Unit 8 | Climate Change & Human Impact

Living Environment   **21-26 days**

Human population growth, globalization, and industrialization are having profound impacts on the long term health and stability of ecosystems, permanently altering the products of billions of years of evolutionary history on planet Earth. In this unit, students create plans to address the population decline of endangered species, gaining a greater understanding of how humans have altered ecosystems and what actions may be taken (including the use of biotechnology) to preserve biodiversity. Students create models and utilize simulations to gain a deeper understanding of large scale geological and biological processes.

How are human activities altering the physical and living environment? Is it possible to save species from extinction?

UNIT STORYLINE SNAPSHOT

Anchor Phenomenon: Human Impact
How are human activities altering the physical and living environment? Is it possible to save species from extinction?

Performance Task: Species Survival Plans

Evolution, Natural Selection, & Extinction *5E Instructional Model Plan*	**Mechanisms & Effects of Climate Change** *3E Instructional Model Plan*
Mechanisms & Effects of Resource Use *5E Instructional Model Plan*	**Investigating Solutions to Human Impact** *5E Instructional Model Plan*

PLANNING RESOURCES

Knowledge and Enduring Understandings

Storyline and Pacing Guide

Common Core Standards

NY State Regents Exam Readiness

NY State Science Standards

Unit Vocabulary

KNOWLEDGE AND ENDURING UNDERSTANDINGS

Knowledge: (Students will know. . .)	Enduring Understandings

High priority content - required	Mid-priority content - recommended	
human impact: climate change human impact on ecosystems evolution	Carbon cycle Cycling of matter and flow of energy through ecosystems	• Organisms have adaptations that enable them to survive in their environments. • A species can change, through evolution, but this takes a very long time. • Humans have extensive impact on ecosystems both because of the exponential growth of the human population, and because of humans' unsustainable use of resources.

✦Storyline and Pacing Guide

	Time	Teacher Resource	Driving Questions	What students figure out *Ideas that contribute to student thinking about the anchor phenomenon and performance task*
Launch Anchor Phenomenon	1 Days	Link	*How can our knowledge of keystone species help us be strategic in conservation decisions?*	• Keystone species play an important role in an ecosystem, maintaining stability and a biodiversity
Introduce Performance Task	1 Day	Link	*What types of information do we need to know in order to develop a species conservation plan?*	• Evidence based conservation decisions use information from a variety of sources including, population data surveys, ecosystem maps, and human resource use

Living Environment | Unit 8: *Climate Change & Human Impact*

	Natural Selection (optional)**	2-6 Days	[5E Plan](#)	*How do populations of organisms change over time?*	• Populations (not individuals) change over time through the process of natural selection • The process of natural selection requires variations in traits across a population • Some traits are more advantageous for a particular environment, thus those possessing the traits reproduce more, passing those traits onto offspring • Those possessing advantageous traits, for a particular environment, increase over time, changing the genetic makeup of the population -- natural selection
	Evolution, Natural Selection & Extinction	5-8 Days	[5E Plan](#)	*How do individuals 'adapt' to environmental changes?* *How do populations adapt to environmental changes over time?* *Why do some organisms go extinct?* *How will climate change impact individuals and populations?* *How have drastic environmental changes impacted organisms over geologic time scales? And how does this compare to current climate change?*	• Individuals can acclimate, or make small changes to their behavior, in order to tolerate environmental changes • Acclimation is different than adaptation, as it impacts only a small number of individuals, over a short period of time. Adaptation is at the population level, and impacts survivability and reproduction over the longer term • Through natural selection, organisms can adapt to a different environmental condition, but this takes place over many generations • Organisms may go extinct for many reasons, but in the past, there is evidence that significant environmental or climatic change can contribute • Current climate change is happening at a faster rate than what has been observed in the past, and many organisms may not be able adapt to deal with these changes in time • There is evidence that climate change is impacting species in many ways: shifting their ranges, changing behaviors, and placing stress on vulnerable organisms.

Living Environment | Unit 8: *Climate Change & Human Impact*

| Mechanisms & Effects of Climate Change | 5-8 Days | [5E Plan](#) | *How can we understand the causes and potential impacts of climate change?*

How does carbon move through the biosphere, geosphere, and atmosphere?

