East Penn School District
Curriculum and Instruction

Curriculum for: Environmental Science, College Preparatory

Course(s): CP Environmental Science

Grades: 10-12

Department: Science

Length of Period (average minutes): 42

Periods per cycle: 6

Length of Course (yrs): 1

Type of offering: elective

Credit(s) awarded: 1.0 4.0/4.0

Developed by: Kristin Susens and Briana Luancing

ADOPTED: 2018

Enduring Understandings	**Essential Questions**	**Knowledge**	**Skills**	**Standards**
● Humans rely on the environment for all of the resources necessary for survival ● Environmental degradation has an economic and human cost ● Earth and its resources are protected by environmental laws and treaties	● How can we best balance our own interests and needs with the health of the environment? ● How do humans rely on the environment? ● What impact have humans had on the environment?	● The environment provides humanity with services and resources that have economic value (ECOSYSTEM SERVICES) ● Current environmental laws and policies are the result of past environmental degradation ● Resources can be renewable, non-renewable or continual ● How the tragedy of the commons can explain overexploitation of commonly held resources ● General trends in human population size and resource use	● Construct a model of sustainable use of a resource ● Identify causal relationships between environmental catastrophes and current environmental laws. ● Evaluate their ecological footprint and factors that influence their resource consumption ● Analyze case studies to identify social, economic, and environmental factors that are impacting human populations.	NGSS Standards: ● HS-ESS3-1: Human Sustainability Construct an explanation based on evidence for how the availability of natural resources, occurrence of natural hazards, and changes in climate have influenced human activity. ● HS-ESS3-6: Human Sustainability Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
● The Earth is made of interconnected systems that all living things interact with. ● Where an organism lives is dependent on	● How do we know that an ecosystem is healthy? ● How do local and global decisions	● How the laws of conservation of matter and energy impact ecosystems ● How patterns in temperature and	● Create a model of flow of energy and matter for a given ecosystem. ● Evaluate the health of a given ecosystem	NGSS Standards: ● HS-LS2-2 Ecosystems: Interactions, Energy, and Dynamics Use mathematical

environmental factors • Altering the environment significantly changes the habitat and resource availability for all organisms. • Humans rely on biodiversity for tangible and intangible benefits • The ability of an ecosystem and or organism to adapt to change is dependent upon its resiliency.	affect biodiversity? • What is the value in biodiversity? • Are we in a 6th mass extinction?	precipitation affect community composition and levels of biodiversity • How apex predators, invasive species, and keystone species affect ecosystem composition • How an organism's niche determines its resiliency • Identify cultural, ecological and provisional benefits from biodiversity • Causes of biodiversity and habitat loss • The environmental and economic effects of biodiversity and habitat loss	based on indicators • Design, evaluate and refine a solution for reducing the impacts of human activity on biodiversity. • Analyzing case studies of loss of biodiversity to identify the social, environmental, and economic impacts • Evaluate the effect of consumer choices on biodiversity and habitat loss	representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales. • HS-LS4-6 Biological Evolution: Unity and Diversity Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.* • HS-LS2-6: Ecosystem Dynamics, Functioning and Resiliency Evaluate 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.
• Humans are exposed to toxins and pollutants during daily activities	• How does pollution impact human health? • How do we	• Routes of exposure to environmental toxins. • How the solubility	• Identify sources of indoor and outdoor air pollution in our area	NGSS Standards: • HS-ESS3-4: Human Impacts on Earth's

• Exposure to chemical and biological agents can impact the short-term and long term health of an organism. • Air, water, and soil quality are monitored to protect human health. • Both natural processes and human activities can cause air and water pollution.	determine the health effects and safe levels of pollution? • Why is clean water and air important?	and persistence of a toxin affects its safety • Describe bioaccumulation and biomagnification of toxins • How risk assessments determine safe exposure levels • Major sources of air pollution (indoor and outdoor) • Water pollution can be chemical, physical or biological • Sources and effects of major pollutants in surface and groundwater • Organisms can be used as indicators of water quality • Sources and effects of major pollutants in the ocean	• Evaluate the current air quality of the local area • Evaluate the health of an aquatic ecosystem based on chemical and biological indicators • Identify sources of water pollution in our area • Analyze a dose-response curve to calculate an LD50 • Analyze personal body burdens from household products • Evaluate a technological solution that reduces the impact of pollution in the environment.	Systems Evaluate or refine a technological solution that reduces impacts of human activities on natural systems. • HS-ESS3-6: Human Sustainability Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
• There is a finite supply of freshwater on Earth. • Availability of safe drinking water is essential for human survival. • Changes to water	• Why are we running out of water? • How do we sustainably ensure clean drinking water for everyone?	• How water is distributed geographically and temporally • Sources and methods of obtaining human drinking water	• Design and construct a water filter • Quantify the water footprint of their lifestyle and evaluating methods of reducing their footprint	NGSS Standards: • HS-ETS1-1 Engineering Design Analyze a major global challenge to specify qualitative and quantitative criteria and

