessing+student+understanding&fq_grade=PK&fq_gr

Cross Cutting Ideas:
Classroom Culture and Environment

Activities that show how this topic may relate to students' everyday lives include:

- <http://www.ncosp.wvu.edu/> North Cascades and Olympics Science Partnership has many ideas and strategies for use in your classroom.

<p>ade=PS several different courses through Teachers' domain of professional development focused on the science classroom.</p>	
<p>Strategies to focus on student conversations, interactive notebook prompts, model-building include:</p>	<p>Activities that show how scientists think and do science in relationship to this content standards include:</p> <ul style="list-style-type: none">• http://www.racerocks.com/racerock/energy/tidalenergy/tidalenergy.htm This site is comprehensive in presenting many different aspects of ecosystems, including research being done, data collected (which can be used for evaluating data), population studies, energy studies and more.• http://earthobservatory.nasa.gov/ Beautiful images and maps showing all the parameters NASA measures on Earth, from surface temperatures to vegetation over time.