Environmental Science: Population Dynamics

Summit Public Schools
Summit, New Jersey
Grade Level: / Content Area:
11th and 12th Grade
Environmental Science: Population Dynamics
2nd Semester

Developed by
Helen Bremert,
and Thomas O'Dowd
Summit High School
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Curriculum

Course Description:

Environmental Science: Population Dynamics is designed for students who have an interest in environmental issues and solutions. In this activity and project-oriented course, students study to gain an understanding of environmental science, environmental issues and avenues for effective citizen action. Students will gain an in depth understanding of how man is impacting his ecosystem. They will explore the complexity of the problems and recognize the difficulty of solutions. Students will be able to research current environmental issues and systematically weigh pros and cons, discuss solutions, and trouble-shoot ideas through the use of multimedia research techniques. Students will explore the complex interconnections between the environment and the economy. With these strategies, students will gain a growing respect for human impact on the environment and develop strategies that will lead to a sustainable society.

Semester 2: Populations

Unit 1: Economics, Policy, and Personal Responsibility
- 21: Economics, Policy, Future

Unit 2: Populations
- 8: Understanding Populations
- 9: Human Populations
- 20: Human Health and Future

Unit 3: Land and Food
- 14: Land
- 15: Food and Agriculture

Unit 4: Mining and Resources
- 16: Mining
- 17: Nonrenewable Energy
- 18: Renewable Energy
- 19: Waste and Air Pollution

UNIT 1: ECONOMICS, POLITICAL POLICY, AND PERSONAL RESPONSIBILITY

5.1 Science Practices: All students will understand that science is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. The four Science Practices strands encompass the knowledge and reasoning skills that students must acquire to be proficient in science.

Strand C. Reflect on Scientific Knowledge: Scientific knowledge builds on itself over time.
5.3 Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
5.4 Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe
Strand B. History of Earth: From the time that Earth formed from a nebula 4.6 billion years ago, it has been evolving as a result of geologic, biological, physical, and chemical processes.
Social Studies
Standard 6.2 World History/Global Studies: All students will acquire the knowledge and skills to think analytically and systematically about how past interactions of people, cultures, and the environment affect issues across time and cultures. Such knowledge and skills enable students to make informed decisions as socially and ethically responsible world citizens in the 21st century.

Big Ideas:
Matter and Energy Transformation
Food is required for energy and building cellular materials. Organisms in an ecosystem have different ways of obtaining food, and some organisms obtain their food directly from other organisms.
Interdependence
All animals and most plants depend on both other organisms and their environment to meet their basic needs.
Evolution and Diversity:
Sometimes, differences between organisms of the same kind provide advantages for surviving and reproducing in different environments. These selective differences may lead to dramatic changes in characteristics of organisms in a population over extremely long periods of time.
Technological innovation, economic interdependence, changes in population growth, migratory patterns, and the development, distribution, and use of natural resources offer challenges and opportunities that transcend regional and national

Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
Is all economic growth positive? What political system is best for the environment? How has globalization impacted the environment? What is biodiversity worth? Are environmental impact statements more important than economic impact statements? Can we fix our atmosphere? Should mankind be planning an escape from planet Earth? Can a healthy economy and a healthy environment coexist? What environmental law was the most important? How should the government proceed from here? What effect can an individual have on the planet?	Students will understand that… ● Refinement of understandings, explanations, and models occurs as new evidence is incorporated. ● Data and refined models are used to revise predictions and explanations. ● Science is a practice in which an established body of knowledge is continually revised, refined, and extended as new evidence emerges. ● Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work. ● Science involves using language, both oral and written, as a tool for making thinking public. Ensure that instruments and specimens are properly cared for and that animals, when used, are treated humanely, responsibly, and ethically.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	**Examples, Outcomes, Assessments**
Students will: SOCIAL STUDIES 6.2.12.C.6.b Compare and contrast demographic trends in industrialized and developing nations, and evaluate the potential impact of these trends on the economy, political stability, and use of resources.	Instructional Focus: ● Provide an environmental context for major changes in US Domestic policy. ● Trace the development of US environmental laws and policies coupled with relevant scientific advances. Define

