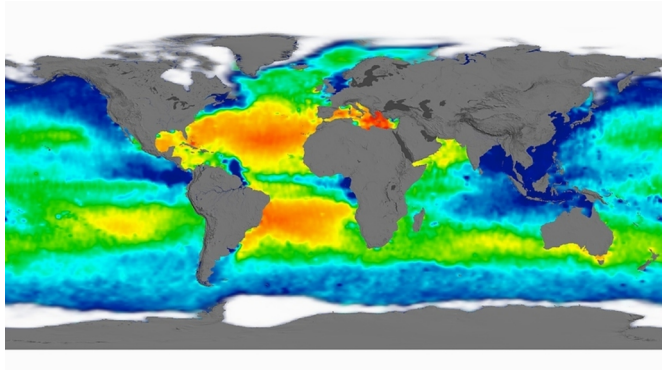
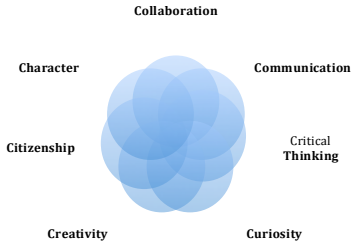
Content Area: Science	Course: Environmental Science	Grade Level: 11-12
	**R14 The Seven Cs of Learning** 	

Unit Titles	Length of Unit
• Ecosystem Dynamics and Biodiversity	• 4 weeks
• Energy Resources and Conservation Methods	• 4 weeks
• Weather and Climate	• 5 weeks
• The Global Water Supply and Waste Management	• 5 weeks
• Ecology and Populations	• 6 weeks
• Land use and Soil Composition	• 5 weeks

Strands	Course Level Expectations
Earth's Systems	• Students understand that life on Earth exists in the Biosphere, wherein portions of the Earth's other major spheres (atmosphere, lithosphere, and hydrosphere) coalesce to create Earth's environment. • Students understand that changes in one environmental component can stimulate responses in another.
Ecosystems & Biodiversity	• Students understand that all species depend on certain environmental conditions in order to thrive, and that Earth's varied climates and ecosystems provide these conditions, thus supporting biological diversity • Students will develop an in depth understanding of the interactions between living organisms and their environment. • Students understand that significant changes in one or more elements can drastically influence conditions within the Biosphere, thus affecting biodiversity • Students will develop an in depth understanding of how and why biological evolution accounts for the unity and diversity of living organisms
Human Impacts	• Students understand that human population growth, resource consumption, and pollution and waste generation can negatively alter conditions on Earth. • Students understand that mankind's efforts to identify and confront environmental problems can foster innovation and change at the technological, political, and social levels. • Students will understand the value of land and water resources as well as the consequences of their overuse, and humankind's role in creating a sustainable future. • Students will understand that there are costs, benefits, and consequences of exploration, development, and consumption of renewable and nonrenewable resources

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Unit Title	Ecosystem Dynamics and Biodiversity	**Length of Unit**	4 weeks

Inquiry Questions (Engaging & Debatable)	● How and why do species interact? ● What, if any, is the relationship between biological diversity and ecosystem stability?
Standards*	HS-LS2-1, HS-LS2-2, HS-LS2-4, HS-LS2-6, HS-LS2-7
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Cycles of Matter and Energy Transfer in Ecosystems ● Interdependent Relationships in Ecosystems ● Ecosystem Dynamics, Functioning, and Resilience **Cross Cutting Concepts (CCC)** ● Energy and Matter ● Scale, Proportion, and Quantity ● Stability and Change
Key Vocabulary	Carrying Capacity, Food Web, Biodiversity, Biomass, Photosynthesis, Cellular Respiration,

*Standards based on Next Generation Science Standards (NGSS) For more information visit: https://www.nextgenscience.org/

Unit Title	Ecosystem Dynamics and Biodiversity	**Length of Unit**	weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
● Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. hese limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. ● Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. ● 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 change occurs, it could return to its original status, therefore the ecosystem is resilient. ● Extreme fluctuations in conditions or size of any population can challenge the functionality of the ecosystem in terms of resources and habitat. ● At each link upward in a food web, only a small fraction of the matter consumed at the lower level is transferred upward, to produce growth and release energy in cellular respiration at the higher level. Given this inefficiency, there are generally fewer organisms at higher levels of a food web. ● Some matter reacts to release energy for life functions, some matter	● Use graphs and tropic level biomass calculations to represent tropic interdependence and carrying capacity to support explanations of factors that affect carrying capacity of ecosystems. ● Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales ● Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. ● Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions. ● 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. ● Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and

is stored in newly made structures, and much is discarded. The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. ● Anthropogenic changes (caused by human activity) in the environment can disrupt an ecosystem and threaten the survival of some species.	biodiversity

Assessments:	• Interim and summative assessments • Laboratory performance assessment
Teacher Resources:	Region 14 Implementation Guide

