**Centerville High School Curriculum Mapping**
**Environmental Science**
**Matt Osborne**

## Environmental Science Overview

The Indiana Academic Standards specify the core, fundamental skills students should learn, master, and apply at grade level beginning in kindergarten and continuing through grade twelve. These academic standards serve as the basis to our curriculum in Centerville-Abington Community Schools but do not serve as curriculum alone. The Indiana Academic Standards are supported through grade-level, content-specific curriculum maps and resources. These curriculum maps and resources are aligned to the Indiana Academic Standards and provide the tools which are necessary to meet the needs of all learners. As a result, the Centerville-Abington Community Schools' curriculum maps are examined regularly and undergo periodic revisions.

Environmental Science is an interdisciplinary course that integrates biology, earth science, chemistry, and other disciplines. Students enrolled in this course conduct in-depth scientific studies of ecosystems, population dynamics, resource management, and environmental consequences of natural and anthropogenic processes. Students formulate, design, and carry out laboratory and field investigations as an essential course component. Students completing Environmental Science acquire the essential tools for understanding the complexities of national and global environmental systems. Labs include outdoor collection of data, and are geared toward problem solving and understanding issues associated with environmental problems often found in headlines.

Textbook: McGraw-Hill. (2023). *Principles of Environmental Science: Inquiry & Application.*

| **Unit 1 Theme** | **Essential Question(s)** |
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| *Introduction to Environmental Science*<br>Unit One explains what environmental science is and how it is used to solve environmental problems. The unit introduces the major themes of environmental science including sustainability, human population growth, climate change, natural resources, conservation, biodiversity, pollution, and ecosystem services. | What Is Environmental Science?<br>What Are The Major Themes of Environmental Science?<br><br>**Duration of Unit**<br>(3 Weeks) |
| **End of Unit 1 Authentic Learning Task**<br>Students will select a current environmental issue and create an environmental awareness poster. The poster will describe the environmental issue, identify 3 problems associated with the issue, and suggest 3 solutions to addressing the issue. The posters are put on display in the science wing to raise environmental awareness and educate others about the particular issue.<br>Standards: HS-ENV1-2, HS-ENV1-3, 9-10.LST.2.1,9-10.LST.2.2,9-10.LST.2.3,9-10.LST.3.3 9-10.LST.6.2, 9-10.LST.7.1, 9-10.LST.7.2 | |

| Pacing: Unit 1, Chapters 1 & 2 (3 Weeks) | |
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| **Indiana Academic Standards**<br>HS-ENV1-2, HS-ENV1-3, HS-ENV2-7, HS-ENV5-1, HS-ENV6-2, HS-ENV4-2, 9-10.LST.2.1,9-10.LST.2.2,9-10.LST.2.3,9-10.LST.3.3 9-10.LST.6.2, 9-10.LST.7.1, 9-10.LST.7.2 | |
| **Academic Vocabulary**<br>environmental science, science, scientific method, biodiversity, climate change, natural resources, ecosystem services, sustainability greenhouse gasses, interdisciplinary, pollution, invasive species | |
| **Key Concepts/Learning Targets**<br>I can describe the scientific method.<br>I can explain how science is used to investigate the natural world.<br>I can develop a proper scientific experiment.<br>I can state the current human population.<br>I can explain what is meant by exponential growth.<br>I can identify 4 advances in human civilization that have resulted in rapid population growth.<br>I can define environmental science.<br>I can describe why environmental science is interdisciplinary.<br>I can list the steps involved in environmental problem solving procedure.<br>I can explain the concept of environmental sustainability.<br>I can explain how sustainability relates to environmental problem solving.<br>I can cite specific textual evidence to support my analysis.<br>I can identify useful specific textual evidence for its use in analysis of science and technical texts. I can cite specific textual evidence for its use in supporting the main idea, supporting details, conclusion, and purpose.<br>I can determine the central ideas and conclusions of a text.<br>I can follow a multistep procedure for experiments. I can take measurements and perform technical tasks.<br>I can determine why an author provided an explanation. I can determine why an author described a procedure, or discussed an | **Question Stems**<br>What is the scientific method?<br>How is science different from other ways of understanding the world?<br>How are experiments conducted using the scientific method?<br>What is the human population of planet earth?<br>What is exponential growth?<br>What advances have allowed the human population to grow exponentially?<br>What is environmental science?<br>What makes environmental science an interdisciplinary science?<br>What steps are employed to solve environmental problems?<br>What is environmental sustainability?<br>Why is sustainability often a requisite goal of solving environmental problems?<br>What specific text evidence or data is used to support the main idea?<br>How does the text evidence or data support the supporting details of this text? How does the specific text evidence or data from the text support your conclusion?<br>What is the central idea of this text?<br>What is the purpose of this experiment?<br>Why did the author explain _____ in the text?<br>Why did the author describe the procedure?<br>What am I trying to prove in my research?<br>How do I come up with a research topic or question?<br>What sources are most reliable for informational research?<br>What sources are credible? |

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| experiment. I can determine why an author provided an explanation, described a procedure, or discussed an experiment. | Which sources are relevant to my key question?<br>How do you synthesize your sources?<br>How do you summarize your research?<br>How do you paraphrase the information from your source? |
| **Resources/Activities**<br>Environmental Science Inquiry & Application Textbook and associated online resources.<br>DVD: *Planet in Peril*, A CNN production that introduces contemporary major environmental issues.<br>Teacher file, Powerpoint presentation including Chapter 1 & 2 notes<br>Teacher file, note taking guide<br>Case Study: Lake Washington handout, teacher file<br>Teacher file, lab activity: Too Many Deer in Indiana State Parks<br>Internet: World population clock<br>TED video, YouTube: Environmental Sustainability | **Assessment(s)**<br>Smartbook reading comprehension assessments. (Smartbook is an online tool linked to the online version of the textbook. Students read sections of the textbook and answer questions to demonstrate comprehension and content mastery.)<br>Lab activity<br>Chapter 1 & 2 Worksheet, generated with textbook software<br>Poster Project (Environmental Awareness)<br>Unit Test, Teacher Developed |

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| **Unit 2 Theme**<br>*Ecosystems and Living Things*<br>Unit Two covers the basic principles of Ecology concerning species interaction. This includes the flow of energy through ecosystems, the concepts of niche, habitat, and symbiosis, and the process of succession. | **Essential Question(s)**<br>How do living things get and use energy?<br>How do living things interact with each other and their environment?<br><br>**Duration of Unit**<br>(8 Weeks) |
| **End of Unit 2 Authentic Learning Task**<br>Students take a field trip to a local woodlot featuring various stages of ecological succession. Students will take pictures and create either a slide show or pamphlet (student choice) that explains the process of ecological succession. Students must use their own pictures, and create a product that could be used at an outdoor education facility to educate the general public about the process of succession.<br>Standards: HS-ENV1-1, HS-ENV1-5, HS-ENV2-1, HS-ENV2-2, HS-ENV2-3, HS-ENV4-1, 9-10.LST.2.3, 9-10.LST.3.1, 9-10.LST.3.2, 9-10.LST.4.1, 9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.6.1, 9-10.LST.6.2, 9-10.LST.7.2 | |