SCIENCE 5.1.12.C.1 Reflect on and revise understandings as new evidence emerges. 5.1.12.C.2 Use data representations and new models to revise predictions and explanations. 5.1.12.C.3 Consider alternative theories to interpret and evaluate evidence-based arguments. 5.1.12.D.1 Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences. 5.1.12.D.2 Represent ideas using literal representations, such as graphs, tables, journals, concept maps, and diagrams 5.1.12.D.3 Demonstrate how to use scientific tools and instruments and knowledge of how to handle animals with respect for their safety and welfare.	the roles of federal agencies state governments and local municipalities in dealing with environmental laws. ● Describe the relationship between economic development and environmental changes. ● Compare and contrast environmental treatment under democratic vs. totalitarian regimes. ● Use the models of the tragedy of the commons, pure capitalism as a comparison to Biomimicry and natural Capital models. ● Relate globalization of the world's economies to the need for international agreements on approaches to environmental issues. ● Outline the unique challenges facing developing nations with regard to environmental regulations. ● Provide examples of individual citizen's impact on environmental issues in Summit, New Jersey and the nation ● Reflect on each individual's role as a steward of the environment. Sample Assessments: ● Cross-curricular project involving International Relations class and or the Law class in the Social studies department. ● Create a spreadsheet of all major environmental legislation indicating pros cons and modifications ● Create a proposal to make SHS a greener high school. Including environmental and economic impact statements. ● Create a timeline showing the changing environmental attitudes in the United States. ● Personal reflection as a course summary on future role as a steward of the environment. ● Paper tests on public policy and the environment. ● Create an environmental resume for a job/career found by doing a job search. Instructional Strategies: Interdisciplinary Connections ● Joint international relations environmental science project. ● Joint Law environmental science project. Technology Integration ● Use state government web sites to track a piece of environmental legislation. Media Literacy Integration ● Research the background, funding and publications of a global warming skeptic as compared to a research scientist studying global warming. Global Perspectives ● dStudy biodiversity hot spots and research living standards in those areas.

Texts and Resources:
2008 Holt Environmental Science by Arms

Unit 2: Understanding Populations

Standard HS-ETS1 Engineering Design

At the high school level students are expected to engage with major global issues at the interface of science, technology, society and the environment, and to bring to bear the kinds of analytical and strategic thinking that prior training and increased maturity make possible. As in prior levels, these capabilities can be thought of in three stages—defining the problem, developing possible solutions, and improving designs.
Big Ideas: **Defining the problem** at the high school level requires both qualitative and quantitative analysis. For example, the need to provide food and fresh water for future generations comes into sharp focus when considering the speed at which world population is growing, and conditions in countries that have experienced famine. While high school students are not expected to solve these challenges, they are expected to begin thinking about them as problems that can be addressed, at least in part, through engineering. **Developing possible solutions** for major global problems begins by breaking them down into smaller problems that can be tackled with engineering methods. To evaluate potential solutions students are expected to not only consider a wide range of criteria, but to also recognize that criteria need to be prioritized. For example, public safety or environmental protection may be more important than cost or even functionality. Decisions on priorities can then guide tradeoff choices. **Improving designs** at the high school level may involve sophisticated methods, such as using computer simulations to model proposed solutions. Students are expected to use such methods to take into account a range of criteria and constraints, to try and anticipate possible societal and environmental impacts, and to test the validity of their simulations by comparison to the real world.

Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
What are characteristics of all populations? What are the most important factors that impact populations? Can we apply our knowledge on populations to protect and preserve resources? Can histograms successfully predict future population change?	Students will understand that… ● Logically designed investigations are needed in order to generate the evidence required to build and refine models and explanations. ● Mathematical tools and technology are used to gather, analyze, and communicate results. ● Empirical evidence is used to construct and defend arguments. ● Data and refined models are used to revise predictions and explanations. ● Science involves practicing productive social interactions with peers, such as partner talk, whole-group discussions, and small-group work.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	**Examples, Outcomes, Assessments**
Students will: HS-ETS1-1. Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. HS-ETS1-2. Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.	Instructional Focus: ● Environmental Science is an applied science. ● Human population is growing exponentially. ● Every population has a carrying capacity due to limiting factors. Human population is still growing exponentially due to our ability to technologically manipulate carrying capacity. ● Demonstrate appropriate use of Inquiry. ● Evaluate current and historic scientific literature on population trends.

HS-ETS1-3. Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.	• Plotting and interpreting data to understand and predict future population trends. Sample Assessments: • Histogram activity. • Human population growth lab. • How will our population grow? Lab activity. Instructional Strategies: Interdisciplinary Connections • Scientific method applies to all sciences • Technology Integration • Create a spreadsheet and graph • Examine histograms to predict future populations. Media Literacy Integration • Use of various Youtube video clips and TED Talks podcasts to reinforce information. Global Perspectives • The current rise in the human population can be linked to all environmental problems. • Study of environmental changes created by emerging markets.
5.1.12 B.1. Select and use the appropriate instrumentation to design and construct investigations. **5.1.12 B.2** Show that experimental results can lead to new questions and further investigations. **5.1.12 B.3** Discuss significant technological achievements in which science has played an important part as well as technological advances that have contributed directly to the advancement of scientific knowledge. **5.1.12.C.2** Use data representations and new models to revise predictions and explanations. **5.1.12.D.1** Engage in multiple forms of discussion in order to process, make sense of, and learn from others' ideas, observations, and experiences.	21st Century Skills: Creativity and Innovation Critical Thinking and Problem Solving • Discuss the problems that would be associated with various growth rates that exist throughout the world. Communication and Collaboration • Students will discuss and understand that despite that information we see on population growth there is a lag time that exists between understanding and implementation of practices to decrease growth rate. Information Literacy • Reading and analyzing data in the form of histograms, and growth curves. Life and Career Skills Understanding the impact of population growth can help with future family planning.
The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area.	
Standard HS-LS2: Ecosystems: Interactions, Energy, and Dynamics help students formulate an answer to the question, "How and why do organisms interact with their environment, and what are the effects of these interactions?" The LS2 Disciplinary Core Idea includes four sub-ideas: Interdependent Relationships in Ecosystems, Cycles of Matter and Energy Transfer in Ecosystems, Ecosystem Dynamics, Functioning, and Resilience,	**Big Ideas:** LS2.A: Interdependent Relationships in Ecosystems 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. Organisms

and Social Interactions and Group Behavior. High school students can use mathematical reasoning to demonstrate understanding of fundamental concepts of carrying capacity, factors affecting biodiversity and populations, and the cycling of matter and flow of energy among organisms in an ecosystem. These mathematical models provide support of students' conceptual understanding of systems and their ability to develop design solutions for reducing the impact of human activities on the environment and maintaining biodiversity. Crosscutting concepts of systems and system models play a central role in students' understanding of science and engineering practices and core ideas of ecosystems.	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. 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 original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.

Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
Why is important to understand population interactions? How does evolution determine and affect the relationships between species? What are the main types of interactions between species? What is the difference between a niche and a habitat? How do you identify a keystone species? How have the various stages of human history impacted the environment in the pastoan in the future? What are the population and consumption crisis, and how are they impacting the environment? What can the demographic transition tell us about various populations?	Students will understand that… ● Biological communities in ecosystems are based on stable interrelationships and interdependence of organisms. ● Stability in an ecosystem can be disrupted by natural or human interactions. ● Human population growth has impacted other populations. ● Natural ecosystems provide an array of essential functions that affect humans. These functions include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. ● Human activities have changed Earth's land, oceans, and atmosphere, and altered many of the essential functions of the ecosystem. As a result we have observed drastic changes in many populations of plant and animal species.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	**Examples, Outcomes, Assessments**
Students will: HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of 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.	**Instructional Focus:** ● A niche is the role an organism plays in its environment. Explain how the interactions amongst populations have created specific niches for organisms. Keystone species exist in a pivotal niche that makes them crucial to the survival of ecosystems ● Various interactions exist between populations (predation, parasitism, commensalism, mutualism) ● Discuss how evolution has created the populations that exist in various locations. ● Describe the characteristics that r-species show and where they can be found.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*	• Describe the characteristics of k-species and where they can be found. • The various stages of human history have had varying impact on the environment. Identify the pros and cons of each stage of human history as each relates to the environmental. • Defining the population and consumption crisis. Compare and contrast these issues with reference to the stage of development for a nation state. Recognize the geographic concentrations of these issues. • The exponential growth of the human population has necessitated the altering of the ecosystem to expand carrying capacity. • Explore the impact of the continued manipulation of carrying capacity for both short and long term consequences. **Sample Assessments:** • Case studies on keystone species. • Population dispersion pattern activity. • Plotting human population growth over various time periods and researching events from that period. • Utilizing technology to view areas of the world that have been negatively impacted due to population growth and overconsumption of natural resources. **Instructional Strategies:** **Interdisciplinary Connections** • Biological Science • Environmental issues and preservation of various biomes can be linked to local laws and international affairs. Creation and enforcement of laws need to be well understood when attempting to decrease losses in populations. **Technology Integration** • YouTube video on population explosion. • Use of Google Earth to view and analyze impact of human population. **Media Literacy Integration** • Use of scientific literature to demonstrate negative impact of human population growth on the environment. **Global Perspectives** • Examine biological hotspots for identification and preservation of biodiversity • Developed countries around the world are part of the consumption crisis, which can be linked back to resources from developing countries.
5.3.12.C.1 Analyze the interrelationships and interdependencies among different organisms, and explain how these relationships contribute to the stability of the ecosystem. **5.3.12.C.2** Model how natural and human-made changes in the environment will affect individual organisms and the dynamics of populations.	

5.4.12.G.2 Explain the unintended consequences of harvesting natural resources from an ecosystem. **5.4.12.G.5** Assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited the region.	
The following skills and themes listed to the right should be reflected in the design of units and lessons for this course or content area.	

Unit 3: Land and Food

Standard 5.3 Life Science: All students will understand that life science principles are powerful conceptual tools for making sense of the complexity, diversity, and interconnectedness of life on Earth. Order in natural systems arises in accordance with rules that govern the physical world, and the order of natural systems can be modeled and predicted through the use of mathematics.
Standard 5.4 Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.
Standard HS-LS2: Ecosystems:
Interactions, Energy, and Dynamics help students formulate an answer to the question, "How and why do organisms interact with their environment, and what are the effects of these interactions?" The LS2 Disciplinary Core Idea includes four sub-ideas: Interdependent Relationships in Ecosystems, Cycles of Matter and Energy Transfer in Ecosystems, Ecosystem Dynamics, Functioning, and Resilience, and Social Interactions and Group Behavior. High school students can use mathematical reasoning to demonstrate understanding of fundamental concepts of carrying capacity, factors affecting biodiversity and populations, and the cycling of matter and flow of energy among organisms in an ecosystem. These mathematical models provide support of students' conceptual understanding of systems and their ability to develop design solutions for reducing the impact of human activities on the environment and maintaining biodiversity. Crosscutting concepts of systems and system models play a central role in students' understanding of science and engineering practices and core ideas of ecosystems.

