

Science	SCI.III.5.6	Grade: 8th
Strand III: Using Scientific Knowledge in Life Science		
Standard 5: Ecosystems - All students will explain how parts of an ecosystem are related and how they interact; explain how energy is distributed to living things in an ecosystem; investigate and explain how communities of living things change over a period of time; describe how materials cycle through an ecosystem and get reused in the environment; and analyze how humans and the environment interact.		
Benchmark 6: Explain the effects of agriculture and urban development on selected ecosystems.		
<p>Constructing and Reflecting:</p> <p>SCI.I.1.1– Ask questions that can be investigated empirically.</p> <p>SCI.I.1.2– Design and construct scientific investigations.</p> <p>SCI.I.1.5– Discuss topics in groups by making clear presentations, restating or summarizing what others have said, asking for clarification or elaborating, taking alternative perspectives and defending a position.</p> <p>SCI.II.1.1– Justify plans or explanations on a theoretical or empirical basis.</p> <p>SCI.II.1.2– Describe some general limitations of scientific knowledge.</p> <p>SCI.II.1.3– Show how common themes of science, mathematics and technology apply in real world contexts.</p> <p>SCI.II.1.4– Discuss the historical development of key scientific concepts and principles.</p> <p>SCI.II.1.5– Explain the social and economic advantages and risks of new technology.</p> <p>SCI.II.1.6– Develop an awareness of and sensitivity to the natural world.</p>		
<p>Vocabulary</p> <p>Common factors that influence ecosystems:</p> <ul style="list-style-type: none"> • Pollution of ecosystems <ul style="list-style-type: none"> ➤ Fertilizer ➤ Insecticide ➤ Other chemicals • Land management • Biodiversity • Sustainability • Loss of habitat • Algae blooms • Biodegradable • Nonbiodegradable • Biological magnification • Crop rotation • Contour plowing • Erosion • Terracing • No-till farming • Land banks 	<p>Context</p> <p>Common factors that influence ecosystems:</p> <ul style="list-style-type: none"> • Pollution of ecosystems from: <ul style="list-style-type: none"> ➤ Agriculture ➤ Industry ➤ Urban development • Restoration of habitats • Effects of wastewater where phosphates negatively affects plant growth (ex. history of Lake Erie) 	

Knowledge and Skills

Students will:

- Identify and analyze the impact of agriculture, manufacturing, recreation, and urban development on ecosystems.
- Analyze how decisions that impact the environment are made.
- Debate the value of protecting the environment vs. the economic impact of those decisions. Discuss how natural resources can be protected and at the same time used.

Resources

Coloma Resources:

Book: Holt Science & Technology
Book E Chapter 4 pg 76-98

Other Resources:

- Scope Unit – [Creating A Sustainable Environment](#)
- Michigan Teacher Network –
<http://mtn.merit.edu/mcf/SCI.III.5.HS.6.html>
- http://www.aqua.org/education/teachers/che_sapeake.html “Human impact”
- Science Olympiad event “Water Quality”
- [Decisions, Decisions, the Environment](#)
Tom Snyder Productions (free trial available)
- Science Expo and Science Fair projects
- 4-H
- Department of Environmental Quality
- Berrien County Solid Waste Committee
- Berrien County Waste Recovery
- Engineering firms: Abonmarche, etc
- MI State Agricultural Extension
- Tour of a wastewater treatment plant
• or using staff members for guest speakers
- Wastewater Treatment Simulation Lab (See appendix)
- Local, state, and federal legislations that determine the health of the environment (ex. EPA)

Instruction

- Have the students develop an experiment to determine the impact of a pollutant on a population. Summarize and discuss the results. Relate the results to a local ecosystem. **Corresponds to standard I.1.2**
- Example: Predict how Duckweed will grow in different concentrations of phosphate detergents and liquid fertilizer high in nitrogen. Run an experiment, testing how different concentrations of nitrates and phosphates affect the growth of Duckweed. Count the number of leaflets in the population at the beginning and the end of the experiment. **Corresponds to standard I.1.2**
- Extension – Try used motor oil concentrations on the duckweed populations. Dispose of oil carefully
- (Reindeer moss can also be used for similar experiments to duckweed).
- Wastewater Simulation Lab (See Appendix). **Corresponds to standard I.1.2**

Assessment

- Create a comic book, illustrating the effects of a selected pollutant on a habitat in your area. **Corresponds to standard II.1.1**
(Evaluation rubric available on MI-CLiMB)

The book should include (One point each):

- Source of the pollutant (farm, sewer system, power plant etc.)
- Mechanism of dispersion for pollutant (e.g. wind, ground water, etc.)
- Short term effects on one organism.
- Long term effects on one organism.
- Short term effects on the entire habitat.
- Long term effects on the entire habitat.
- Social issues and implications for humans.
- Economic issues and implications for humans.