distribution in the hydrosphere affects the lithosphere, biosphere and atmosphere. ● People, items and processes have a 'water footprint' that encompasses all of the water involved in the production		● Methods and rationale for treating drinking water ● Methods of conserving water	● Design and justify a water treatment solution for areas with poor sanitation ● Model a watershed and evaluate impacts of human activity on water quality ● Modeling movement of a pollutant through an aquifer.	constraints for solutions that account for societal needs and wants. ● HS-LS2-7 Ecosystems: Interactions, Energy, and Dynamics Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity. ● HS-ESS3-6: Human Sustainability Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.
● Human population has grown exponentially due to advances in medicine, sanitation and industrialization ● The amount of arable land to grow food is decreasing with desertification and growth of urban/suburban areas	● How and why has the human population changed? ● How will the earth provide enough resources for a growing human population? ● How can we balance our	● Demography is the study of human populations and their characteristics ● Population pyramids provide information about the past, present and future of a population ● Factors that affect infant mortality, death rates, and	● Comparing characteristics of countries in different stages of demographic transition and predicting future trends ● Justify personal position on instituting a One-Child Policy to reduce global strain	NGSS Standards: ● HS-LS2-1: Interdependent Relationships in Ecosystems Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of

• Raising livestock comes with a higher environmental impact than planting crops	growing demand for food with our need to protect the environment?	birth rates • Cultural strategies to reduce total fertility rates • How has our agricultural system changed to produce more food • Issues associated with current industrial agricultural practices (pesticide/herbicide resistance, pesticide/fertilizer pollution, monocultures, desertification, greenhouse gas emissions, erosion, groundwater mining/diversion)	on resources • Evaluating various solutions to the global food crisis (GMOs, vertical farming, organic/biodynamic agriculture, permaculture, aquaculture, crop rotation, contour/terrace farming) • Identify how personal food choices have an environmental effect	ecosystems at different scales. • HS-ETS1-1 Engineering Design Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants. • ESS3-4: Human Sustainability Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.
• The greenhouse effect impacts the energy budget of Earth • The composition of the atmosphere has changed since the industrial revolution. • The global carbon budget has changed since the industrial revolution • Reducing climate	• What are the causes and consequences, both human and environmental, of a warming Earth? • How do our choices as consumers and waste producers affect our environment?	• Carbon sinks and sources in the environment • How the atmosphere has changed since the industrial revolution • How an increase in greenhouse gases has exacerbated the greenhouse effect • Anthropogenic and natural causes of	• Evaluate their carbon footprint and develop a personal plan to reduce their footprint in the future • Analyze geoscience data to make an evidence based justification of global climate change and associated impacts • Model the effect of increasing carbon	NGSS Standards: • HS-ESS3-5 Earth and Human Activity 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

change requires action to increase energy efficiency, sharply reduce greenhouse gas emissions and increasing reliance on renewable energy sources.	• What are potential solutions to slow climate change?	climate change. • Effects of projected climate change on Earth's systems and the human way of life. • Preventative and "clean up" solutions to climate change	dioxide levels on photosynthetic biomass and ocean acidification	systems. • HS-ESS2-6 Earth's Systems Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere. • HS-ESS3-3 Earth and Human Activity Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. • HS-ESS2-2: Earth Materials and Systems Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
• Nonrenewable energy reserves are finite. • The use of nonrenewable	• Can we depend on nonrenewable energy sources for our energy	• Current global and local energy consumption and generation	• Evaluating solutions for managing energy resources based on cost-benefit ratios	NGSS Standards: • HS-ESS3-3 Earth and Human Activity

resources provides immediate benefits but results in pollution, climate change, and biodiversity losses. ● It takes energy to produce energy. ● Renewable energy sources will provide	needs? ● How can we manage renewable resources for sustainable use? ● At what point do the costs of fossil fuel acquisition and use outweigh the benefits? ● How will the earth provide enough resources for a growing human population? ● How can society transition to a more sustainable energy future?	● The advantages and disadvantages of nonrenewable and renewable resources ● Ways that energy is used inefficiently and solutions to improve efficiency ● The environmental and economic impacts of our energy use and sources.	● Evaluate personal energy usage and develop a plan to reduce energy use at home ● Identify and evaluate different potential sources of energy for a particular use and geographic location.	Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity. ● HS-ESS3-2 Earth and Human Activity Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios. ● HS-ETS1-1 Engineering Design Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
● Small actions can collectively have a large impact. ● Scientific thinking and engineering design processes can be used to solve real-world problems and challenges.	● What can individuals do to have a positive impact on the environment?	● Due to the individual nature of the project, the knowledge base of each student will be unique and driven by their inquiry process.	● Critically examining problems and identifying solutions. ● Pitching ideas for implementation. ● Planning time and resource utilization ● Collaborating with peers and community	NGSS Standards: ● S-LS2-7 Ecosystems: Interactions, Energy, and Dynamics Design, evaluate, and refine a solution for reducing the impacts of human activities on the

			members to attain a goal. ● Documenting and reflecting on the design process. ● Communicating results and findings in a TED style forum.	environment and biodiversity.

Materials and Resources:

"Environmental Science-How the World Works & Your Place In It"
ISBN 0-920008-92-5 (J.M. LeBel Enterprises) 2007