Big Ideas: *Course Objectives / Content Statement(s)*

Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
In what ways do humans use land in urban and rural settings? Is soil depletion an inevitable outcome of a growing human population? What is the government's role in land management? What steps are necessary for healthy management of forests? Can we decrease our ecological footprint and improve the quality of life?	Students will understand that… ● As matter cycles and energy flows through different levels of organization within living systems (cells, organs, organisms, communities), and between living systems and the physical environment, chemical elements are recombined into different products. ● Each recombination of matter and energy results in storage and dissipation of energy into the environment as heat. ● Continual input of energy from sunlight keeps matter and energy flowing through ecosystems. ● Soil is a limited resource that took thousands of years to create and needs to be preserved.

What causes urban crisis and what impact does it have on people? Can a better diet positively impact both our health and the health of the environment? Is their a sustainable way of controlling pests?	● The ways in which humans use land can have an long term impacts on the soil and the environment as a whole. ● Increasing population has lead to urbanization, which has both pros and cons to long-term sustainability. ● The typical US diet leads to a high ecological footprint.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	**Examples, Outcomes, Assessments**
Students will: HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.*	Instructional Focus: ● Explore how agriculture has changed over time and the idea that modern agricultural techniques designed to make food production more efficient and profitable can also be detrimental to our health and the future of agriculture. ● Discuss the different ways land is used ● Examine the process of food production and distribution keeping track of a the many resources required. Compare processed, local and organic food. ● Determine the pros and cons of pesticide use ● Identify the major causes of malnutrition ● Compare the environmental costs of producing different types of food ● Explain how food distribution problems and drought can lead to famine. Sample Assessments: ● Characteristics of soil lab ● Track multiple food products from their origination to your plate ● Public Lands Project Instructional Strategies: Interdisciplinary Connections ● Health and foods classes by discussing nutritional requirements ● History of agriculture Technology Integration ● Discuss video clips involving the controversy of food production Media Literacy Integration ● Determine your ecological footprint Global Perspectives ● Global land use ● Global food distribution
5.3.12.B.1 Cite evidence that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.	
5.3.12.B.2 Use mathematical formulas to justify the concept of an efficient diet.	

Unit 4: Mining and Resources

5.4 Earth Systems Science: All students will understand that Earth operates as a set of complex, dynamic, and interconnected systems, and is a part of the all-encompassing system of the universe.
ESS2: Earth's Systems: help students formulate an answer to the question: "How and why is Earth constantly changing?" The ESS2 Disciplinary Core Idea from the NRC Framework is broken down into five sub-ideas: Earth materials and systems, plate tectonics and large-scale system interactions, the roles of water in Earth's surface processes, weather and climate, and biogeology. For the purpose of the NGSS, biogeology has been addressed within the life science standards. Students develop models and explanations for the ways that feedbacks between different Earth systems control the appearance of Earth's surface. Central to this is the tension between internal systems, which are largely responsible for creating land at Earth's surface, and the sun-driven surface systems that tear down the land through weathering and erosion. Students begin to examine the ways that human activities cause feedbacks that create changes to other systems. Students understand the system interactions that control weather and climate, with a major emphasis on the mechanisms and implications of climate change. Students model the flow of energy between different components of the weather system and how this affects chemical cycles such as the carbon cycle. The crosscutting concepts of cause and effect, energy and matter, structure and function and stability and change are called out as organizing concepts for these disciplinary core ideas. In the ESS2 performance expectations, students are expected to demonstrate proficiency in
developing and using models, planning and carrying out investigations, analyzing and interpreting data, and engaging in argument; and to use these practices to demonstrate understanding of the core ideas.

