Middle School (Grades 6, 7, and 8 in the Integrated Course Model)

6.5.c. – Energy: Pass It On!

"Energy: Pass it On!" uses a study of the population of California wolverines as the basis for exploring the interactions within and dynamics of ecosystems, as well as energy flow through these systems. It explores how human activities have influenced populations of wolverines over the past 150 years. Using the relationship of the wolverine to its habitat, students learn about ecosystem functions, including energy flow through food pyramids. They construct a model food web based on the wolverine's habitat and predator-prey relationships. Students review the resources that humans consume from natural systems, and discuss timber harvesting as an example of a human activity that can alter energy flow in an ecosystem. Using this as a model, they examine how human activities have affected the wolverine population in California. They discuss the cause and effect relationships between various examples of natural resource consumption and the effects of human decisions and practices on ecosystem function.

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California Education and the Environment Initiative

The EEI Curriculum cohesively integrates science and engineering practices (SEPs), content (disciplinary core ideas/DCIs), and crosscutting concepts (CCs) within its lesson procedures. This preliminary analysis intentionally teases apart the individual SEPs, DCIs, and CCs as a means of correlating the EEI unit with specific performance expectations; however, the EEI lessons weave these components back together to provide three-dimensional learning for students.

Next Generation Science Standards* Correlation with the California Education and the Environment Initiative (EEI) Curriculum

The EEI Curriculum is a great choice for transitioning to NGSS and contributes toward achievement of the performance expectations for the disciplinary core idea reflected in the Summary Chart below: MS-LS2 Ecosystems: Interactions, Energy and Dynamics; and MS-ESS3 Earth and Human Activity. Each EEI unit highlights a small number of performance expectations, science and engineering practices, disciplinary core ideas, and crosscutting concepts. Therefore, the EEI units contribute to students' overall achievement of the performance expectations by the end of a school year, where they will have had multiple opportunities to engage in all appropriate science and engineering practices, disciplinary core ideas, and crosscutting concepts. While EEI was designed to teach the 1998 California science standards to mastery, it reflects the real world interconnections in science and already incorporates many of the paradigm shifts reflected in the NGSS. To learn more about how EEI supports NGSS, visit http://californiaeei.org/curriculum/correlations/nextgenscience/.

	Next Generation Science Standards					
	MS-LS2			MS-ESS3		
California Connection		✓	✓		✓	✓
Lesson 1 - Explore the term population through the eyes of California wolverines.	✓	✓	✓	✓	✓	✓
Lesson 2 - Discover functions of organisms in different natural regions of California.	✓	✓				
Lesson 3 - Investigate energy flow in an ecosystem.	✓	✓	✓			
Lesson 4 - Investigate how people influence energy flow in ecosystems.	✓	✓	✓	✓	✓	✓
Lesson 5 - Examine how human use of natural resources influences ecosystems.	✓		✓	✓	✓	✓
Traditional Unit Assessment		✓	✓	✓	✓	✓
Alternative Unit Assessment		✓	✓	✓	✓	✓
	SEP	DCI	CC	SEP	DCI	CC

Correlation Chart Key

SEP (Science and Engineering Practices)
DCI (Disciplinary Core Ideas)
CC (Crosscutting Concepts)

DRAFT

EEI Unit 6.5.c. Energy: Pass It On!

Disciplinary Core Ideas Supported by this EEI Unit

MS-LS2 Ecosystems: Interactions, Energy and Dynamics
MS-ESS3 Earth and Human Activity

Performance Expectations	Suggestions for Using the EEI Unit to Support NGSS
MS-LS2-1: *(Grade 7 in the Integrated Course Model)* Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.	Use this unit to have students discover that as certain populations compete for survival within an ecosystem, their total population depends on the amount of available energy within that ecosystem.
MS-LS2-3: *(Grade 7 in the Integrated Course Model)* Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.	Use this unit to have students create energy flow models in a variety of California's ecosystems.
MS-ESS3-3: *(Grade 6 in the Integrated Course Model)* Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.	Use this unit to have students understand that the decisions humans make regarding the consumption of natural resources impacts natural systems.
MS-ESS3-4: *(Grade 8 in the Integrated Course Model)* Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.	Use this unit to have students analyze data supporting how the increase in human population and consumption of natural resources influences ecosystems throughout California.

