Grade 7 Science - Unit 1 - Ecology and Human Impact

Unit Focus

This unit will focus on ecosystem dynamics as students investigate how changes to an ecosystem can have far-reaching effects. The unit will begin with an environmental phenomenon that students will work to decipher through their content investigations. Students will develop a model of an ecosystem, investigate the interdependence of the biotic and abiotic factors, and recognize how just one change can alter the balance of an environment. Students will further investigate ecosystem dynamics by performing an experiment on the effect of certain chemicals on aquatic environments. In doing so, students will be able to quantify how different concentrations of widely used pollutants can damage our local aquatic ecosystems and use this data to support their explanation for the environmental phenomenon that launched this unit. Students will engage in a Field Study of Bauer Park to assess the health of that ecosystem. The culminating experience will ask students to develop and promote a pollution mitigation plan to help decrease water pollution in Madison, using scientifically-based justifications for their claims. This unit answers the guiding question, "What effect do changes in the physical and biological components of an ecosystem have on the overall health of that ecosystem?"

Stage 1: Desired Results - Key Understandings

Standard(s)

Next Generation Science Standards

Performance Expectations: Middle School Earth and Space Sciences

- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process. (MS-ESS2-1)
- Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment. (MSESS3-3)
- Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems. (MS-ESS3-4)

Performance Expectations: Middle School Life Sciences

- 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-LS1-6)
- 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. (MSLS1-7)
- Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. (MS-LS2-1)
- Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems. (MS-LS2-2)
- Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem. (MSLS2-3)

Transfer

Students will be able to independently use their learning to...

T1 Communicate effectively based on purpose, task, and audience to promote collective understanding and/or recommend actions.

T2 Use the scientific process to generate evidence that addresses the original questions.

Meaning

Understanding(s)

Students will understand that...

U1 Ecosystems are dynamic and interconnected systems.

U2 Matter and energy move through ecosystem through food webs and the biogeochemical cycles.

U3 Humans are actively designing solutions to minimize the impact of human activities on the environment.

U4 Human activities significantly alter natural habitats, causing changes to Earth’s environment that can impact living things.

U5 Matter cycles between the living and non-living parts of an ecosystem.

U6 Organisms and populations are dependent on their environmental interactions both with other living things and with nonliving factors, any of which can limit their growth.

Essential Question(s)

Students will keep considering...

Q1 How do matter and energy move through systems?

Q2 How can disruptions in one system cause changes in another?

Q3 How can we mitigate the negative impact our activities have on our local resources?

Q4 How do interactions between living and nonliving things impact populations and communities?

Stage 1: Desired Results - Key Understandings

- Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. (MS-LS2-4)

Next Generation Science Standards (DCI)

Science: 7

- Water continually cycles among land, ocean, and atmosphere via transpiration, evaporation, condensation and crystallization, and precipitation, as well as downhill flows on land. (ESS2.6.C1)
- Human activities have significantly altered the biosphere, sometimes damaging or destroying natural habitats and causing the extinction of other species. But changes to Earth's environments can have different impacts (negative and positive) for different living things. (ESS3.6.C1)
- 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. (LS1.6.C1)
- 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. (LS1.6.C2)
- Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (LS2.6.A1)
- In any ecosystem, organisms and populations with similar requirements for food, water, oxygen, or other resources may compete with each other for limited resources, access to which consequently constrains their growth and reproduction. (LS2.6.A2)
- Growth of organisms and population increases are limited by access to resources. (LS2.6.A3)
- Food webs are models that demonstrate how matter and energy is transferred between producers, consumers, and decomposers as the three groups interact within an ecosystem. Transfers of matter into and out of the physical environment occur at every level. Decomposers recycle nutrients from dead plant or animal matter back to the soil in terrestrial environments or to the water in aquatic environments. The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem. (LS2.6.B1)

U7 Food webs model how matter and energy are transferred among producers, consumers, and decomposers as the three groups interact within an ecosystem.
U8 Ecosystem characteristics vary over time. Disruptions to any part of an ecosystem can lead to shifts in all of its populations.
U9 Plants use the energy from light to make sugars (food) through photosynthesis.
U10 Within every organism, food is broken down through a series of chemical reactions that release energy.
U11 The atoms that make up the organisms in an ecosystem are cycled repeatedly between the living and nonliving parts of the ecosystem.

Acquisition of Knowledge and Skill

Knowledge	Skill(s)
Students will know... **K1** Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with non-living factors **K2** The law of conservation of matter states that matter can neither be created nor destroyed, only rearranged, thus, matter is continually recycled on earth through the carbon, nitrogen, water and phosphorus cycle. **K3** Plants and animals require nutrients such as nitrogen, phosphorus, water, oxygen to function. **K4** Water moving through a watershed picks up, suspends or dissolves various substances produced by nature and by human activities. The quality and usability of water depends on what materials have been picked up, carried and concentrated in the water. **K5** Water quality is important to support a variety of aquatic life and for human consumption. **K6** Plants, algae, and other producers use the energy from light to make sugar from carbon dioxide from the	*Students will be skilled at...* **S1** Analyzing and interpreting data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem. **S2** Constructing an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. **S3** Explaining, citing scientific evidence, how human activity may impact water resources in Connecticut, such as ponds, rivers, and the Long Island Sound ecosystems and propose a solution. **S4** Developing a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

Stage 1: Desired Results - Key Understandings		
• Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (LS2.6.C1) **Madison Public Schools Profile of a Graduate** • Design: Engaging in a process to refine a product for an intended audience and purpose. (POG.2.2) • Citizenship: Identify, analyze and contribute to critical issues in society in an ethical and responsible manner. (POG.5.1)	atmosphere and water through the process of photosynthesis, which also releases oxygen. **K7** Eutrophication is the accumulation of nitrogen and phosphorus (largely from wastewater and fertilizers) that causes hypoxic conditions, resulting in dead zones due to the increase in algae on the surface of the water and, ultimately, the decomposition of large amounts of organisms. **K8** When disruptions in living or non-living components of an ecosystem happen, there are changes that can happen to other living or non-living components as a result. **K9** Vocabulary: Biodiversity, producer, consumer, decomposer, herbivore, omnivore, carnivore, predator, prey, aquatic organisms, interdependent, competition, mutually beneficial interactions, mitigate, microbe, microorganism, phytoplankton, algae, fungi, organic matter, organic waste, photosynthesis, transformation, conservation, convert, atom, molecule, sugar, carbon, carbon dioxide, hydrogen, nitrogen, oxygen, chemical process, chemical reaction, molecule, nutrient, moisture, structure, tissue, chemical reaction, reactant, product, biotic, abiotic, cellular respiration, sugar decomposition, run-off, ground water, pollutant, watershed, wastewater, eutrophication.	**S5** Constructing 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.