Pacing: Unit 2, Chapters 3 & 4 Selected Sections (9 Weeks)

**Indiana Academic Standards**

HS-ENV1-1, HS-ENV1-4, HS-ENV1-5, HS-ENV2-1, HS-ENV2-2, HS-ENV2-3, HS-ENV4-1, 9-10.LST.2.3, 9-10.LST.3.2, 9-10.LST.4.1, 9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.5.2, 9-10.LST.6.1, 9-10.LST.6.2

**Academic Vocabulary**

population, community, ecosystem, biotic, abiotic, biosphere, ecosphere, producer, autotroph, consumer, heterotroph, decomposer, scavenger, detritovore, herbivore, omnivore, insectivore, trophic level, food chain, food web, biomass, 1st & 2nd laws of thermodynamics, niche, habitat, symbiosis, mutualism, parasitism, commensalism, endosymbiosis, competitive exclusion, predator-prey relationship, competition, resource partitioning, keystone species, indicator species, green world hypothesis, pyramid of energy, pyramid of numbers, pyramid of biomass, succession, primary succession, secondary succession, pioneer community, climax community

| **Key Concepts/Learning Targets** | **Question Stems** |
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| I can define the levels of organization in an ecosystem (population, community, ecosystem, biosphere, ecosphere).<br>I can distinguish between abiotic and biotic factors.<br>I can describe how heterotrophs and autotrophs get energy for life.<br>I can explain how energy flows through an ecosystem, starting with the sun and ending as heat, as dictated by the laws of thermodynamics.<br>I can compare and contrast ecological pyramids of energy, pyramids of biomass, and pyramids of numbers.<br>I can analyze and label an ecological pyramid of energy.<br>I can describe the niche of a species.<br>I can explain the concept of competitive exclusion.<br>I can identify the trophic levels of a food chain, including producer, consumers, and decomposers.<br>I can explain the concept of a food web in an ecosystem.<br>I can give examples of the 3 types of symbiosis (mutualism, parasitism, and commensalism).<br>I can explain a predator-prey relationship.<br>I can graph data that show a predator-prey relationship.<br>I can explain how keystone species are vital to the functional balance of an ecosystem.<br>I can give examples of keystone species.<br>I can compare and contrast primary and secondary succession.<br>I can explain how different human diets (i.e. vegan, vegetarian, | What are the levels of organization in an ecosystem?<br>What are examples of abiotic and biotic factors in an ecosystem?<br>How do autotrophs and heterotrophs get energy?<br>How do the laws of thermodynamics dictate the flow of energy through an ecosystem?<br>What are pyramids of energy, biomass, and numbers?<br>What is a niche?<br>What is competitive exclusion?<br>What is a food chain? What is a food web? What is the relationship between a food chain and food web?<br>What is symbiosis?<br>What is meant by these symbiotic relationships: mutualism, parasitism, commensalism?<br>What is a predator prey relationship?<br>What is a keystone species?<br>What is succession?<br>How are primary and secondary succession different?<br>How does what you eat (where you are in the food chain) impact the environment?<br>Why does the green hypothesis suggest that predators are an important component of a balanced ecosystem?<br>What are the steps?<br>What is the best unit of measurement to use?<br>What instruments or tools are used? |

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| omnivore) impact the environment in different ways.<br>I can describe how predators are essential to the balance of an ecosystem.<br>I can identify what tools or instruments I need for a procedure.<br>I can analyze results of an experiment, including evidence and data to support my conclusion.<br>I can analyze the structure of a text.<br>I can analyze how ideas are organized into categories or hierarchies in a text.<br>I can use multiple sources of information presented in a variety of formats to answer a question or solve a problem.<br>I can compare ideas in a text to information presented in other formats.<br>I can contrast ideas in a text to information presented in other formats. I can identify similarities in information between multiple sources.<br>I can write arguments with clear reasons and relevant evidence.<br>I can write an informative text that appropriately applies to my audience. I can clearly and systematically organize my procedure/experiment or process needed.<br>I can use technology to share and update my writing with others.<br>I can evaluate new information and feedback about my writing. | Based on the information from the text, what can you conclude from the results?<br>How did the author structure the text? What is the relationship between the concept of _____ and _____ in the text?<br>How are ideas organized within the text?<br>How does this information relate to the question or problem?<br>How are the ideas in the text similar to those in the experiment/simulation/video/etc.?<br>How are the ideas in the text different from those in the experiment/simulation/video/etc.?<br>What evidence will you use to support your claim?<br>What supporting information will you use to explain your topic?<br>How can you use technology to write collaboratively?<br>Did you effectively incorporate technology into your writing process? |
| **<u>Resources/Activities</u>**<br>Chapter 3 and 4 Environmental Science Inquiry & Application Textbook and associated online resources<br>Teacher file, Powerpoint presentation including Chapter 3 & 4 notes<br>Teacher file, note taking guide<br>DVD, *Cycles of Life–Ecology Module*, “Ecosystems”<br>DVD, *Cycles of Life–Ecology Module*, “Community Interactions”<br>Howard Hughes Medical Institute, Biointeractive (website): “Some Animals Are More Equal Than Others: Keystone Species and Trophic Cascades”, online documentary and activity sheet<br>Construct a Food Web, teacher file<br>Energy Flow Through Ecosystems, worksheet, teacher file<br>Oh Deer!, habitat and niche, outdoor activity, teacher file | **<u>Assessment(s)</u>**<br>Smartbook reading comprehension assessments, selected sections from Chapters 3 and 4. (Smartbook is an online tool linked to the online version of the textbook. Students read sections of the textbook and answer questions to demonstrate comprehension and content mastery.)<br>Lab activity sheets<br>Student created graphs linked to specific activity sheets (*Oh Deer!*, *Predator-Prey Relationships*)<br>Unit quiz, teacher file<br>Unit test, teacher file |

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| Oh Deer! lab activity sheet and graphing exercise, teacher file<br>Owl Pellet Dissection, teacher file<br>Succession Interactive Simulation online:<br>https://biomanbio.com/HTML5GamesandLabs/EcoGames/succession_interactive.html<br>Identifying Types of Symbiosis, teacher file<br>TED video,YouTube: Energy Flow<br>Smartbook, online text<br>Field trip to a local forest (Duning Woods) | |