Science and Engineering Practices (SEPs)	Suggestions for Using EEI to Support SEPs	Disciplinary Core Ideas (DCIs)	Suggestions for Using EEI to Support DCIs	Crosscutting Concepts (CCs)	Suggestions for Using EEI to Support CCs
Developing and Using Models (MS-LS2-3)	Use the unit to have students complete and analyze models that demonstrate the flow of energy in three California regions (Lessons 2 and 4). Have students evaluate models to determine that as energy flows up through the trophic levels in an energy pyramid, the amount of energy available to consumers is lost (Lesson 3).	**LS2.A: Interdependent Relationships in Ecosystems:** • Organisms, and populations of organisms, are dependent on their environmental interactions both with other living things and with nonliving factors. (MS-LS2-1) • Growth of organisms and population increases are limited by access to resources. (MS-LS2-1)	Use the unit to have students learn that the wolverines' survival is dependent on their interactions with humans and the effects of human activities on the ecosystems where they live (Lesson 1 and 4). Have students analyze how the growth and survival of living organisms in a variety of habitats is based on resource availability within those ecosystems (Lessons 2 and 3).	**Cause and Effect (MS-LS2-1, MS-ESS3-3, MS-ESS3-4)**	Use the unit to have students study past environmental issues, and analyze that information to predict how certain human decisions might affect ecosystems throughout California (Lesson 1, 4 and 5).
Analyzing and Interpreting Data (MS-LS2-1)	Use the unit to have students interpret data about the population of wolverines in California, and how their numbers have decreased to the point of endangerment as human populations have increased (Lessons 1 and 4). Have students examine data to predict if and how certain human activities influence the functioning and health of natural systems (Lessons 4 and 5).			**Energy and Matter (MS-LS2-3)**	Use the unit to have students examine how the amount of usable energy decreases as it is transferred through an ecosystem; energy from the Sun is lost at each trophic level as food is consumed and energy is transferred up the energy pyramid (Lessons 3 and 4).

Science and Engineering Practices (SEPs)	Suggestions for Using EEI to Support SEPs	Disciplinary Core Ideas (DCIs)	Suggestions for Using EEI to Support DCIs	Crosscutting Concepts (CCs)	Suggestions for Using EEI to Support CCs
Constructing Explanations and Designing Solutions (MS-ESS3-3) **Engaging in Argument from Evidence (MS-ESS3-4)**	Use the unit to have students evaluate possible solutions and new sources of natural resources, such as new farming or mining operations, while minimizing the potential environmental impacts on natural systems (Lessons 4 and 5). Use the unit to have students construct arguments supporting the idea that an increase in human population, and the resulting increased consumption of natural resources, has a direct effect on plant and animal populations (Lessons 1, 4, and 5).	**LS2.B: Cycle of Matter and Energy Transfer in Ecosystems:** 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. (MS-LS2-3) **ESS3.C: Human Impacts on Earth Systems** • 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. (MS-ESS3-3) • Typically as human populations and per-capita consumption of natural resources increase, so do the negative impacts on Earth unless the activities and technologies involved are engineered otherwise. (MS-ESS3-4)	Use the unit to have students study how energy is transferred between and among trophic levels in an ecosystem through the study of an energy pyramid (Lesson 3). Use the unit to have students evaluate the Wolverine Ecosystem Food Web to understand how matter and energy interact within that ecosystem (Lesson 4). Use the unit to have students analyze how the increase in California's human population since 1850 has negatively affected the wolverine population in California (Lesson 1 and 4). Have students examine how an increase in the per-capita consumption of natural resources relates to corresponding effects on ecosystems, but that humans can engage in activities and technologies that can mitigate the negative impacts on Earth's systems (Lessons 4 and 5).	**Influence of Science, Engineering, and Technology on Society and the Natural World (MS-ESS3-3, MS-ESS3-4)**	Use the unit to have students consider how human practices in natural systems, from wildlife and resource management to the construction of dams, influence the energy available in an ecosystem (Lessons 4 and 5); use the unit to give students the opportunity to analyze the effects of the human consumption of natural resources on Earth's natural systems (Lessons 1 and 5).