Criteria	Apprentice	Basic	Meets	Exceeds
Completeness of contents	Answers with fewer than three correct responses from list above.	Answers with three correct responses from list above.	Answers with four correct responses from list above.	Answers with more than four correct responses from list above.
Accuracy of concepts	Conveys concepts inaccurately.	Conveys some concepts accurately.	Conveys all concepts accurately.	Conveys all concepts accurately with creativity and quality.

Teacher Notes:

Focus Question: What is the impact of pollution on an ecosystem?

Explain how parts of an ecosystem are related and how they interact.

It is important for students to learn about many ecosystems, but they need to begin with those that have the closest connection to them. Very young children think in terms of organisms that are around them such as pets, animals in zoos, and houseplants. At a young age, many children think humans help to feed wild animals. As they mature, children begin to understand the concept of populations of organisms in the wild. The concept of populations is most clearly understood in terms of food chains and food webs.

In elementary school, students should be introduced to food chains and learn about some of the organisms involved. Early in this time, students may only be able to understand the relationship between two organisms. Later, students should be able to identify the organisms involved in both food chains and food webs and the feeding relationships that occur. Interestingly, children in elementary school may not believe that food can be a scarce resource in a food web. They think that all animals are more like people in that animals can change what they need to eat whenever they want according to what is available. Students in these grades should be able to describe all of the basic requirements needed for all living things to exist.

As students progress through the upper elementary grades and go into middle school they should become more aware of different interactions between organisms, besides food. For example, there are mutually beneficial relationships like plants depending on animals for pollination. There are also competitive relationships in which different animals with similar environmental requirements compete for the same resources. In the middle school, students should be made aware of the relationships between organisms in which neither could survive without the other. By high school, students should be able to describe common ecological relationships between and among species and their environments. They should understand the difficult concepts of competition, territory, and carrying capacity among others.

Explain how energy is distributed to living things in an ecosystem.

Students misunderstand the concept of energy. Young children think about food as something that they eat. They do not think about food being converted into a useable form of energy. As middle school students, they start to understand the idea of converting energy, but not into anything in particular. It is just converted. They also have trouble understanding the role of plants and the process of photosynthesis. Students often think that anything taken in by plants is food. Even when they start to understand photosynthesis, most students still believe that plants still take in some kind of food for themselves. Soon they start believing that the food the plant makes is for animals, including humans, not the plant itself.

Students should be able to describe how organisms acquire energy directly and indirectly from sunlight. They should also be able to explain how energy flows through ecosystems. The arrows that we use in food chains and food webs to model energy flow are also confusing for students. Even when it appears that students understand food webs and food pyramids, additional questioning shows that students do not understand the crucial role of solar energy and photosynthesis. Even at the high school level, students believe that higher order consumers can survive without plants if there is enough prey and they keep reproducing. The misunderstanding becomes even greater when students study aquatic environments because they do not understand what a plant really is and because their experiences with aquatic environments are very limited.

Investigate and explain how communities of living things change over a period of time.

Students in elementary school generally have experiences growing particular plants and animals. They also have opportunities to see examples of other ecosystems both managed (farms and gardens) and unmanaged. As students move to middle school they are more prepared to see the effects that changes in one population may have on another. This interdependence is also discussed in the previous benchmark. Students should be able to describe the predictable succession of an ecosystem over time. They should describe the general factors that regulate population size in ecosystems. Students should describe how an ecosystem responds to events that cause it to change. It is important to note that ecosystems can change dramatically and have rapid fluctuations. Over the course of time, the system is fairly stable.

Describe how materials cycle through an ecosystem and get reused in the environment.

Carbon and soil nutrient cycling are critical to understanding how communities change over time. High school students need support in understanding that when organisms die they do not simply "rot away" but that the matter is converted into other materials in the environment. Students need to be reminded that microorganisms are responsible for the decay. High school students frequently think about matter as being created or destroyed rather than it cycles through the ecosystem to be reused in a different form.

Analyze how humans and the environment interact.

Students need to learn the role that animals play in design of systems managed by humans. Students should describe the positive and negative effects that humans have on the environment. They should understand the systems that best encourage the growth of plants and animals and then can be managed by humans. Finally, they should describe more positive and negative effects that humans have on the environment. Students in middle school should be able to explain how humans benefit from the use of plant and animal materials. In middle school, students should be able to describe ways in which humans change the environment. In high school, they should be able to explain the effects that agriculture and urban development have on ecosystems.