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| **Unit 3 Theme**<br>*Ecosystems and Nutrient Cycles*<br>Unit Three continues and concludes the discussion of basic ecological concepts including nutrient flow through ecosystems and the distribution of biomes on planet earth. Nutrients flow in a cyclic pattern and are regulated by feedback loops. These feedback loops maintain balance in ecosystems and result in a distribution of biomes on Earth. | **Essential Question(s)**<br>How does matter flow through ecosystems?<br>How is the distribution of biomes on Earth related to abiotic factors and nutrient cycles?<br><br>**Duration of Unit**<br>(4 Weeks) |
| **End of Unit 3 Authentic Learning Task**<br>Students complete a "Biodome" project in small groups of 3 or 4. In the project, the group must construct a self-contained, self-sustaining "Biodome". The biodome must consist of (at least) 3 interconnected 2-liter bottles (or other type of container). Each bottle must represent a biome of Earth, and contain at least one plant, animal, and decomposer. The Biodome must be sealed and "self-sustaining", just like functional ecosystems on Earth. Projects are evaluated with a rubric.<br>Standards: HS-ENV1-1, HS-ENV1-4, HS-ENV1-5, HS-ENV1-6, HS-ENV1-7, HS-ENV1-8, HS-ENV2-1, HS-ENV2-2, HS-ENV3-1, HS-ENV4-2, 9-10.LST.2.3, 9-10.LST.3.1, 9-10.LST.3.2, 9-10.LST.4.1, 9-10.LST.4.2, 9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.5.2, 9-10.LST.6.1, 9-10.LST.6.2, 9-10.LST.7.1, 9-10.LST.7.2 | |

| Pacing: Unit 3, Chapters 3 & 6 Selected Sections (4 Weeks) |
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| **Indiana Academic Standards**<br>HS-ENV1-1, HS-ENV1-4, HS-ENV1-5, HS-ENV1-6, HS-ENV1-7, HS-ENV1-8, HS-ENV2-1, HS-ENV2-2, HS-ENV3-1, HS-ENV4-2, 9-10.LST.2.3, 9-10.LST.3.1, 9-10.LST.3.2, 9-10.LST.4.1, 9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.6.1, 9-10.LST.7.1 |
| **Academic Vocabulary** |

| biotic, abiotic, carbon/oxygen cycle, hydrologic cycle, nitrogen cycle, phosphorus cycle, limiting factors, photosynthesis, cellular respiration, evaporation, condensation, precipitation, nitrogen fixation, legumes, sediment, fossil fuels, greenhouse gases, mutualism, assimilation, nitrification, denitrification, biome, weather, climate, latitude, altitude, wetland, savannah, desert, temperate deciduous forest, rainforest, coniferous/boreal forest, taiga, temperate rainforest, chaparral, freshwater ecosystem (river, pond, lake, reservoir), marine ecosystem, estuary, brackish water, intertidal zone, marine ecosystem, watershed, zonation (littoral, limnetic, profundal), benthos, spring and fall turnover, vertical zonation, rainshadow effect | |
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| **Key Concepts/Learning Targets**<br>I can describe a nutrient cycle and the flow of matter through an ecosystem.<br>I can compare and contrast the flow of matter through an ecosystem and the flow of energy through an ecosystem.<br>I can identify and sequence the steps of the hydrologic cycle.<br>I can identify and sequence the steps of the carbon/oxygen cycle.<br>I can identify and sequence the steps of the nitrogen cycle.<br>I can identify and sequence the steps of the phosphorus cycle.<br>I can explain the concept of and give an example of a limiting factor.<br>I can describe why carbon, nitrogen, and phosphorus are each essential nutrients for life.<br>I can explain how fossil fuels are related to the carbon cycle.<br>I can define biomes.<br>I can identify the abiotic factors that determine the distribution of biomes on Earth.<br>I can describe the main abiotic and biotic factors of Earth's major biomes.<br>I can relate the distribution of biomes on Earth to latitude.<br>I can relate the distribution of biomes to altitude on a mountainside.<br>I can explain the difference between weather and climate.<br>I can describe the abiotic factors that determine the type of aquatic biome in an area.<br>I can list the major types of freshwater biomes on Earth.<br>I can identify the areas of zonation in a freshwater biome such as a lake or reservoir.<br>I can follow a multistep procedure for experiments. I can take measurements and perform technical tasks.<br>I can use the context to determine the meaning of words. | **Question Stems**<br>What is a nutrient cycle and what does it matter?<br>How is the flow of matter different from the flow of energy in an ecosystem?<br>What are the steps of the hydrologic cycle, tracing water from abiotic to biotic and back to biotic in an ecosystem?<br>What are the steps of the carbon/oxygen cycle, tracing carbon from abiotic to biotic and back to biotic in an ecosystem?<br>What are the steps of the nitrogen cycle, tracing nitrogen from abiotic to biotic and back to biotic in an ecosystem?<br>What are the steps of the phosphorus cycle, tracing phosphorus from abiotic to biotic and back to biotic in an ecosystem?<br>Why are carbon, nitrogen, and phosphorus essential for life?<br>What is a limiting factor?<br>What is an example of how a limiting factor might limit the size or range of a population?<br>How are fossil fuels related to the carbon cycle?<br>What is a biome?<br>What determines the distribution of terrestrial biomes on Earth?<br>How is the distribution of biomes related to latitude?<br>What is the difference between weather and climate?<br>What are the main biotic and abiotic features of the Earth's major biomes?<br>What are the main abiotic factors that characterize aquatic biomes?<br>What are the main types of freshwater biomes?<br>What are the areas of zonation in a freshwater lake or pond?<br>What is the purpose of this experiment?<br>Based on the context, what does the key terms or domain-specific mean<br>Based on the context, what does this symbol mean?<br>How does the organization of the text contribute to your understanding of |

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| I can use the context to determine the meaning of symbols.<br>I can evaluate how the organization of a text contributes to my understanding of a topic. I can convey the purpose of a section of the text.<br>I can evaluate multiple sources of information. I can use multiple pieces of credible information from multiple sources to solve a problem.<br>I can contrast ideas in a text to information presented in other formats. I can identify similarities in information between multiple sources.<br>I can use relevant evidence to support my analysis.<br>I can generate questions and hypotheses to guide my research.<br>I can use research to solve a problem.<br>I can combine multiple sources on a subject to gain understanding. | it? Is this an effective way to structure the text?<br>How do you know if a source of information is credible? What criteria is used to evaluate the material?<br>How can you combine the ideas from these sources to answer the question?<br>How are the ideas in the text different from those in the experiment/simulation/video/etc.?<br>How do you determine the validity and credibility of your evidence?<br>How can I use research to solve a problem?<br>Does the hypothesis clearly signify a dependent and an independent variable?<br>Is the hypothesis measurable with an objective viewpoint? |
| **Resources/Activities**<br>Chapter 3 and 6, selected sections, Environmental Science Inquiry & Application Textbook and associated online resources<br>Teacher file, Powerpoint presentation including Chapter 3 & 6 notes<br>Teacher file, note taking guide<br>DVD, *Cycles of Life–Ecology Module*, "Terrestrial Biomes"<br>DVD, *Cycles of Life–Ecology Module*, "Aquatic Biomes"<br>Howard Hughes Medical Institute, Biointeractive (website): https://www.biointeractive.org/classroom-resources/biomevieweronline, interactive activity and activity sheet<br>Carbon Cycle Lab activity, teacher file<br>Nutrient cycles, worksheet, teacher file<br>Let's Climb a Mountain (observe vertical zonation, graphing exercise), teacher file<br>Google Earth, biome distribution online<br>Too Much of Good Thing, nutrient pollution and freshwater ecosystems, teacher file<br>Biodome Project, teacher file<br>Biodome Project rubric, teacher file<br>TED video,YouTube: Nutrient Cycles: https://www.youtube.com/watch?v=A4cPmHGegKI&t=3s | **Assessment(s)**<br>Smartbook reading comprehension assessments, selected sections from Chapters 3 and 6. (Smartbook is an online tool linked to the online version of the textbook. Students read sections of the textbook and answer questions to demonstrate comprehension and content mastery.)<br>Lab activity sheet, HHMI BioInteractive website & activity sheet<br>Lab activity sheets, teacher file<br>Student-created graphs linked to specific activity sheets (*Let's Climb a Mountain!*)<br>Unit quiz, teacher file<br>Unit test, teacher file<br>Biodome Project, teacher file |

