

## California Education and the Environment Initiative

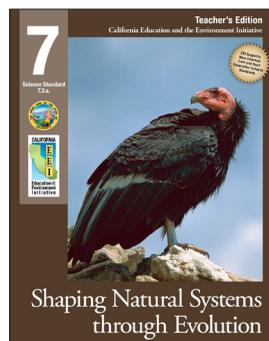
The EEI Curriculum cohesively integrates science and engineering practices (SEPs), content (disciplinary core ideas/DCIs), and crosscutting concepts (CCs) within its lesson procedures. This preliminary analysis intentionally teases apart the individual SEPs, DCIs, and CCs as a means of correlating the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



Middle School (Grade 8 in the Integrated Course Model)

### 7.3.a. Shaping Natural Systems through Evolution

“Shaping Natural Systems through Evolution” engages students in the study of biological evolution by introducing them to several species of pupfish, many of which live in extreme environments that challenge their survival and reproduction. Based on what they have learned about these fish, they create a class model of natural selection that allows them to predict the kinds of adaptations that would be selected in different environments. They analyze an example of evolutionary change observed in a California species of snail, and then to gain deeper insight into the mechanism of natural selection, the students evaluate four examples from current research in evolutionary biology. Students examine how a variety of environmental factors, such as climate and elevation, can influence evolution and how species adapt to the corresponding habitats. Finally, they analyze the influence of human activities on the pupfish’s survival and evolution.



## 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-LS4 Biological Evolution: Unity and Diversity; 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/>.



#### Correlation Chart Key

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

	Next Generation Science Standards					
	MS-LS4			MS-ESS3		
<b>California Connection</b>		✓	✓		✓	✓
<b>Lesson 1</b> -- Explore basic ideas about adaptation, evolution, and diversity using pupfish as an example.	✓	✓	✓	✓	✓	✓
<b>Lesson 2</b> - Analyze current scientific studies that introduce the dynamics of natural selection.	✓	✓	✓	✓		✓
<b>Lesson 3</b> - Undertake an analysis of mutation, variation, and natural selection in Darwin’s finches.	✓	✓	✓	✓		✓
<b>Lesson 4</b> - Use maps and other information to match adaptations of contemporary California species.	✓	✓	✓	✓		✓
<b>Lesson 5</b> - Examine a human activity that has influenced evolutionary change in a species.	✓	✓	✓		✓	✓
<b>Lesson 6</b> - Analyze pupfish as a model of evolutionary changes caused by human	✓	✓	✓		✓	✓
<b>Traditional Unit Assessment</b>	✓	✓	✓	✓	✓	✓
<b>Alternative Unit Assessment</b>	✓	✓	✓	✓	✓	✓
	SEP	DCI	CC	SEP	DCI	CC

\*The “Next Generation Science Standards” logo is a registered trademark of Achieve. Except for the State of California, neither Achieve nor the lead states and partners that developed the Next Generation Science Standards, was involved in the production of, and does not endorse, this product.

