EAST PENN SCHOOL DISTRICT

Environmental Science

July 14, 2025

Environmental Science Unit 1 - Introduction

STAGE 1 | DESIRED RESULTS

Standards

3.3.9-12.O - 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.

3.3.9-12.M Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ 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

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ 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?

Acquisition(need to align with above and standards)

Students will know...

ESS3.A - Natural Resources

- ☐ Resource availability has guided the development of human society.

ESS3.B - Natural Hazards

- ☐ Natural hazards and other geologic events have shaped the course of human history; [they] have significantly altered the sizes of human populations and have driven human migrations.

Students will be skilled at...

- ☐ *Develop and use a model of sustainable use of a resource*
- ☐ *Analyze and identify causal relationships between environmental catastrophes and current environmental laws.*
- ☐ *Conduct an investigation to evaluate their ecological footprint and factors that influence their resource consumption*
- ☐ *Analyze and interpret case studies to identify social, economic, and environmental factors that are impacting human populations.*

	ESS2.D - Weather and Climate ☐ Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of humangenerated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary) **ESS3.D - Global Climate Change** ☐ Through computer simulations and other studies, important discoveries are still being made about how the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. Other knowledge: ☐ *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*	

Envi Science Unit 2 - Biodiversity

STAGE 1 | DESIRED RESULTS

Standards

3.1.9-12.L - Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

3.1.9-12.V - Create or revise a simulation to test a solution to mitigate the adverse impacts of human activity on biodiversity.

3.1.9-12.M 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.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ The Earth is made of interconnected systems that all living things interact with.
- ☐ Where an organism lives is dependent on 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.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How do we know that an ecosystem is healthy?
- ☐ How do local and global decisions affect biodiversity?
- ☐ What is the value in biodiversity?
- ☐ Are we in a 6th mass extinction?

Acquisition(need to align with above and standards)

Students will know...

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 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.

LS4.C Adaptation

Students will be skilled at...

- ☐ *Develop and use a model of flow of energy and matter for a given ecosystem.*
- ☐ *Analyze and evaluate the health of a given ecosystem based on indicators*
- ☐ *Design, evaluate and refine a solution for reducing the impacts of human activity on biodiversity.*
- ☐ *Analyze and interpret case studies of loss of biodiversity to identify the social,*

	☐ Changes in the physical environment, whether naturally occurring or human induced, have thus contributed to the expansion of some species, the emergence of new distinct species as populations diverge under different conditions, and the decline–and sometimes the extinction– of some species. **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. Other knowledge: ☐ *How the laws of conservation of matter and energy impact ecosystems* ☐ *How patterns in temperature and 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*	*environmental, and economic impacts* ☐ *Construct an argument to evaluate the effect of consumer choices on biodiversity and habitat loss*

Envi Science Unit 3 - Human Health

STAGE 1 | DESIRED RESULTS

Standards

3.3.9-12.M Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

3.3.9-12.Q Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ Humans are exposed to toxins and pollutants during daily activities
- ☐ 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.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ How does pollution impact human health?
- ☐ How do we determine the health effects and safe levels of pollution?
- ☐ Why is clean water and air important?

Acquisition(need to align with above and standards)

Students will know...

ESS2.D Weather and Climate

- ☐ Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of humangenerated greenhouse gases added to the atmosphere each year and by the ways in which these gases are absorbed by the ocean and biosphere. (secondary)

ESS3.D Global Climate Change

- ☐ Through computer simulations and other studies, important discoveries are still being made about how

Students will be skilled at...