What is the greenhouse effect and how does it relate to climate change?

How will climate change impact biodiversity?

How do the current changes in climate compare to past changes in Earth's history? | Carbon normally moves through the biosphere, geosphere, and atmosphere in the carbon cycle Human activity, including burning fossil fuels increases the amount to carbon in the atmosphere Increased greenhouse gases, such as carbon dioxide, in the atmosphere, traps heat and increases the Earth's temperature -- changing climate. This is called the greenhouse effect. Current climate change is occuring at an accelerated pace, compared to past climate fluctuations Climate change will have many impacts including shifting climate zones, increasing sea level, and destroying habitats -- these impacts will have a negative impact on biodiversity |

Return to the performance task and engage students in revising their initial response to the cladogram task and their reasoning, based on the new evidence and ideas generated in the Evolution, Natural Selection, & Extinction and Climate Change instructional sequences.

Revisit the **Unit Driving Question Board** - are there questions that have been addressed in these instructional sequences? -- have new questions been brought to the forefront?

Resource Use   **5-8 Days**   [5E Plan](#)

Why are some resources considered renewable and others are nonrenewable?

How does human population growth and industrialization impact the environment?

How are humans, and their use of resources, impacting the environment and biodiversity?

- Resources, such as: energy, trees, agricultural land, and animals can be considered renewable, nonrenewable, or can be used unsustainably.
- Renewable resources, such as the sun, can be easily renewed or reused in a timely manner
- Nonrenewable resources, such as fossil fuels, are not easily renewed or reused in a timely manner
- Many renewable resources, such as agricultural land, can be over exploited so that it becomes unusable
- Human population is increasing, but not all people use or have access to resources at the same rate. Some countries, such as the US, use more resources per person, than most other countries
- Generally, humans are using the Earth's resources in an unsustainable manner, negatively impacting the environment and biodiversity

Return to the performance task and engage students in revising their initial response to the cladogram task and their reasoning, based on the new evidence and ideas generated in the Resource Use instructional sequence.

Revisit the **Unit Driving Question Board** - are there questions that have been addressed in these instructional sequences? -- have new questions been brought to the forefront?

		5-8 Days	**5E Plan**	*How can we use the causes behind environmental concerns and biodiversity loss to develop effective solutions?* *What types of solutions to environmental and conservations concerns are possible?*	● Understanding the root causes of environmental problems facilitates the development of solutions ● Most environmental and conservation concerns can be traced back to the combustion of fossil fuels for energy and the overuse or over consumption of resources ● There are many solutions available, including using technology, social, political, and individual actions ● Solutions to environmental and conservation concerns must consider the scale of impact, social, and economic impacts
	Investigating Solutions to Human Impact				
	Complete Culminating Task	1 Day	**Link**	*How can we use what we know about our species, and the causes behind human impact, to develop a plan to protect a keystone species?*	● Students develop three action plans that target high level threats to their species.

** **The natural selection 5E plan can be taught in several different moments throughout the course. It isn't optional content, but where natural selection is explicitly taught can be in Units 4, 6, and 8. Evolution is meant to be spiraled throughout the course, starting in Unit 1.**

✦NY State Regents Exam Readiness

Regents Topics (from 1996 standards)	Historical Coverage (over the last 5 administrations of LE Regents)[1]	More Details *How is this addressed in the unit?*

---

[1] Regents Tool; Awesome table

Living Environment | Unit 8: *Climate Change & Human Impact*

Evolution	10%	Although evolution is spiraled throughout the course, this unit explicitly delves into natural selection, adaptation, and the extinction of species in the **Evolution, Natural Selection, and Extinction 5E Plan**
Individual & Population Growth	6.4%	In the **Resource Use** 5E Plan, students review the concepts of population dynamics, introduced in unit 7. Concepts, such as carrying capacity, are applied to human population growth.
Human Impact	8%	The **climate change** 5E plan explores the causes behind human-lead climate change and compares current changes to past climate fluctuations. The **Resource Use 5E** plan introduces how the overexploitation of resources contributes to environmental problems and biodiversity loss. In the **Investigating solutions** 5E Plan students learn about how to address human impact at the individual and societal levels.
Beaks of Finches Lab	3.3%	Addressed in the **Evolution, Natural Selection, and Extinction 5E Plan**
	[Unit 8 Regents Item Bank](#)	

✦New York State Science Standards

NY State MST Standards (1996) *This unit was designed to address the following NY State 1996 Standards.*	**NYSSLS (2017)** *As designed, this unit works towards the following NYSSLS Performance Expectations, with partial alignment.*

Key Idea 1: Living things are both similar to and different from each other and from nonliving things
PI 1.1 - Explain how diversity of populations within ecosystems relates to the stability of ecosystems.

