**Stanford NGSS Integrated Curriculum: An Exploration of a Multidimensional World**

**Unit 4: A Warmer World**

**Essential Question:** How do humans impact organisms around the world and what can we do about it?

**Total Number of Instructional Days:** 24.5 – 26.5

**Group Culminating Project:**

Create An Advocacy Video Describing a Method to Minimize Human Impact On An Organism

**Individual Culminating Project**

Compare and Evaluate Different Solutions

**Lift-Off Task:**

Bad News For Bees

**Task 2:**

It Takes Two

**Task 3:**

Feeling the Impact

**Task 1:**

Heating Up

Connect to the Culminating Project using the Project Organizer

**Unit 4 Pop-Out**

**Storyline for Unit 4**

Students have likely seen images and videos depicting very sad stories of animals affected by climate change. In this unit, students explore why global warming is happening, how it is affecting organisms around the world, and what they can do to minimize this human impact.

In the last unit, students learned about how algae are being affected by human-caused environmental changes—excess fertilizer runoff and changing weather conditions associated with climate change. In this Lift-Off Task, students are introduced to another organism that is affected by human-caused environmental change—bees. After looking at an infographic showing bee population data, students begin to generate questions that might help them better make sense of what is happening to the bee population. These questions will guide students throughout the unit as they continue to make sense of the declining bee population, its causes and effects, and what can be done to address the issue.

In Task 1, students explore the rise in global temperatures over the past century, including why they have risen and how this affects Earth. By introducing one piece of data at a time, students have an opportunity to process the evidence and use it to generate their own questions that drive further learning. By the end of this task, students will be able to explain why global warming occurs, and apply this new knowledge to define the problem facing their chosen organism for their culminating project.

Before students can explore what rising temperatures means for Earth and its organisms, they need to understand what affects the survival and reproduction of organisms in the first place. In Task 2, students will learn about the different animal behaviors and plant structures that help organisms to successfully survive and reproduce. In doing so, they will learn that these characteristics are often interrelated and thus organisms, like bees and flowering plants, rely on each other. This sets the stage for students to learn, in Task 3, how these animal behaviors and plant structures are negatively impacted by global warming. By the end of Task 2, students will be able to describe the specialized structures or behaviors that help their specific organism survive and reproduce.

In Task 3, students learn that an organism’s ability to survive and reproduce is at risk because of the rise in global temperatures. Using the same examples from Task 2, students research what happens when an organism’s environment is compromised so much that it affects their behaviors and structures. By focusing on their own organism, students are able to complete the research required for their Culminating Project. However, students will also see that the impact of rising global temperatures is a broader issue as they learn about other organisms in a mock science conference format.

Once students have completed all tasks and their Project Organizers, they can begin work on their Culminating Project. Their Culminating Project is to pick a plant or animal affected by global warming and then design a method to minimize or monitor this impact. As a group, students will create an advocacy video that describes the human impact on their organism and gives a potential solution, thus replacing the sad and hopeless type of video we usually see. After presenting their videos to the class, each student will compare and evaluate all the solutions presented by their classmates, and present their evaluation in the format of their choice (report, poster, powerpoint, video, etc.). As compared to the other three units, Unit 4 is unique in that is introduces two PEs (MS-ESS3-3 and MS-ETS1-2) in the final project only and not during the tasks themselves. These PEs will be easier for students to understand in the full context of the project.

**Three-Dimensional Breakdown of the Performance Expectations**

This unit was developed to align with, teach, and assess students’ understanding and skills related to these Performance Expectations. Below, we have mapped out the disciplinary core ideas, crosscutting concepts, and science and engineering practices addressed in this unit. Aspects of the dimensions that are not explicitly addressed in this unit are crossed out.