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| Smartbook, online text | |

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| **Unit 4 Theme**<br>*The Human Population*<br>The world population is now 8 billion. This is made possible by advances in technology, medicine, agriculture and sanitation. But the impact on the environment is staggering. This unit looks at the challenges of a growing human population, and the solutions necessary to sustain it. | **Essential Question(s)**<br>What factors have resulted in rapid human population growth?<br>How are all environmental issues linked to human population growth?<br><br>**Duration of Unit**<br>(3 Weeks) |
| **End of Unit 4 Authentic Learning Task**<br>Population Statistics of Countries, classroom presentation. (Pairs of) Students select and research the population statistics of a country. This research is compiled and used to create a classroom presentation. The pair of students act as "ambassadors" of their chosen country and present their country's statistics at a mock United Nations gathering.<br>Standards:HS-ENV2-7, HS-ENV4-1, HS-ENV4-2, HS-ENV5-1, HS-ENV5-2, HS-ENV6-1, HS-ENV6-2. 9-10.LST.2.3, 9-10.LST.3.1, 9-10.LST.3.2, 9-10.LST.4.1, 9-10.LST.4.2, 9-10.LST.5.2, 9-10.LST.6.1, 9-10.LST.7.1, 9-10.LST.7.2 | |

| Pacing: Unit 4, Chapter 5 (3 Weeks) | |
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| **Indiana Academic Standards**<br>HS-ENV2-7, HS-ENV4-1, HS-ENV4-2, HS-ENV5-1, HS-ENV5-2, HS-ENV5-3, HS-ENV5-4, HS-ENV6-1, HS-ENV6-2, 9-10.LST.3.3, 9-10.LST.7.1 | |
| **Academic Vocabulary**<br>ecological footprint, consumption overpopulation, people overpopulation, fertility rate, replacement level fertility, growth rate, death rate, birth rate, doubling time, carrying capacity, exponential growth, less developed country, developing country, developed country, demographics, stages of demographic transition, density dependent limiting factors, density independent limiting factors, biotic potential, population pyramid, zero population growth (ZPG) | |
| **Key Concepts/Learning Targets**<br>I can identify the 4 advances in human civilization that have led to rapid population growth.<br>I can distinguish between density dependent and independent limiting factors.<br>I can give examples of density dependent and independent limiting | **Question Stems**<br>What are the key advances in human civilization that have resulted in rapid population growth?<br>Why are most populations limited to the carrying capacity of the environment?<br>What makes density dependent and density independent limiting factors |

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| factors.<br>I can calculate the birth rate, death rate, growth rate, and doubling time of a population.<br>I can list the main cultural factors that influence the birth rates of a country.<br>I can describe the concept of an ecological footprint.<br>I can list the key demographic features of less developed, moderately developed, and developed countries?<br>I can describe how government policy can influence the birth rate of a country.<br>I can explain what is meant by "consumption overpopulation".<br>I can explain the concept of "people overpopulation".<br>I can explain the concept of zero population growth (ZPG).<br>I can describe how zero population growth (ZPG) is achieved.<br>I can explain the predictable change in a country's growth rate through demographic transition.<br>I can determine why an author provided an explanation. I can determine why an author described a procedure, or discussed an experiment. I can determine why an author provided an explanation, described a procedure, or discussed an experiment.<br>I can identify what issues remain unresolved in the text.<br>I can I use research to solve a problem.<br>I can combine multiple sources on a subject to gain understanding. | different?<br>What are some examples of density dependent and independent limiting factors?<br>How are a country's birth and death rates, growth rates, and doubling time calculated?<br>What are the main cultural factors that influence the birth rates in a country?<br>What is meant by an "ecological footprint"?<br>What are the key demographic features of a less developed, moderately developed, and developed country?<br>What role does a government play in the birth rate of a country?<br>What is the difference between consumption overpopulation and people overpopulation?<br>What is zero population growth and how is it achieved?<br>How does a country's growth rate change through demographic transition?<br>What was the author demonstrating with the description of this procedure?<br>What questions remain unanswered in the text?<br>What important issues remain unresolved in the text?<br>How do I organize information from multiple sources?<br>How can I use research to solve a problem? |
| **Resources/Activities**<br>Chapter 5, selected sections, Environmental Science Inquiry & Application Textbook and associated online resources<br>Teacher file, Powerpoint presentation including Unit 4 notes<br>Teacher file, note taking guide<br>DVD, *Cycles of Life–Ecology Module*, "Populations"<br>DVD, *NOVA: World in the Balance–The Population Paradox*<br>Website:<br>https://www.pbs.org/wgbh/nova/teachers/activities/3108_worldbal.html ,<br>online activity companion to DVD<br>Howard Hughes Medical Institute, Biointeractive (website): | **Assessment(s)**<br>Smartbook reading comprehension assessments, Chapter 5. (Smartbook is an online tool linked to the online version of the textbook. Students read sections of the textbook and answer questions to demonstrate comprehension and content mastery.)<br>Lab activity sheet, HHMI BioInteractive website & activity sheet<br>Lab activity sheets (*Cougar Hunt* and *Population Demographics*, teacher file<br>Student created graphs linked to specific activity sheets (*Population Demographics*<br>Unit quiz, teacher file<br>Unit test, teacher file |

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| https://media.hhmi.org/biointeractive/click/populationdynamics/#/ interactive activity and activity sheet (Population Dynamics)<br>Populations and Limiting Factors, worksheet, teacher file<br>Demographics, graphing the population statistics of countries (graphing exercise), teacher file<br>Cougar Hunt, activity and worksheet, teacher file<br>Ecological Footprint simulator, online resource: https://www.footprintcalculator.org/home/en<br>Smartbook, online text | Population Statistics of Countries, class presentation rubric |

