

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.



High School Biology/Life Science

B.8.a. - Differential Survival of Organisms

“Differential Survival of Organisms” starts with a study of the sea otter population along the coastline of Central California, giving students the opportunity to examine the process of evolution as it occurs through natural selection and the adaptation of populations. They have the chance to study a variety of marine organisms to determine which adaptations are essential for their survival. Students examine both the naturally-occurring biotic and abiotic factors that can influence the survival of each species. Using this information they learn about the differential survival of populations of organisms and examine the role of differential survival in evolutionary processes. Students are introduced to the concept of selection pressure and analyze how various adaptations can result from those evolutionary forces. Finally, the unit gives students an opportunity to evaluate the influence that human decisions and activities have had on the sea otter population off of California’s coast and evaluate particular solutions for reducing the impacts of human activities on the environment and biodiversity.



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 standards reflected in the Summary Chart below: HS-LS2 Ecosystems: Interactions, Energy, and Dynamics and HS-LS4 Biological Evolution: Unity and Diversity. 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/NGSSGuides/>.



Correlation Chart Key

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

	Next Generation Science Standards					
	HS-LS2			HS-LS4		
California Connection		✓	✓		✓	✓
Lesson 1 – Examine sea otter distribution off the California coast in light of various environmental factors.	✓	✓	✓	✓	✓	✓
Lesson 2 – Explore how phenotypes of organisms change as a result of shifting environmental conditions.	✓	✓	✓	✓	✓	
Lesson 3 – Investigate how selection pressures result in the differential survival of organisms.	✓		✓	✓	✓	✓
Lesson 4 – Assess how abiotic and biotic factors, including humans, influence environmental change.	✓	✓		✓	✓	✓
Lesson 5 – Analyze the differential survival of sea otters as it relates to human activities and practices.	✓	✓	✓	✓	✓	✓
Traditional Unit Assessment	✓	✓	✓	✓	✓	✓
Alternative Unit Assessment	✓	✓	✓	✓	✓	✓
	SEP	DCI	CC	SEP	DCI	CC

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Disciplinary Core Ideas Supported by this EEI Unit					
HS-LS2 Ecosystems: Interactions, Energy, and Dynamics HS-LS4 Biological Evolution: Unity and Diversity					
Performance Expectations			Suggestions for Using the EEI Unit to Support NGSS		
<p>HS-LS2-6: Evaluate the claims, evidence, and reasoning that the complex interactions in ecosystems maintain relatively consistent numbers and types of organisms in stable conditions, but changing conditions may result in a new ecosystem.</p>			<p>Use this unit to have students evaluate evidence that natural factors, such as local changes in temperature and increased numbers of predators, as well as human caused changes, for example the introduction of nonnative species, can all influence the rates at which environments change.</p>		
<p>HS-LS2-7: Design, evaluate, and refine a solution for reducing the impacts human activities have on the environment and biodiversity.</p>			<p>Use this unit to have students evaluate the influence that human decisions and activities have had on the sea otter population off the California coast, initially resulting in the decimation of the population due to hunting, and more recently the recovery of the population due to conservation efforts.</p>		
<p>HS-LS4-2: Construct an explanation based on evidence that the process of evolution primarily results from four factors: (1) the potential for a species to increase in number, (2) the heritable genetic variation of individuals in a species due to mutation and sexual reproduction, (3) competition for limited resources, and (4) the proliferation of those organisms that are better able to survive and reproduce in the environment.</p>			<p>Use this unit to have students construct an explanation to determine the effect the four factors above have on the number of sea otters in this ecosystem, and which factor has had the greatest influence over the last century; have them consider what the environmental conditions for the sea otter may be like in the future, and discuss potential solutions to the negative influence these factors could have on the evolutionary process.</p>		
<p>HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.</p>			<p>Use this unit to have students study marine organisms, focusing on adaptations essential for their survival; have them identify and explain the selection pressures that might have resulted in those adaptations; have students describe how natural factors can influence the survival of organisms.</p>		
<p>HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in: (1) increases in the number of some individuals of some species, (2) the emergence of new species over time, (3) the extinction of other species.</p>			<p>Use this unit to have students analyze evidence that supports the claim that both naturally occurring and human-caused changes to the environment have affected the size of the sea otter population off the coast of Central California</p>		
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
<p>Constructing Explanations and Designing Solutions (HS-LS2-7, HS-LS4-2, HS-LS4-4)</p>	<p>Use this unit to have students examine sea otter distribution off the California coast in light of various environmental factors (Lesson 1). Have them explain how phenotypes of organisms change as a result of shifting environmental conditions (Lesson 2). Have students investigate how selection pressures result in the differential survival of groups of organisms (Lesson 3). Have them assess how abiotic and biotic factors, including humans, influence environmental changes (Lesson 4).</p>	<p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience: A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less</p>	<p>Use this unit to have students examine sea otter distribution off the coast of Central California (Lesson 1). Have them explore how phenotypes of organisms change as a result of changing environmental conditions (Lesson 2). Have students identify and describe how abiotic and biotic factors, including humans, can cause environmental changes (Lesson 4). Have them use evidence about the survival of sea otters as it relates to human activities and practices to support</p>	<p>Cause and Effect (HS-LS4-2, HS-LS4-4, HS-LS4-5)</p>	<p>Use this unit to have students study activities and changes that caused the California sea otter population to drop to only 50 otters in the early 1900's and identify some of the effects of the diminished population on other ecosystems in coastal Central California (Lesson 1). Have them analyze the adaptations essential to the differential survival of other marine organisms and explain how both naturally occurring and human caused changes can influence the survival of organisms (Lesson 3).</p>

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
		<p>LS4.C: Adaptation:</p> <ul style="list-style-type: none"> - Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline—and sometimes the extinction—of some species. (HS-LS4-5) - Species become extinct because they can no longer survive and reproduce in their altered environment. If members cannot adjust to change that is too fast or drastic, the opportunity for the species’ evolution is lost. (HS-LS4-5) <p>LS4.D: Biodiversity and Humans: Humans depend on the living world for the resources and other benefits provided by biodiversity. But human activity is also having adverse impacts on biodiversity through overpopulation, overexploitation, habitat destruction, pollution, introduction of invasive species, and climate change. Thus sustaining biodiversity so that ecosystem functioning and productivity are maintained is essential to supporting and enhancing life on Earth. Sustaining biodiversity also aids humanity by preserving landscapes of recreational or inspirational value. (secondary to HS-LS2-7)</p>	<p>Use this unit to have students examine the ability of organisms to adapt to natural and human-caused environmental changes that can, over time, affect their survival. Have them identify and describe what happens to organisms that cannot adapt to changes in the local environment (Lessons 1-5).</p> <p>Use this unit to have students examine environmental changes resulting from natural factors and human activities and describe how human activities affect the rates of environmental change and the resulting rates of survival of organisms in an ecosystem. Have them identify factors that can cause significant changes to the distribution and population of organisms and explain how those factors affect the organisms (Lessons 1-5).</p>		