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| **Performance Expectations** | **Scientific and Engineering Practices** | **Disciplinary Core Ideas** | **Crosscutting Concepts** |
| **MS-ESS3-5. Ask questions to clarify evidence of the factors that have caused the rise in global temperatures over the past century.** [Clarification Statement: Examples of factors include human activities (such as fossil fuel combustion, cement production, and agricultural activity) and natural processes (such as changes in incoming solar radiation or volcanic activity). Examples of evidence can include tables, graphs, and maps of global and regional temperatures, atmospheric levels of gases such as carbon dioxide and methane, and the rates of human activities. Emphasis is on the major role that human activities play in causing the rise in global temperatures.] | **Asking Questions and Defining Problems**   * Ask questions to identify and clarify evidence of an argument. | **ESS3.D: Global Climate Change**   * Human activities, such as the release of greenhouse gases from burning fossil fuels, are major factors in the current rise in Earth’s mean surface temperature (global warming). Reducing the level of climate change and reducing human vulnerability to whatever climate changes do occur depend on the understanding of climate science, engineering capabilities, and other kinds of knowledge, such as understanding of human behavior and on applying that knowledge wisely in decisions and activities. | **Stability and Change**   * Stability might be disturbed either by sudden events or gradual changes that accumulate over time. |
| **MS-ETS1-1***.* **Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.** | **Asking Questions and Defining Problems**   * Define a design problem that can be solved through the development of an object, tool, process or system and includes multiple criteria and constraints, including scientific knowledge that may limit possible solutions. | **ETS1.A: Defining and Delimiting Engineering Problems**   * The more precisely a design task’s criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. | **No CCC listed** |
| **MS-LS1-4. Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.** [Clarification Statement: Examples of behaviors that affect the probability of animal reproduction could include nest building to protect young from cold, herding of animals to protect young from predators, and vocalization of animals and colorful plumage to attract mates for breeding. Examples of animal behaviors that affect the probability of plant reproduction could include transferring pollen or seeds, and creating conditions for seed germination and growth. Examples of plant structures could include bright flowers attracting butterflies that transfer pollen, flower nectar and odors that attract insects that transfer pollen, and hard shells on nuts that squirrels bury.] | **Engaging in Argument From Evidence**   * Use an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. | **LS1.B: Growth and Development of Organisms**   * Animals engage in characteristic behaviors that increase the odds of reproduction. * Plants reproduce in a variety of ways, sometimes depending on animal behavior and specialized features for reproduction. | **Cause and Effect**   * Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability. |
| **MS-ESS3-3. Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment.\*** [Clarification Statement: Examples of the design process include examining human environmental impacts, assessing the kinds of solutions that are feasible, and designing and evaluating solutions that could reduce that impact. Examples of human impacts can include water usage (such as the withdrawal of water from streams and aquifers or the construction of dams and levees), land usage (such as urban development, agriculture, or the removal of wetlands), and pollution (such as of the air, water, or land).] | **Designing Solutions**   * Apply scientific principles to design an object, tool, process or system. | **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. * 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. | **Cause and Effect**   * ~~Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation.~~ |
| **MS-ETS1-2. Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.** | **Engaging in Argument From Evidence**   * Evaluate competing design solutions based on jointly developed and agreed-upon design criteria. | **ETS1.B: Developing Possible Solutions**   * There are systematic processes for evaluating solutions with respect to how well they meet the criteria and constraints of a problem. | **No CCC listed** |

**Connections to Common Core Math and ELA Standards:**

Over the course of this unit, students will gain knowledge and skills in science, as well as in math and English-Language Arts. Below we list the Common Core ELA and Math standards for middle school and 6th grade that are relevant to the curriculum tasks in this unit. Within the curriculum, there are opportunities to incorporate components of the following ELA and Math Standards:

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| **Middle School and 6th Grade Common Core ELA Standards** | | **Unit Task** |
| **Key Ideas and Details** | CCSS.ELA-Literacy.RST.6-8.1: Cite specific textual evidence to support analysis of science and technical texts. | Task 2  Project |
| **Text Types and Purposes** | CCSS.ELA-Literacy.WHST.6-8.1: Write arguments focused on discipline-specific content. | Task 2  Project |
| **Research to Build and Present Knowledge** | CCSS.ELA-Literacy.WHST.6-8.7: Conduct short research projects to answer a question (including a self-generated question), drawing on several sources and generating additional related, focused questions that allow for multiple avenues of exploration. | Task 1  Task 2  Task 3  Project |
| CCSS.ELA-Literacy.WHST.6-8.8: Gather relevant information from multiple print and digital sources, using search terms effectively. | Task 1  Task 2  Task 3  Project |
| CCSS.ELA-Literacy.WHST.6-8.9: Draw evidence from informational texts to support analysis, reflection, and research. | Task 2  Task 3  Project |

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| **Middle School and 6th Grade Common Core Math Standards** | | **Unit Task** |
| **Mathematical Practice** | CCSS.MATH.MP.2: Reason abstractly and quantitatively. | Task 1  Project |

**Connections to English Language Development (ELD) Standards:**

We acknowledge that language development is a key component of disciplinary understanding and helps to support more rigorous and equitable outcomes for diverse students. This curriculum thus takes into account both the receptive and productive language demands of the culminating projects and strives to increase accessibility by including scaffolds for language development and pedagogical strategies throughout learning tasks. We aim to support language acquisition through the development of concept maps; utilizing sentence frames; implementing the Critique, Correct, Clarify technique; employing the Stronger Clearer strategy; and fostering large and small group discussions.