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| **Unit 6 Theme**<br>*Air & Water Resources*<br>This unit is about why we need clean air and water for a livable world. We look at the ways that water and air are used, and the issues that arise when they are abused. We also look at the role the government plays in regulating and protecting air and water resources. | **Essential Question(s)**<br>How is water used and what measures are taken to regulate and protect water resources?<br>What measures are taken to regulate and protect air quality?<br><br>**Duration of Unit**<br>(8 Weeks) |
| **End of Unit 6 Authentic Learning Task**<br>Students participate in a program called Hoosier Riverwatch. We take a field trip to a local stream and perform a battery of water quality tests, including biological survey data and chemical testing. The test results are compiled and shared with an Indiana DNR database.<br>Standards: HS-ENV1-2, HS-ENV1-3, HS-ENV1-4, HS-ENV1-8, HS-ENV2-5, HS-ENV2-7, HS-ENV4-1, HS-ENV5-3, HS-ENV6-1, HS-ENV6-2, 9-10.LST.2.3, 9-10.LST.3.1, 9-10.LST.3.2, 9-10.LST.4.1, 9-10.LST.4.2, 9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.5.2, 9-10.LST.6.1, 9-10.LST.6.2, 9-10.LST.7.1, 9-10.LST.7.2 | |

| Pacing: Unit 6, Chapters 7, 8, & 9 (8 Weeks) |
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| **Indiana Academic Standards**<br>HS-ENV1-2, HS-ENV1-3, HS-ENV1-4, HS-ENV1-8, HS-ENV2-5, HS-ENV2-7, HS-ENV4-1, HS-ENV5-3, HS-ENV6-1, HS-ENV6-2, 9-10.LST.2.3, 9-10.LST.4.2, 9-10.LST.5.2, 9-10.LST.7.1 |
| **Academic Vocabulary**<br>watershed, point source pollution, non-point source pollution, chemical pollution, dissolved oxygen, pesticides, runoff, eutrophication, indicator species, turbidity, pH scale, thermal pollution, nutrient pollution, sediment pollution, erosion, benthic macroinvertebrate, effluent, pathogen, wastewater treatment (primary, secondary, tertiary), acid rain, emissions, ozone depletion, climate change, fossil fuels, greenhouse gases, |

| combustion, carbon footprint, CFC's, cap and trade legislation, Clean Water Act, Safe Drinking Water Act, Clean Air Act, particulate matter, AQI (air quality index), ozone, radon, Montreal Protocol, Paris Agreement, radon | |
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| **Key Concepts/Learning Targets**<br>I can define watershed and identify a watershed on a map.<br>I can distinguish between point source and nonpoint source pollution.<br>I can explain the relationship between benthic macroinvertebrates and water quality.<br>I can describe and give an example of the following types of water pollution: chemical, sediment, thermal, and nutrient.<br>I can conduct water quality tests for the following: dissolved oxygen, pH, turbidity, E.coli, nitrate, and phosphate.<br>I can explain the process of eutrophication.<br>I can relate the process of eutrophication to levels of nitrate and phosphate.<br>I can explain primary, secondary, and tertiary treatment in modern wastewater treatment facilities.<br>I can summarize the contents of the Clean Water Act and the Safe Water Drinking Act.<br>I can explain the air quality issue called acid rain.<br>I can explain how acid rain forms and what human activities cause acid rain.<br>I can identify the negative effects of acid rain on ecosystems and human structures.<br>I can discuss the ways that cap and trade legislation led to a reduction in emissions that cause acid rain.<br>I can explain why ozone depletion is harmful to life on Earth.<br>I can describe the role that CFCs play in ozone depletion.<br>I can summarize the legislation known as the Montreal Protocol.<br>I can relate climate change to fossil fuel consumption.<br>I can explain the concept of a "carbon footprint".<br>I can summarize the legislation known as the Paris Agreement.<br>I can summarize the content of the Clean Air Act.<br>I can generate questions and hypotheses to guide my research.<br>I can I use research to solve a problem. | **Question Stems**<br>What is a watershed? What are the geographical features of a watershed?<br>What is point source pollution? What is nonpoint source pollution?<br>What are benthic macroinvertebrates?<br>How do benthic macroinvertebrates reflect water quality?<br>What are the following types of water pollution: chemical, sediment, thermal, and nutrient?<br>How are the following water quality tests conducted: dissolved oxygen, pH, turbidity, E. coli, nitrate and phosphate?<br>What is eutrophication?<br>How is eutrophication related to phosphate and nitrate levels in the water?<br>What steps are involved in wastewater treatment?<br>What role does the Water Quality Act and Safe Drinking Water Act play in protecting and maintaining water quality?<br>How does acid rain form?<br>What human activities result in acid rain?<br>What is the effect of acid rain on ecosystems and human made structures?<br>What is ozone depletion?<br>What role do CFCs play in ozone depletion?<br>How did the Montreal Protocol address the problem of ozone depletion?<br>How is climate change related to fossil fuel consumption?<br>What is a "carbon footprint"?<br>What is the Clean Air Act?<br>What is the Paris Agreement?<br>How do I organize information from multiple sources?<br>How can I use research to solve a problem?<br>What is the purpose of a described experiment?<br>Based on the experimental data, what can you conclude from the results?<br>How do I evaluate the validity and reasonableness of the hypothesis? How do I evaluate the validity of data and conclusions?<br>What are the limitations, strengths, and weaknesses of the data?<br>What is the topic of your composition?<br>What supporting information will you use to explain your topic? |

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| I can identify what tools or instruments I need for a procedure.<br>I can analyze results of an experiment, including evidence and data to support my conclusion.<br>I can evaluate the validity of data in scientific texts.<br>I can find limitations, strengths and weaknesses in the data. I can find other sources of information that challenge conclusions. I can verify data when possible.<br>I can include precise descriptions and conclusions drawn from data and research in an informative text.<br>I can write an informative text that appropriately applies to my audience. I can clearly and systematically organize my procedure/experiment or process needed. | How will you organize and present the procedure/experiment or process you present? |
| **<u>Resources/Activities</u>**<br>Chapter 7, 8, & 9, Environmental Science Inquiry & Application Textbook and associated online resources<br>Powerpoint presentation for Hoosier Riverwatch, teacher file<br>Powerpoint presentation for Water Pollution & Water Quality, teacher file<br>Powerpoint presentation for Air Pollution & Air Quality, teacher file<br>Note taking guide for Powerpoint presentations, teacher file<br>DVD, *Before The Flood*<br>*Before the Flood* viewing guide, teacher file<br>Howard Hughes Medical Institute, Biointeractive (website): https://www.biointeractive.org/classroom-resources/science-climate-change<br>short documentary, interactive activity and activity sheet (The Science of Climate Change)<br>Water pollution, worksheet, teacher file<br>Air pollution, worksheet, teacher file<br>Acid Rain Lab Activity Worksheet, teacher file<br>Ozone Depletion Activity Worksheet, teacher file<br>Hoosier Riverwatch, water quality testing forms, Indiana DNR, located in teacher file<br>Indiana DNR Hoosier riverwatch database, online resource: https://www.in.gov/idem/riverwatch/ | **<u>Assessment(s)</u>**<br>Smartbook reading comprehension assessments, Chapter 5. (Smartbook is an online tool linked to the online version of the textbook. Students read sections of the textbook and answer questions to demonstrate comprehension and content mastery.)<br>Lab activity sheet, HHMI BioInteractive website & activity sheet<br>Lab activity sheets (*Acid Rain, Ozone Depletion)*<br>Water Resources & Water Pollution Test, teacher file<br>Air Resources & Air Pollution Test, teacher file<br>Water Quality Data Sheet, collected in conjunction with on-site field trip to a local river |

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| CarbonFootprint simulator, online resource: https://www.carbonfootprint.com/calculator.aspx<br>Smartbook, online text | |

| **Unit 7 Theme** | **Essential Question(s)** |
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| *Land Use & Biodiversity*<br>Unit 7 investigates the biodiversity of planet Earth–why it is critical to a healthy planet, and why it is in decline. In particular, the unit looks at the challenges of modern agriculture to feed a growing population while protecting biodiversity. | What is biodiversity and how is it related to the quality of life on planet Earth?<br>What is the impact of land use on the level of biodiversity of planet Earth?<br><br>**Duration of Unit**<br>(6 Weeks) |

**End of Unit 7 Authentic Learning Task**

Students will select either an endangered species or national park and prepare a multimedia presentation. Students must research their topic and prepare a presentation that is evaluated with a rubric. The goal of the presentation is to create awareness about concerning and protecting biodiversity.