- ☐ *Ask questions and define problems related to common indoor and outdoor pollutants in the local area, using environmental data and community input to identify their sources and potential impacts.*
- ☐ *Analyze and interpret data from local air quality monitoring tools to assess trends in pollutant levels and evaluate implications for public health and policy*
- ☐ *Plan and conduct investigations of local water bodies to evaluate the health of an aquatic ecosystem*

	the ocean, the atmosphere, and the biosphere interact and are modified in response to human activities. **ESS3.C Human Impacts on Earth Systems** ☐ The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. Other knowledge: ☐ *Routes of exposure to environmental toxins.* ☐ *How the solubility 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*	*based on chemical and biological indicators* ☐ *Construct explanations supported by evidence to identify sources of water pollution in our area* ☐ *Use mathematical and computational thinking to analyze a dose-response curve to calculate an LD50* ☐ *Obtain, evaluate, and communicate information by analyzing ingredient labels and personal body burdens from household products* ☐ *Engage in argument from evidence to evaluate a technological solution that reduces the impact of pollution in the environment.*

Envi Science Unit 4 - Human Impacts on Waterways

STAGE 1 | DESIRED RESULTS

Standards

3.3.9-12.M Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

3.1.9-12.N Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

3.3.9-12.M Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ There is a finite supply of freshwater on Earth.
- ☐ Availability of safe drinking water is essential for human survival.
- ☐ Changes to water 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

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ Why are we running out of water?
- ☐ How do we sustainably ensure clean drinking water for everyone?

Acquisition(need to align with above and standards)

Students will know...

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- ☐ Anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.

ESS2.D Weather and Climate

- ☐ Current models predict that, although future regional climate changes will be complex and varied, average global temperatures will continue to rise. The outcomes predicted by global climate models strongly depend on the amounts of humangenerated greenhouse gases added to the atmosphere each year and by the ways in

Students will be skilled at...

- ☐ *Design and construct a water filter*
- ☐ *Analyze and quantify the water footprint of their lifestyle and evaluating methods of reducing their footprint*
- ☐ *Design and justify a water treatment solution for areas with poor sanitation*
- ☐ *Develop and use a model of a watershed to evaluate impacts of human activity on water quality*
- ☐ *Develop and use a model to show the movement of a pollutant through an aquifer.*

	which these gases are absorbed by the ocean and biosphere. (secondary) **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. Other knowledge: ☐ *How water is distributed geographically and temporally* ☐ *Sources and methods of obtaining human drinking water* ☐ *Methods and rationale for treating drinking water* ☐ *Methods of conserving water*	

Envi Science Unit 5 - Human Population and Food

STAGE 1 | DESIRED RESULTS

Standards

3.3.9-12.R Evaluate or refine a technological solution that reduces the impact of human activities on natural systems.

3.1.9-12.I Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ 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
- ☐ Raising livestock comes with a higher environmental impact than planting crops

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ 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 growing demand for food with our need to protect the environment?

Acquisition(need to align with above and standards)

Students will know...

ESS3.C: Human Impacts on Earth Systems

- ☐ Scientists and engineers can make major contributions by developing technologies that produce less pollution and waste and that preclude ecosystem degradation.

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 would have the capacity to produce populations of great size were it not for the fact that

Students will be skilled at...

- ☐ *Construct an argument comparing characteristics of countries in different stages of demographic transition and predicting future trends*
- ☐ *Construct an argument to justify personal position on instituting a One-Child Policy to reduce global strain on resources*
- ☐ *Analyze and evaluating various solutions to the global food crisis (GMOs, vertical farming, organic/biodynamic agriculture,*

	environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. Other knowledge: ☐ *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 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)*	*permaculture, aquaculture, crop rotation, contour/terrace farming)* ☐ *Analyze, interpret, and communicate how personal food choices have an environmental effect*

Envi Science Unit 6 - Towards a Sustainable Future

STAGE 1 | DESIRED RESULTS

Standards

3.3.9-12.H Analyze geoscience data to make the claim that one change to Earth's surface can create feedback that causes changes to other Earth systems.

3.3.9-12.L Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

3.3.9-12.S 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.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ 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 change requires action to increase energy efficiency, sharply reduce greenhouse gas emissions and increasing reliance on renewable energy sources.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ 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?
- ☐ What are potential solutions to slow climate change?

Acquisition(need to align with above and standards)

Students will know...

ESS2.A: Earth Materials and Systems

- ☐ Earth's systems, being dynamic and interacting, cause feedback effects that can increase or decrease the original changes.