The California ELD Standards are comprised of two sections: the standards and a rubric. Outlined below are the standards from Section One that are met within this curriculum. For additional information, please refer to: https://www.pausd.org/sites/default/files/pdf-faqs/attachments/SS\_ELD\_6.pdf.

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| **6th Grade ELD Standards** | | |
| **Part I: Interacting in Meaningful Ways** | A: Collaborative | 1.Exchanging information and ideas with others through oral collaborative discussions on a range of social and academic topics |
| 2. Interacting with others in written English in various communicative forms (print, communicative technology, and multimedia) |
| 3. Offering and justifying options, negotiating with and persuading others in communicative exchanges |
| 4. Adapting language choices to various contexts (based on task, purpose, audience, and text type) |
| B: Interpretive | 5. Listening actively to spoken English in a range of social and academic contexts |
| 6. Reading closely literary and informational texts and viewing multimedia to determine how meaning is conveyed explicitly and implicitly through language |
| 7. Evaluating how well writers and speakers use language to support ideas and arguments with details or evidence depending on modality, text type, purpose, audience, topic, and content area |
| 8. Analyzing how writers and speakers use vocabulary and other language resources for specific purposes (to explain, persuade, entertain, etc.) depending on modality, text type, purpose, audience, topic, and content area |
| C: Productive | 9. Expressing information and ideas in formal oral presentations on academic topics |
| 10. Writing literary and informational texts to present, describe, and explain ideas and information, using appropriate technology |
| 11. Justifying own arguments and evaluating others’ arguments in writing |
| 12. Selecting and applying varied and precise vocabulary and other language resources to effectively convey ideas |
| **Part II: Learning About How English Works** | A: Structuring Cohesive Texts | 1. Understanding text structure |
| 2. Understanding cohesion |
| B: Expanding and Enriching Ideas | 3. Using verbs and verb phrases |
| 4. Using nouns and noun phrases |
| 5. Modifying to add details |
| C: Connecting and Condensing Ideas | 6. Connecting ideas |
| 7. Condensing ideas |

**Connections to Environmental Awareness:**

Over the course of this curriculum, students will explore content related to various environmental principles and concepts that examine the interactions and interdependence of human societies and natural systems. In accordance with the *Education and the Environment Initiative (EEI),* tasks throughout this curriculum explore many of *California’s Approved Environmental Principles and Concepts.* The principles relevant to this unit are outlined in the chart below:

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| **Unit Task** | **EEI Principle** | **EEI Concept** |
| Task 1  Project | Principle I: The continuation and health of individual human lives and of human communities and societies depend on the health of the natural systems that provide essential goods and ecosystem services. | Concept A: The goods produced by natural systems are essential to human life and to the functioning of our economies and cultures. |
| Lift-Off Task  Task 1  Task 3  Project | Principle II: The long-term functioning and health of terrestrial, freshwater, coastal and marine ecosystems are influenced by their relationships with human societies. | Concept A: Direct and indirect changes to natural systems due to the growth of human populations and their consumption rates influence the geographic extent, composition, biological diversity, and viability of natural systems. |
| Concept B. Methods used to extract, harvest, transport, and consume natural resources influence the geographic extent, composition, biological diversity, and viability of natural systems. |
| Concept C: The expansion and operation of human communities influences the geographic extent, composition, biological diversity, and viability of natural systems. |
| Task 1  Task 3  Project | Principle III: Natural systems change in ways that people benefit from and can influence. | Concept A: Natural systems proceed through cycles and processes that are required for their functioning. |
| Concept C: Human practices can alter the cycles and processes that operate within natural systems. |
| Lift-Off Task  Task 1  Task 3  Project | Principle IV: The exchange of matter between natural systems and human societies affects the long-term functioning of both. | Concept A: The effects of human activities on natural systems are directly related to the quantities of resources consumed and to the quantity and characteristics of the resulting byproducts. |
| Concept B: The byproducts of human activity are not readily prevented from entering natural systems and may be beneficial, neutral, or detrimental in their effect. |
| Concept C: The capacity of natural systems to adjust to human-caused alterations depends on the nature of the system as well as the scope, scale, and duration of the activity and the nature of its byproducts. |
| Project | Principle V: Decisions affecting resources and natural systems are complex and involve many factors. | Concept A: There is a spectrum of what is considered in making decisions about resources and natural systems and how those factors influence decisions. |