Standards: HS-ENV4-1, HS-ENV4-2,, HS-ENV5-4, HS-ENV6-1, 9-10.LST.2.1, 9-10.LST.2.2, 9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.5.2, 9-10.LST.6.1, 9-10.LST.6.2, 9-10.LST.7.1, 9-10.LST.7.2

Pacing: Unit 7, Chapters 6, 10, & 11 (6 Weeks)

**Indiana Academic Standards**

HS-ENV1-3, HS-ENV1-5, HS-ENV2-6, HS-ENV2-7, HS-ENV4-1, HS-ENV4-2, HS-ENV5-2, HS-ENV5-3, HS-ENV5-4, HS-ENV6-1, HS-ENV6-2, 9-10.LST.2.1, 9-10.LST.2.2, 9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.5.2, 9-10.LST.6.2, 9-10.LST.7.1

**Academic Vocabulary**

biodiversity, endangered species, threatened species, genetic biodiversity, species diversity, Endangered Species act, *Silent Spring*, biomagnification, bioaccumulation, DDT, pesticides, green revolution, high-input agriculture, erosion, runoff, crop rotation, alternative agriculture, cover crop, crop rotation, cover crop, no-till agriculture, background extinction, extinction, endemic, reproductive success, habitat loss, habitat fragmentation, in situ conservation, ex situ conservation, CITES, Green Revolution

| **Key Concepts/Learning Targets** | **Question Stems** |
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| I can identify the major human activities that have accelerated the loss of biodiversity world wide. | What human activities have resulted in a dramatic increase in the rate of extinction worldwide? |

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| I can describe features that make some species more vulnerable to extinction than others.<br>I can distinguish between species biodiversity, habitat biodiversity, and ecosystem biodiversity.<br>I can describe and give examples of in situ conservation.<br>I can describe and give examples of ex situ conservation.<br>I can explain how the Endangered Species Act protects species from extinction.<br>I can explain the role of the Antiquities Act in creating National Parks and National Forests.<br>I can compare and contrast the goals of National Parks and National Forests.<br>I can compare subsistence, low-input, and high-input agricultural systems.<br>I can describe the costs and benefits of high-input agriculture.<br>I can explain how fertilizer use accelerates the process of eutrophication.<br>I can distinguish between broad spectrum pesticides and narrow spectrum pesticides.<br>I can relate the process of natural selection to genetic resistance in pests over time.<br>I can explain the processes of biomagnification and bioaccumulation and clarify the difference between the two.<br>I can expound the virtues of low-input agriculture.<br>I can explain several strategies of conservation tillage, including crop rotation, no-till farming, and cover crop usage.<br>I can debate the benefits of conservation tillage as it relates to environmental impact.<br>I can identify useful specific textual evidence for its use in analysis of science and technical texts. I can cite specific textual evidence for its use in supporting the main idea, supporting details, conclusion, and purpose.<br>I can explain how the author organizes and develops ideas in a text.<br>I can paraphrase a text in simpler terms.<br>I can compare ideas in a text to information presented in other formats. | What features make some species more vulnerable to extinction?<br>What is meant by species biodiversity, habitat biodiversity, and ecosystem biodiversity?<br>How do in situ and ex situ conservation strategies help species recover from being endangered?<br>What is the Endangered Species Act?<br>What is the Antiquities Act?<br>How are National Parks and National Forests alike and different?<br>What are the differing strategies of subsistence, low-input, and high-input agriculture?<br>What are the major pros and cons of high-input agriculture?<br>What is the relationship between fertilizer use and eutrophication?<br>How do broad spectrum pesticides differ from narrow spectrum pesticides?<br>How are pesticides passed along the food chain?<br>Why do pesticides stop working, or become less effective, over time?<br>What is low-input agriculture?<br>What are some examples of conservation tillage that qualify as low-input agriculture?<br>Why is conservation tillage “better for the environment” than traditional agricultural tillage?<br>How does the text evidence or data support the supporting details of this text? How does the specific text evidence or data from the text support your conclusion?<br>What was the purpose of citing the specific text evidence or data at the time of publication? What is the precise details or explanations or descriptions I am looking to address?<br>How does the author develop ideas throughout the text?<br>How are the ideas in the text organized?<br>How can you paraphrase the information in the text?<br>What ideas from the text are supported by the experiment/simulation/video/etc.?<br>What ideas from the text are contradicted by the experiment/simulation/video/etc.?<br>What is your claim and what evidence will you use to support your claim?<br>How will you organize and present the procedure/experiment or process you present? |

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| I can contrast ideas in a text to information presented in other formats. I can identify similarities in information between multiple sources.<br>I can write arguments with clear reasons and relevant evidence.<br>I can include precise descriptions and conclusions drawn from data and research in an informative text.<br>I can use technology to write collaboratively.<br>I can use technology to share and update my writing with others.<br>I can conduct research to learn more about a topic.<br>I can synthesize information from multiple sources.<br>I can evaluate a source's credibility.<br>I can generate questions and hypotheses to guide my research.<br>I can I use research to solve a problem.<br>I can combine multiple sources on a subject to gain understanding. | How will you verify your data?<br>What technology will be most useful for publishing your writing?<br>How can you use technology to write collaboratively?<br>Did you effectively incorporate technology into your writing process?<br>What am I trying to prove in my research?<br>How do I come up with a research topic or question?<br>What sources are most reliable for informational research?<br>What do I need to find out about my topic?<br>Where can I learn more about my topic?<br>How can I determine if a source is credible? |
| **Resources/Activities**<br>Chapter 6, 10, & 11, Environmental Science Inquiry & Application Textbook and associated online resources<br>Powerpoint presentation for Biodiversity, teacher file<br>Powerpoint presentation for Agriculture & the Environment, teacher file<br>Note taking guide for Powerpoint presentations, teacher file<br>DVD, *Food, Inc.* documentary<br>*Food, Inc.* viewing guide, teacher file<br>Scientific American Frontiers, Season 11, Episode 6, *Wild Places*, selected segments, online streaming: http://www.chedd-angier.com/frontiers/season11.html<br>Howard Hughes Medical Institute, Biointeractive (website): https://www.biointeractive.org/classroom-resources/vertebrate-declines-and-sixth-mass-extinction<br>interactive activity and activity sheet (*Vertebrate Decline & The Sixth Mass Extinction*)<br>**Biodiversity**, worksheet, questions from textbook Chapter 6 question bank<br>**Agricultural Systems** worksheet, questions from textbook Chapter 11 question bank | **Assessment(s)**<br>Smartbook reading comprehension assessments, selected sections from Chapters 6, 10 & 11. (Smartbook is an online tool linked to the online version of the textbook. Students read sections of the textbook and answer questions to demonstrate comprehension and content mastery.)<br>Lab activity sheet, HHMI BioInteractive website & activity sheet<br>Lab activity sheets, teacher file<br>Biodiversity Chapter Test, teacher file<br>Agricultural Systems Test, teacher file<br>Multimedia Project and Rubric, teacher file |