Unit Title	Energy Resources and Conservation Methods	Length of Unit	4 weeks

Inquiry Questions (Engaging & Debatable)	● What are the potential uses and limitations of renewable energy and/or non-renewable energy uses? ● What is the feasibility of developing alternative energy sources, and what environmental, economic, and social costs are associated?
Standards*	HS-PS1-8, HS-PS3-3, HS.ESS3-2, HS.ETS1-3
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Nuclear Processes ● Definitions of Energy ● Developing Possible Solutions **Cross Cutting Concepts (CCC)** ● Energy and Matter
Key Vocabulary	Thermal Energy, Fission, Fusion, Radioactive Decay, Neutrons, Protons

Unit Title	Energy Resources and Conservation Methods	Length of Unit	4 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
● Nuclear processes, including fusion, fission, and radioactive decays of unstable nuclei, involve release or absorption of energy. The total number of neutrons plus protons does not change in any nuclear process. ● At the macroscopic scale, energy manifests itself in multiple ways, such as in motion, sound, light, and thermal energy ● All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors.	● Develop qualitative models to illustrate nuclear decay and energy production through chain reaction. ● Design, build, and refine a device to convert one form of energy into another form of energy, using materials provided them. ● Evaluate and identify best practices to minimize impacts associated with fossil fuels, with an emphasis on coal oil and natural gas extraction methods and their effects on natural systems, and including a cost-benefit analysis. ● Posit a claim and support it with scientific evidence related to alternative energy potential.

Assessments:	• Interim and summative assessments • Laboratory assessment
Teacher Resources:	Region 14 Implementation Guide

Unit Title	**Weather and Climate**	**Length of Unit**	4 weeks

Inquiry Questions (Engaging & Debatable)	● How has climate changed over time on our planet? ● What are the social and economic impacts of climate change?
Standards*	HS-ESS2-1, HS-ESS2-4, HS-ESS3-1, HS-ESS3-4, HS-ESS3-5.
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Earth and the Solar System ● Earth Materials and Systems ● Weather and Climate ● Natural Hazards ● Global Climate Change **Cross Cutting Concepts (CCC)** ● Scale, Proportion, and Quantity ● Stability and Change ● Cause and Effect
Key Vocabulary	Plate Tectonics, Electromagnetic Radiation, Atmosphere, biosphere, Weathering, Erosion

Unit Title	Weather and Climate	Length of Unit	4 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
● Cyclical changes in the shape of Earth's orbit around the sun, together with changes in the orientation of the planet's axis of rotation, both occurring over hundreds of thousands of years, have altered the intensity and distribution of sunlight falling on Earth. These phenomena cause cycles of ice ages and other gradual climate changes ● The geological record shows that changes to global and regional climate can be caused by interactions among changes in the sun's energy output or Earth's orbit, tectonic events, ocean circulation, volcanic activity, glaciers, vegetation, and human activities. These changes can occur on a variety of time scales from sudden (e.g., volcanic ash clouds) to intermediate (ice ages) to very long-term tectonic cycles. ● The foundation for Earth's global climate system is the electromagnetic radiation from the sun as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems and this energy's reradiation into space ● Though the magnitudes of humans' impacts are greater than they have	● Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. ● Construct an explanation, based on evidence, for the effects of climate changes on human activity as a result of sea level rise and changing precipitation patterns. ● Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. ● Analyze geoscience data and the results from global climate models to make an evidence-based forecast of the current rate of global or regional climate change and associated future impacts to Earth systems.

ever been, so too are humans' abilities to model, predict, and manage current and future impacts ● Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation	

Assessments:	• Interim and summative assessments • Laboratory assessment
Teacher Resources:	Region 14 Implementation Guide

Unit Title	The Global Water Supply and Waste Management	Length of Unit ,	5 weeks

Inquiry Questions (Engaging & Debatable)	● What is the current condition of Earth's surface and groundwater, and what are the short- and long-term consequences of this? ● How does water quality affect organisms? ● What are the national and global trends in solid waste generation, and how have they affected waste management practices?
Standards*	HS.LS2-1, HS.LS2-4, HS.LS2-6, HS.ESS3-1, HS.ESS2-2, HS.ESS3-4, HS.ETS1-3
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Interdependent Relationships in Ecosystems ● Cycles of Matter and Energy Transfer in Ecosystems ● Ecosystem Dynamics, Functioning, and Resilience ● Natural Resources ● Human Impacts on Earth Systems **Cross Cutting Concepts (CCC)** ● Scale, Proportion, and Quantity ● Energy and Matter ● Stability and Change ● Cause and Effect
Key Vocabulary	Surface Water, Ground Water, Aquatic Macroinvertebrates, biosolids, Greenhouse Gases, Biosphere