**EEl Unit 7.3.a. Shaping Natural Systems through Evolution**

<b>Disciplinary Core Ideas Supported by this EEI Unit</b>					
<b>MS-LS4 Biological Evolution: Unity and Diversity</b> <b>MS-ESS3 Earth and Human Activity</b>					
<b>Performance Expectations</b>			<b>Suggestions for Using the EEI Unit to Support NGSS</b>		
<b>MS-LS4-4:</b> <i>(Grade 8 in the Integrated Course Model)</i> Construct an explanation based on evidence that describes how genetic variations of traits in a population increase some individuals' probability of surviving and reproducing in a specific environment.			Use this unit to have students obtain evidence, through a study of several species, that species with large populations are more likely than species with small populations to include individuals with traits that enable them to survive human- or naturally-caused changes to the environment.		
<b>MS-LS4-5:</b> <i>(Grade 8 in the Integrated Course Model)</i> Gather and synthesize information about the technologies that have changed the way humans influence the inheritance of desired traits in organisms.			Use this unit to have students examine case studies of five species and analyze how human activities have influenced the inheritance of traits by altering the amount of genetic variation within their populations, thereby recognizing that there can be positive and negative outcomes as a result of humans causing changes through the implementation of different technologies.		
<b>MS-LS4-6:</b> <i>(Grade 8 in the Integrated Course Model)</i> Use mathematical representations to support explanations of how natural selection may lead to increases and decreases of specific traits in populations over time.			Use this unit to have students analyze and support the claim that natural selection has resulted in species evolving differently over time and evaluate the influence that environmental factors have had on their evolution.		
<b>MS-ESS3-4:</b> <i>(Grade 8 in the Integrated Course Model)</i> 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 examine the influences human activities, resulting from the demand for natural resources, have had on the health of several plant and animal species, and how the resulting changes can damage the environment and possibly result in the extinction of some species.		
<b>Science and Engineering Practices (SEPs)</b>	<b>Suggestions for Using EEI to Support SEPs</b>	<b>Disciplinary Core Ideas (DCIs)</b>	<b>Suggestions for Using EEI to Support DCIs</b>	<b>Crosscutting Concepts (CCs)</b>	<b>Suggestions for Using EEI to Support CCs</b>
<p><b>Using Mathematics and Computational Thinking (MS-LS4-6)</b></p> <p><b>Constructing Explanations and Designing Solutions (MS-LS4-4)</b></p>	<p>Have students use mathematical thinking as they engage in a game that simulates natural selection and where environmental factors affect species survival (Lesson 3). Have them analyze how California's vast diversity of species is due to its wide variety of natural environments (Lesson 4).</p> <p>Use the unit to have students gather information as the basis for analyzing several species and determining that inheritable traits help individuals within a species to survive (Lessons 1, 2, and 3). Have them evaluate how humans have influenced evolution to meet their needs (Lesson 5).</p>	<p><b>LS4.B: Natural Selection</b></p> <ul style="list-style-type: none"> <li>Natural selection leads to the predominance of certain traits in a population, and the suppression of others. (MS-LS4-4)</li> <li>In <i>artificial</i> selection, humans have the capacity to influence certain characteristics of organisms by selective breeding. One can choose desired parental traits determined by genes, which are then passed on to offspring. (MS-LS4-5)</li> </ul>	<p>Use the unit to have students recognize that individuals within a population having favorable traits are more likely to survive and that over time those traits become predominant within the population as the adults pass them on to their offspring (Lessons 1, 2, and 3). Have them study several species and consider how humans can alter traits through selective breeding (Lesson 5).</p>	<p><b>Cause and Effect (MS-LS4-4, MS-LS4-5, MS-LS4-6)</b></p>	<p>Use the unit to have students determine the cause and effect relationships that have resulted in natural selection and evolution (over a very long time) as traits that benefit survival become more common in a population of organisms, potentially leading to new species (Lessons 1,2,3, and 4). Have them recognize that although changes in the frequency of certain traits may occur rapidly through natural selection, the evolutionary changes that result in new species typically require tens of thousands of years. Have students analyze the cause and effect relationship between human activities and the accelerated rate of extinction of species over the past 50 years, as the human population has increased dramatically (Lessons 1 and 5).</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><b>Engaging in Argument from Evidence (MS-ESS3-4)</b></p> <p><b>Obtaining, Evaluating, and Communicating Information (MS-LS4-5)</b></p>	<p>Have students analyze how human activities can help explain the decrease in the populations of several plants and animals species (Lesson 6).</p> <p>Use the unit to have students gather evidence that supports the argument that both variation and the environment result in natural selection (Lessons 1, 2, and 3). Have them examine the diversity of California’s species and argue that the state’s environmental conditions have, over time, allowed organisms with favorable traits to survive in a variety of environments (Lesson 4). Have students determine that human activities have, in a relatively short period of time, affected the populations of several species to the point of extinction (Lesson 6).</p> <p>Use the unit to have students obtain data about the time necessary for a species to successfully adjust to changes to their environment and determine that long periods of time are often required for such changes (Lessons 1, 2, and 4). Have them explain how human activities can have both positive and negative effects on species survival and that negative impacts on a population’s ability to survive can happen within a short period of time, such as just a few generations (Lessons 5 and 6).</p>	<p><b>LS4.C: Adaptation</b> Adaptation by natural selection acting over generations is one important process by which species change over time in response to changes in environmental conditions. Traits that support successful survival and reproduction in the new environment become more common; those that do not become less common. Thus, the distribution of traits in a population changes. (MS-LS4-6)</p> <p><b>ESS3.C. Human Impacts on Earth’s Systems</b> 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)</p>	<p>Use the unit to have students examine how adaptations result from natural selection for the traits that increase the chances for the survival and reproduction of individuals within a population (Lessons 1, 2 and 4). Have them establish that traits which help individuals within a population to survive become more common over a period of generations within that population or species (Lessons 1, 2, and 3).</p> <p>Use the unit to have students recognize that the detrimental effects humans have had on biodiversity, through pollution, habitat loss, or a rise in overall global temperatures, can occur so rapidly that the affected population or species cannot adapt to the changes and, as a result, may go extinct locally or over its complete range (Lessons 1, 5 and 6).</p>		

# DRAFT

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><b>Developing and Using Models</b> <i>(Not associated with a specific Performance Expectation identified above)</i></p>	<p>Use the unit to have students create a class model of natural selection that focuses on pupfish (Lesson 1). Have them create origami “bird beaks” and engage in a game that demonstrates how animals adapt to their environment (Lesson 3).</p>				