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| *Parachuting Cats Into Borneo (A Pesticide Cautionary Tale)*, worksheet, teacher file<br>**Multimedia Presentation** project description and rubric, teacher file<br>Smartbook, online text | |

| **Unit 8 Theme** | **Essential Question(s)** |
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| *Energy Resources*<br>Unit 8 is about the energy resources that power the civilized world. The unit looks at the environmental impact of the major energy resources, and the transition from fossil fuels to renewable sources of energy that is already underway. | What are the energy resources that power the world?<br>What energy resources can support a growing population while sustaining the environment of the Earth?<br><br>**Duration of Unit**<br>(4 Weeks) |

**End of Unit 8 Authentic Learning Task**

Students will conclude the unit, and the school year, by planting a tree. In small groups of 3 or 4, students will research tree species, tree planting techniques, and the relationship between trees and a "carbon footprint". Then, site selection (on school grounds) and tree planting. This tree planting ceremony is meant to draw the course to a close with a positive activity that ties together many themes throughout the year, providing both a summative look back and an optimistic nod to the future.

Standards: HS-ENV1-2, HS-ENV1-3, 9-10.LST.2.1,9-10.LST.2.2,9-10.LST.2.3,9-10.LST.3.3 9-10.LST.6.2, 9-10.LST.7.1, 9-10.LST.7.2

Pacing: Unit 8, Chapters 12 & 13 (4 Weeks)

**Indiana Academic Standards**

HS-ENV2-4, HS-ENV2-5, HS-ENV2-6, HS-ENV2-7, HS-ENV4-1, HS-ENV4-2, HS-ENV5-2, HS-ENV5-3, HS-ENV5-4, HS-ENV6-1, HS-ENV6-2, 9-10.LST.2.1, 9-10.LST.2.2, 9-10.LST.2.3,9-10.LST.4.3, 9-10.LST.5.1, 9-10.LST.5.2, 9-10.LST.6.1, 9-10.LST.7.1

**Academic Vocabulary**

energy sources, fossil fuels, coal, natural gas, petroleum (oil), greenhouse gases, combustion, carbon cycle, photosynthesis, climate change, fission, fusion, isotope, radioactivity, passive solar, active solar, wind farm, wind turbine, electricity, geothermal, sediment, photovoltaic cell, solar farm, reservoir, penstock

| **Key Concepts/Learning Targets** | **Question Stems** |
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| I can list the major sources of energy, including fossil fuels (coal, oil, natural gas), nuclear, and renewable energy sources (hydroelectric, | What are the major sources of energy?<br>What are fossil fuels? |

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| wind, solar, geothermal).<br>I can list examples of fossil fuels.<br>I can describe how fossil fuels form.<br>I can link fossil fuels to the type of energy produced.<br>I can explain how the combustion of fossil fuels disrupts the carbon cycle and causes climate change.<br>I can explain how electricity is generated at a nuclear power plant.<br>I can debate the pros and cons of nuclear power generation.<br>I can compare and contrast active solar power and passive solar power.<br>I can give examples of active solar and passive solar.<br>I can define renewable energy sources and give examples.<br>I can describe how renewable energy sources affect the carbon cycle.<br>I can identify useful specific textual evidence for its use in analysis of science and technical texts. I can cite specific textual evidence for its use in supporting the main idea, supporting details, conclusion, and purpose.<br>I can identify gaps or inconsistencies within the text.<br>I can address the gaps or inconsistencies in the text.<br>I can determine the central ideas and conclusions of a text.<br>I can accurately summarize the text.<br>I can follow a multistep procedure for experiments. I can take measurements and perform technical tasks.<br>I can write arguments with clear reasons and relevant evidence.<br>I can introduce a counterclaim in my argument.<br>I can use relevant evidence to support my analysis.<br>I can paraphrase without plagiarizing.<br>I can create plan and write scientific or technical writing. I am able to revise my work. I can cite, without plagiarizing, appropriate reference materials. I can rewrite my work with a new approach if needed. I can use an editing checklist to ensure my work is strengthened. I can make my writing clear and coherent. I can seek adult or peer advice as needed. | How do fossil fuels form?<br>How are fossil fuels used for energy?<br>In what way do fossil fuels alter the carbon cycle?<br>How is electricity generated at a nuclear power plant?<br>What are the benefits of nuclear power?<br>What are the drawbacks of nuclear power?<br>What is active solar power and what are some examples?<br>What is passive solar power and what are some examples?<br>What are renewable energy sources?<br>How do renewable energy sources affect the carbon cycle?<br>What specific text evidence or data is used to support the main idea?<br>How does the text evidence or data support the supporting details of this text? How does the specific text evidence or data from the text support your conclusion?<br>What gaps or inconsistencies are there within the text?<br>What is the central idea of this text?<br>How can I summarize this text? What is the conclusion of the text?<br>What is the purpose of a described experiment, and what are the steps?<br>What is your claim and what evidence will you use to support your claim?<br>How do you determine the validity and credibility of your evidence?<br>What do you do if you encounter evidence that contradicts your claim?<br>What is your counterargument?<br>Which organizational structure best fits your argument?<br>How does your conclusion further support the argument?<br>What is needed to plan and write a scientific or technical writing? What is needed to revise your work? What is appropriate reference materials? How can I rewrite my work with a new approach to the work? How can I use an editing checklist to ensure my writing is strengthened? Is my writing clear and coherent? How can I seek and receive appropriate peer or adult guidance? |
| **Resources/Activities**<br>Chapter 12 & 13, Environmental Science Inquiry & Application | **Assessment(s)**<br>Smartbook reading comprehension assessments, Chapter 12 & 13, selected |