Key Idea 2: Organisms inherit genetic information in a variety of ways that result in continuity of structure and function between parents and offspring
PI 2.1 - Explain how the structure and replication of genetic material result in offspring that resemble their parents

Key Idea 3: Individual organisms and species change over time
PI 3.1 - Explain the mechanisms and patterns of evolution

Key Idea 6: Plants and animals depend on each other and their physical environment.
PI 6.2 - Explain the importance of preserving diversity of species and habitats

Key Idea 7: Human decisions and activities have had a profound impact on the physical and living environment
PI 7.1 - Describe the range of interrelationships of humans with the living and nonliving environment
PI 7.2 - Explain the impact of technological development and growth in the human population on the living and nonliving environment
PI 7.3 - Explain how individual choices and societal actions can contribute to improving the environment

[New York State Core Curriculum Standards Crosswalk - Living Environment](#)

HS-LS4-1. Communicate scientific information that common ancestry and biological evolution are supported by multiple lines of empirical evidence.

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.

HS-LS4-4: Construct an explanation based on evidence for how natural selection leads to adaptation of populations.

HS-LS4-5: Evaluate the evidence supporting claims that changes in environmental conditions may result in (1) increases in the number of individuals of some species, (2) the emergence of new species over time, and (3) the extinction of other species.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.

HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.

HS-LS2-5. Develop a model to illustrate the role of photosynthesis and cellular respiration in the cycling of carbon among the biosphere, atmosphere, hydrosphere, and geosphere.

HS-LS2-8. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of

Living Environment | Unit 8: *Climate Change & Human Impact*

ecosystems at different scales.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.*

✦Common Core Learning Standards

Reading	Writing

9-10.R.ST.2 **Reading: Key Ideas and Details** Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. **9-10.R.ST.3** **Reading: Key Ideas and Details** Follow precisely a complex multistep procedure when carrying out experiments, taking measurements, or performing technical tasks attending to special cases or exceptions defined in the text. **9-10.R.ST.9** **Reading: Integration of Knowledge and Ideas** Compare and contrast findings presented in a text to those from other sources (including their own experiments), noting when the findings support or contradict previous explanations or accounts.	**9-10.W.HST.10** **Writing: Range of Writing** Write routinely over extended time frames (time for reflection and revision) and shorter time frames (a single sitting or a day or two) for a range of discipline-specific tasks, purposes, and audiences. **9-10.W.HST.10** **Writing: Text Types and Purposes** Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
Listening	**Speaking**

✦Unit Vocabulary

Consider using this list to guide the Explain or Elaborate portions of the 5E plans, and use it as reference for peer to peer vocabulary based discussions.

Unit Vocabulary	Domain Specific	Tier II

5E: EVOLUTION, NATURAL SELECTION, & EXTINCTION	Adapt Acclimate Tolerate Adaptation Natural selection Extinction Climate change	
5E: MECHANISMS & EFFECTS OF CLIMATE CHANGE	Carbon / carbon dioxide Biosphere / geosphere / atmosphere Carbon cycle Greenhouse gases Climate biodiversity	
5E: MECHANISMS & EFFECTS OF RESOURCE USE	Human population growth Renewable vs. nonrenewable Fossil fuels	Resources Exploited unusable
5E: INVESTIGATIONS & SOLUTIONS TO HUMAN IMPACT	Biodiversity conservation	Solutions Root cause Overuse Overconsumption Reduction Technological / social / political / individual actions Social / economic impact
OVERALL UNIT	Keystone species Biodiversity ecosystem	Stability Conservation Evidence Decisions Various sources

*terms that may be encountered, but not fully defined or explored in this 5E Cycle