ESS2.D: Weather and Climate

- ☐ The foundation for Earth's global climate systems is the electromagnetic radiation from the sun, as well as its reflection, absorption, storage, and redistribution among the atmosphere, ocean, and land systems, and this energy's reradiation into space.

Students will be skilled at...

- ☐ *Analyze and 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*
- ☐ *Develop and use a model to show the effect of increasing carbon dioxide levels on photosynthetic biomass and ocean acidification*

	☐ Gradual atmospheric changes were due to plants and other organisms that captured carbon dioxide and released oxygen. ☐ Changes in the atmosphere due to human activity have increased carbon dioxide concentrations and thus affect climate. **ESS3.D Global Climate Change** ☐ Though the magnitudes of human impacts are greater than they have ever been, so too are human abilities to model, predict, and manage current and future impacts. Other knowledge: ☐ *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 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*	

Envi Science Unit 7 - Energy Sources and Consequences

STAGE 1 | DESIRED RESULTS

Standards

3.3.9-12.Q Create a computational simulation to illustrate the relationships among management of natural resources, the sustainability of human populations, and biodiversity.

3.3.9-12.P Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ Nonrenewable energy reserves are finite.
- ☐ The use of nonrenewable resources provides immediate benefits but results in pollution, climate change, and biodiversity losses.
- ☐ It takes energy to produce energy.
- ☐ Renewable energy sources will provide

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ Can we depend on nonrenewable energy sources for our energy 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?

Acquisition(need to align with above and standards)

Students will know...

ETS1.B: Developing Possible Solutions

- ☐ When evaluating solutions, it is important to take into account a range of constraints, including cost, safety, reliability, and aesthetics, and to consider social, cultural, and environmental impacts. (secondary)

ESS3.A: Natural Resources

Students will be skilled at...

- ☐ *Analyze and evaluating solutions for managing energy resources based on cost-benefit ratios*
- ☐ *Analyze and evaluate personal energy usage and develop a plan to reduce energy use at home*
- ☐ *Carry out an investigation to identify and evaluate different potential*

	☐ All forms of energy production and other resource extraction have associated economic, social, environmental, and geopolitical costs and risks as well as benefits. New technologies and social regulations can change the balance of these factors. **ESS3.C Human Impacts on Earth Systems** ☐ The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources. Other knowledge: ☐ *Current global and local energy consumption and generation* ☐ *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.*	*sources of energy for a particular use and geographic location.*

Envi Science Unit 8 - Capstone Project

STAGE 1 | DESIRED RESULTS

Standards

3.1.9-12.N Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

Transfer

Students will be able to independently use their learning to...

- ☐ View the environment with greater perspective
- ☐ Understand human impact on the environment and the environment's impact on human well-being
- ☐ Relate one change in the environment to further changes
- ☐ Identify opportunities for implementation of sustainable development practices

Meaning

UNDERSTANDINGS

Students will understand that...

- ☐ Small actions can collectively have a large impact.
- ☐ Scientific thinking and engineering design processes can be used to solve real-world problems and challenges.

ESSENTIAL QUESTIONS

Students will keep considering...

- ☐ What can individuals do to have a positive impact on the environment?

Acquisition(need to align with above and standards)

Students will know...

LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- ☐ Anthropogenic changes (induced by human activity) in the environment—including habitat destruction, pollution, introduction of invasive species, overexploitation, and climate change—can disrupt an ecosystem and threaten the survival of some species.

ESS3.C Human Impacts on Earth Systems

- ☐ The sustainability of human societies and the biodiversity that supports them requires responsible management of natural resources.

Students will be skilled at...

- ☐ *Planning and carrying out an investgation to critically examine problems and solutions. This also includes:*
  - ☐ *Pitching ideas for implementation.*
  - ☐ *Planning time and resource utilization*
  - ☐ *Collaborating with peers and community members to attain a goal.*
  - ☐ *Documenting and reflecting on the design process.*
- ☐ *Obtaining, evaluating, and communication their results and findings in a TED style forum.*