ESS3: Earth and Human Activity: help students formulate an answer to the question: "How do Earth's surface processes and human activities affect each other?" The ESS3 Disciplinary Core Idea from the NRC Framework is broken down into four sub-ideas: natural resources, natural hazards, human impact on Earth systems, and global climate change. Students understand the complex and significant interdependencies between humans and the rest of Earth's systems through the impacts of natural hazards, our dependencies on natural resources, and the significant environmental impacts of human activities. Engineering and technology figure prominently here, as students use mathematical thinking and the analysis of geoscience data to examine and construct solutions to the many challenges facing long-term human sustainability on Earth. The crosscutting concepts of cause and effect, systems and system models, and stability and change are called out as organizing concepts for these disciplinary core ideas. In the ESS3 performance expectations, students are expected to demonstrate proficiency in developing and using analyzing and interpreting data, mathematical and computational thinking, constructing explanations and designing solutions and engaging in argument; and to use these practices to demonstrate understanding of the core ideas.

Big Ideas:
Biogeochemical Cycles: The biogeochemical cycles in the Earth systems include the flow of microscopic and macroscopic resources from one reservoir in the hydrosphere, geosphere, atmosphere, or biosphere to another, are driven by Earth's internal and external sources of energy, and are impacted by human activity.

Essential Questions *What provocative questions will foster inquiry, understanding, and transfer of learning?*	**Enduring Understandings** *What will students understand about the big ideas?*
Can nonrenewable resources be used sustainably? Who owns a nations natural resources? Is there a better way to mine coal?	Students will understand that …

Can mining be made environmentally friendly? What is the federal government's role in mining? Are fossil fuels renewable? Is it better for the Earth when a developing nation becomes developed? Can the US end our addiction to fossil fuels? Is nuclear energy good or bad from an environmental perspective? Is there a solar solution? Is the energy solution blowing in the wind? Is population growth necessarily linked to waste production? What are the ways in which we deal with waste? How can we reduce the amount of solid waste produced? Can we and should we eliminate our exposure to hazardous waste?	• Natural and human-made chemicals circulate with water in the hydrologic cycle • Natural ecosystems provide an array of basic functions that affect humans. These functions include maintenance of the quality of the atmosphere, generation of soils, control of the hydrologic cycle, disposal of wastes, and recycling of nutrients. • Movement of matter through Earth's system is driven by Earth's internal and external sources of energy and results in changes in the physical and chemical properties of the matter. • Natural and human activities impact the cycling of matter and the flow of energy through ecosystems. • Scientific, economic, and other data can assist in assessing environmental risks and benefits associate with societal activity.
Areas of Focus: Proficiencies (Cumulative Progress Indicators)	**Examples, Outcomes, Assessments**
Students will: 5.4.12.G.1 Analyze and explain the sources and impact of a specific industry on a large body of water (e.g., Delaware or Chesapeake Bay). 5.4.12.G.2 Explain the unintended consequences of harvesting natural resources from an ecosystem. 5.4.12.G.3 Demonstrate, using models, how internal and external sources of energy drive the hydrologic, carbon, nitrogen, phosphorus, sulfur, and oxygen cycles. 5.4.12.G.4 Compare over time the impact of human activity on the cycling of matter and energy through ecosystems. 5.4.12.G.5 Assess (using maps, local planning documents, and historical records) how the natural environment has changed since humans have inhabited the region. 5.4.12.G.6 Assess (using scientific, economic, and other data) the potential environmental impact of large-scale adoption of emerging technologies (e.g., wind farming, harnessing geothermal energy).	Instructional Focus: • Explaining the steps of mineral exploration • Discussing the differences between ore and gangue • Describing the process of reclamation. • Discussing the importance of coal mining to the United States • Subsurface and surface mining have detrimental effects on the environment • Reclamation is the process by which land must be returned to its original state after mineral extraction. • Explaining why fossil fuels are heavily relied upon as an energy source focusing on electrical power generation. • Explaining the environmental implications of burning fossil fuels • Discussing the major renewable energy sources • Explaining the causes/effects of increased amounts waste and how it can be managed. • Patterns of energy consumption and production in the world and in the United States. • The process in which fossil fuels are formed and used. • The advantageous and disadvantageous of nuclear energy. • The six forms of renewable energy and compare their advantages and disadvantages • The difference between biodegradable and non-biodegradable • How landfills work and the environmental problems they cause. • The methods in reducing solid waste • The steps involved in recycling an item. • What makes a material hazardous, how companies deal with hazardous waste, and 1 law that govern hazardous waste. Sample Assessments: • Cookie Mining to understand mining costs, difficulties, and reclamation