Unit Title	The Global Water Supply and Waste Management	Length of Unit	5 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
● How water quality and abundance can affect the carrying capacity of a given ecosystem ● The chemical elements that make up the molecules of organisms pass through food webs and into and out of the atmosphere and soil, and they are combined and recombined in different ways. ● How the consumption of ground and surface water influences Earth's systems ● Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation. ● The outcomes predicted by global climate models strongly depend on the amounts of human-generated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere	● Compute oxygenation levels in surface water and determine the potential effect on carrying capacity of certain macroinvertebrates ● Evaluate tolerance documentation of aquatic macroinvertebrates as an exemplar of both the resiliency and the potential effects of environmental change on ecosystems. ● Analyze geoscience data to understand that accessing fresh groundwater and surface water at non-sustainable rates can create feedbacks causing changes to other Earth systems, including biotic components. ● Investigate energy generation statistics from biosolids and municipal solid waste sources as models for cycling of matter and energy flow in the biosphere. ● Compare and contrast people overpopulation and consumption overpopulation, and the implications of each for waste generation and management. ● Compare energy generation and cost-benefits of alternatives to landfills ● Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

Assessments:	• Interim and summative assessments • Laboratory assessment
Teacher Resources:	Region 14 Implementation Guide

Unit Title	Ecology and Populations	Length of Unit	6 weeks

Inquiry Questions (Engaging & Debatable)	● How and why do populations and ecosystems change over time? ● What factors affect population growth? ● What are the potential environmental and social consequences of unrestrained population growth (of any species)?
Standards*	HS-ESS3-3, HS-LS2-1, HS-LS2-2, HS-LS2-8, HS-LS4-4, HS-LS4-5
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Adaptation ● Ecosystem Dynamics, Functioning, and Resilience ● Social Interactions and Group Behavior ● Human Impacts on Earth Systems **Cross Cutting Concepts (CCC)** ● Scale, Proportion, and Quantity ● Cause and Effect ● Stability and Change
Key Vocabulary	Carrying Capacity, Anthropogenic, Natural Selection, Biodiversity, Speciation, Adaptation, Gene Pool

Unit Title	Ecology and Populations	Length of Unit	6 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
● Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. ● Moreover, anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, over exploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species. ● Natural selection leads to adaptation, which means a population dominated by organisms that are anatomically, behaviorally, and physiologically well suited to survive and reproduce in a specific environment. ● Group behavior has evolved because membership can increase the chances of survival for individuals and their genetic relatives ● Changes in the physical environment, whether	● Explain how natural selection due to biotic and abiotic factors such as temperature change, air quality, and water availability affects survivorship, the gene pool, and gene frequency, ultimately resulting in adaptation of species. ● Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. ● Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales. ● Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales ● Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce. ● Construct an explanation based on evidence for how

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.	natural selection leads to adaptation of populations. ● 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

Assessments:	• Interim and summative assessments • Laboratory assessment
Teacher Resources:	Region 14 Implementation Guide

Unit Title	Land use and Soil Composition	Length of Unit	5 weeks

Inquiry Questions (Engaging & Debatable)	● How can we produce food more sustainably? ● How can we use mineral resources more sustainably? ● What are the major urban resource and environmental problems?
Standards*	HS-LS2-7, HS-ESS2-2, HS-ESS2-5, HS-ESS3-1, HS-ESS3-2, HS-ESS3-4
Unit Strands & Concepts	**DISCIPLINARY CORE IDEAS (DCI):** ● Ecosystem Dynamics, Functioning, and Resilience ● Earth Materials and Systems ● The Roles of Water in Earth's Surface Processes ● Human Impacts on Earth Systems ● Natural Resources **Cross Cutting Concepts (CCC)** ● Stability and Change ● Structure and Function ● Cause and Effect
Key Vocabulary	Urban Sprawl, Deforestation, Maximum Sustainable Yield, Carbon Sequestration, GMO, Renewable and Non-Renewable Resource

Unit Title	Land use and Soil Composition	Length of Unit	5 weeks

Critical Content: **My students will Know…**	**Key Skills:** **My students will be able to (Do)…**
● The way we use land can drastically change the local ecosystems. Urban sprawl, and agriculture require planning to ensure the land is sustainable for future use of land. ● The effects of habitat patterns such as fragmentation, edge effect, connectivity, and resource design ● The impacts of resource extraction and land reclamation efforts ● The negative effects of agriculture on the land and the benefits of sustainable agriculture ● Resource management approaches, including: maximum sustainable yield, ecosystem-based management, and adaptive management ● The effect of the current levels of deforestation in the US and in developing countries	● Evaluate the relationship between geomorphology and environmental processes ● Describe soil development, healthy soil management, soil erosion, and soil conservation techniques ● Identify how land is used and how land use affects ecosystems. ● Summarize the positive and negative effects of urban planning. ● Justify why maintaining specific renewable resources is important, including: soil, freshwater, wild animals, and timber ● Evaluate the factors that contribute to soil degradation as a result of technology, such as: irrigation, salinization, and pesticides ● Explain the role technology and biotechnology plays in food production, including: o GMOs, feedlots, aquaculture, seed banks, and organic foods ● Evaluate the positive and negative impact mining has on both the environment and on society, such as: increased erosion, sediment and debris, water pollution (acid drainage,) air pollution, property damage, and conflicts ● Discuss how biotechnology has impacted the mining industry,

• The various methods of mining and mineral extraction	such as: Hydrogen fuel vs. fossil fuel and metals mined for medical implant purposes

Assessments:	• Interim and summative assessments • Laboratory assessment
Teacher Resources:	Region 14 Implementation Guide