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| Textbook and associated online resources<br>Powerpoint presentation for Energy Sources, teacher file<br>Note taking guide for Powerpoint presentations, teacher file<br>DVD, *Carbon Nation* documentary<br>*Carbon Nation* viewing guide, teacher file<br>DVD, Modern Marvels, *Power Plants*<br>YouTube, Modern Marvels, Enviro Tech<br>https://www.youtube.com/watch?v=XaE_N6zW5Qc<br>**Cars, CO2 & You**, lab activity, teacher file<br>**Energy Sources** worksheet, questions from textbook Chapter 11 question bank<br>**Tree Planting Guide**, Indiana Dept of Environmental Management, Wayne County Chapter, handout<br>Trees purchased through IDEM | sections. (Smartbook is an online tool linked to the online version of the textbook. Students read sections of the textbook and answer questions to demonstrate comprehension and content mastery.)<br>Lab activity sheet (*Cars, CO2 & You)*, teacher file<br>Student created graphs for *Cars, CO2 & You*<br>Energy Resources, unit quiz, teacher file<br>Energy Resources Unit Test, teacher file<br>Tree Planting Activity is assessed on a pass/fail scale |

| **Indiana Academic Standards Addressed and Assessed Each Term<br>Environmental Science<br>(A=assessed; I=introduced; P=practiced; R=reviewed)<br>(Green=high priority; Yellow=moderate priority; Blue=low priority)** | | | | | |
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| **Standard** | **Standard Statement** | **Term 1** | **Term 2** | **Term 3** | **Term 4** |
| Environmental Systems | | | | | |
| HS-ENV1-1 | 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. | I, P | P, A, R | P, A | P, A |
| HS-ENV1-2 | Use a computational representation to illustrate that humans are part of Earth's ecosystems and how human activities can, deliberately or inadvertently, alter ecosystems. | I, P, A, | P, A, R | P, A, R | P, A, R |
| HS-ENV1-3 | Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. | I, P, A | P, A, R | P, A, R | P, A, R |

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| HS-ENV1-4 | Analyze data regarding differences between systems in equilibrium and systems in disequilibrium. Use corresponding data to support how steady state is achieved through negative and positive feedback loops. | I, P | P, A, R | P, A, R | P, A, R |
| HS-ENV1-5 | Evaluate, measure, and communicate biological, chemical, and physical (abiotic and biotic) factors within an ecosystem. | I | P, A | P, A, R | P, A, R |
| HS-ENV1-6 | Use a model to locate and describe the major Earth biomes. Analyze data to assess how biomes are determined by climate (temperature and precipitation patterns) that support specific kinds of plants. | | I, P, A, R | | |
| HS-ENV1-7 | Observe the difference between weather and climate. Observe how weather can be influenced by global climatic patterns, such as El Niño and La Niña. Use a model or simulation to observe the factors that influence weather and climate, the action of gravitational forces, and the rotation of the Earth. | | I, P, A, R | | |
| HS-ENV1-8 | 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. | I | P, A | | P, A, R |
| Flow of Matter and Energy | | | | | |
| HS-ENV2-1 | Construct and revise an explanation based on evidence for the cycling of matter through sources and sinks and how energy is transferred. | | I, P, A | P, A, | R |
| HS-ENV2-2 | Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem. (These mathematical representations may include ecological pyramids of number, biomass, and energy.) | | I, P, A | P, A, | R |
| HS-ENV2-3 | Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate. | I, P, A | P, A, R | P, A, R | P, A, R |
| HS-ENV2-4 | Analyze and interpret the data on the benefits and disadvantages of the different sources of energy including fossil fuels, nuclear energy, hydroelectric, wind, solar, geothermal and biofuels. | I | | | P, A, R |
| HS-ENV2-5 | Use a model or simulation to analyze how layers of energy-rich organic material | | I, P, A | | P, A, R |

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| | have been gradually turned into great coal beds and oil pools by the pressure of the overlying earth. Observe that by burning these fossil fuels, people are passing stored energy back into the environment as heat and releasing large amounts of matter such as carbon dioxide and other air pollutants. | | | | |
| HS-ENV2-6 | Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. | | I, P | | P, A, R |
| HS-ENV2-7 | Analyze computational tools and other technologies that allow for the management of natural resources. Evaluate the trade-offs of these tools regarding human physical and cultural needs versus sustainability and biodiversity. | I, P, A | I, P, A, | I, P, A | I, P, A, R |
| Natural Hazards | | | | | |
| HS-ENV3-1 | Construct an explanation based on evidence for how natural Earth hazards, such as earthquakes, tornadoes, and hurricanes, affect the environment and human activity on both a short-term and long-term scale. | I | P, A, R | | |
| Biodiversity | | | | | |
| HS-ENV4-1 | Use a model or simulation to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. | I, P | P, A | P, A, R | |
| HS-ENV4-2 | Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. | I, P | P, A | P, A, R | |
| The Effect of Human Population and Activities on the Environment | | | | | |
| HS-ENV5-1 | Analyze and interpret data on how the size and rate of growth of the human population in any location is affected by economic, political, religious, technological, and environmental (resource availability) factors. | I | | P, A | A, R |
| HS-ENV5-2 | Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. | I | | P, A | A, R |

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| HS-ENV5-3 | Design, evaluate and refine a technological solution that reduces impacts of human activities on natural systems. | I, P | I, P, A | P, A | P, A, R |
| HS-ENV5-4 | Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity. | I | P, A | P, A, R | P, A, R |
| Environmental Policy | | | | | |
| HS-ENV6-1 | Conduct an investigation to evaluate the effectiveness of environmental policies and/or organizations (Clean Water Act, Clean Air Act, Endangered Species Act, Species Survival Plan, Resource Conservation and Recovery Act, Department of Energy, and the World Health Organization). | I | P, A | P, A, | P, A, R |
| HS-ENV6-2 | Construct an argument to explain that environmental policies/decisions have negative and positive impacts on people, societies, and the environment. | I | P, A | P, A, | P, A, R |
| Literacy in Science and Technical Subjects | | | | | |
| 9-10.LST.2.1 | Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.2.2 | 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, objective summary of the text. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.2.3 | 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. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.3.1 | Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.3.2 | Analyze the structure of the relationships among concepts in a text, including relationships among key terms (e.g., force, friction, reaction force, energy). | I, P, A | I, P, A, R | I, P, A | I, P, A, R |

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| 9-10.LST.3.3 | Analyze the author's purpose in providing an explanation, describing a procedure, or discussing an experiment in a text, defining the question the author seeks to address. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.4.1 | Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.4.2 | Assess the extent to which the reasoning and evidence in a text support the author's claim or a recommendation for solving a scientific or technical problem. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.4.3 | 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. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.5.1 | Write arguments focused on discipline-specific content. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.5.2 | Write informative texts, including scientific procedures/experiments or technical processes that include precise descriptions and conclusions drawn from data and research. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.6.1 | Plan and develop; draft; revise using appropriate reference materials; rewrite; try a new approach, focusing on addressing what is most significant for a specific purpose and audience; and edit to produce and strengthen writing that is clear and coherent. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.6.2 | Use technology to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link to other information and to display information flexibly and dynamically. | I, P, A | I, P, A, R | I, P, A | I, P, A, R |
| 9-10.LST.7.1 | Conduct short as well as more sustained research assignments and tasks to answer a question (including a self-generated question), test a hypothesis, or solve a problem; narrow or broaden the inquiry when appropriate; synthesize | I, P, A | I, P, A, R | I, P, A | I, P, A, R |

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| | multiple sources on the subject, demonstrating understanding of the subject under investigation. | | | | |
| 9-10.LST.7.2 | Gather relevant information from multiple authoritative sources, using advanced searches effectively; annotate sources; assess the usefulness of each source in answering the research question; synthesize and integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation (e.g., APA or CSE). | I, P, A | I, P, A, R | I, P, A | I, P, A, R |