	• Watching you tube clips on life in a coal mine to understand its importance to states like West Virginia • Building a green home with an assigned renewable energy source • Researching areas of the world that use certain renewable energy sources • Writing a green resume • Watching video clips of "Off the Grid" Instructional Strategies: Interdisciplinary Connections • Connects to history and law, foreign affairs, understanding what laws were created to deal with waste products properly • Foreign affairs- countries that use the most fossil fuels, where it is produced, where it is used Technology Integration • Building a green home • Create a PP presentation on an energy resource Media Literacy Integration • Researching different energy sources, what parts of the world they are used in. • Compare how the media push certain forms of fuel or energy based on the political backing of the network Global Perspectives • Where are the most fossil fuels found? What country uses the most? What does this lead to? What are the solutions?

Curricular Addendum

Career-Ready Practices **CRP1**: Act as a responsible and contributing citizen and employee. **CRP2**: Apply appropriate academic and technical skills. **CRP3**: Attend to personal health and financial well-being. **CRP4**: Communicate clearly and effectively and with reason. **CRP5**: Consider the environmental, social and economic impacts of decisions. **CRP6**: Demonstrate creativity and innovation. **CRP7**: Employ valid and reliable research strategies. **CRP8**: Utilize critical thinking to make sense of problems and persevere in solving them. **CRP9**: Model integrity, ethical leadership and effective management. **CRP10**: Plan education and career paths aligned to personal goals. **CRP11**:. Use technology to enhance productivity.	**Interdisciplinary Connections** • Close Reading of works of art, music lyrics, videos, and advertisements • Use Standards for Mathematical Practice and Cross-Cutting Concepts in science to support debate/inquiry across thinking processes **Technology Integration** Ongoing: • Listen to books on CDs, Playaways, videos, or podcasts if available. • Use document camera or overhead projector for shared reading of texts. Other: • Use Microsoft Word, Inspiration, or SmartBoard Notebook software to write the words from their word sorts.

CRP12: Work productively in teams while using cultural global competence.

- Use available technology to create concept maps of unit learning.

Instructional Strategies: Supports for English Language Learners:

Sensory Supports	Graphic Supports	Interactive Supports
Real-life objects (realia)	Charts	In pairs or partners
Manipulatives	Graphic organizers	In triads or small groups
Pictures & photographs	Tables	In a whole group
Illustrations, diagrams, & drawings	Graphs	Using cooperative group
Magazines & newspapers	Timelines	structures
Physical activities	Number lines	With the Internet (websites) or software programs
Videos & films		In the home language
Broadcasts		With mentors
Models & figures		

from https://wida.wisc.edu

Media Literacy Integration

- Use multiple forms of print media (including books, illustrations/photographs/artwork, video clips, commercials, podcasts, audiobooks, Playaways, newspapers, magazines) to practice reading and comprehension skills.

Global Perspectives

- The Global Learning Resource Library

Differentiation Strategies:

Accommodations	Interventions	Modifications
Allow for verbal responses	Multi-sensory techniques	Modified tasks/ expectations
Repeat/confirm directions	Increase task structure (e.g., directions, checks for understanding, feedback)	Differentiated materials
Permit response provided via computer or electronic device	Increase opportunities to engage in active academic responding (e.g., writing, reading aloud, answering questions in class)	Individualized assessment tools based on student need
Audio Books	Utilize prereading strategies and activities: previews, anticipatory guides, and semantic mapping	Modified assessment grading