Shamokin Secondary
Course Overview

Course: Environmental Science (High School) **Teacher**: Certified Science Teacher

Course Introduction:

Environmental Science (high school) is a course intended to extend the students' knowledge of geosciences, ecology, and agriculture.

The course is a full-year course that is divided into mini-units of study:

- Principles of Ecology.
  - Including the definition of science, matter and energy in the environment, and scientific method as applied to environmental science.
- Humans and the Environment
  - Including population dynamics and species diversity
- Natural Resources
  - Including energy resources, waste management, human interaction with the air/atmosphere; including climate change.
- Aquatic Resources
  - Including aquatic resources and pollution types, Agriculture and Society
- Agriculture
  - Including forestry, animal agriculture and plant agriculture

In addition to learning content, the students will demonstrate knowledge of scientific investigation and/or technological design in the area of Earth & Space Science. This will be accomplished through inquiry-based activities, content review questioning strategies that require students to apply the concepts covered in class.

Course Text or Student Materials:

- *Environmental Science, Pearson, 2010*
- GoFormative Website
- Teacher-created Assessments.

Units of Study:	**Student Objectives:**	**Standards/Anchors:**
Principles of Ecology *Big Idea:* Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	*Essential Question:* How and why do organisms interact with their environment and what are the effects of these interactions? By the end of the unit, students will: ● Explain the difference between science and pseudoscience. ● Explain the difference between biotic factors and abiotic factors. ● Explain how matter and energy influences the environment. ● Research solutions to problems caused by interrupting natural cycles ● Explain that ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. ● Describe how significant changes in conditions or population sizes may affect the functioning of an ecosystem's resources and habitat availability. ● Explain that ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. ● Describe how significant changes in conditions or population sizes may affect the functioning of an ecosystem's resources and habitat availability. ● Evaluate the impact of laws and regulations on reducing the number of threatened and endangered species. ● Explain how a population size and biodiversity remain relatively constant over time due to complex interactions within ecosystems.	4.1.7.A. Describe the relationships between biotic and abiotic components of an ecosystem. 4.5.10.D. Research practices that impact biodiversity in specific ecosystems. 4.1.10.E. Analyze how humans influence the pattern of natural changes (e.g. primary / secondary succession and desertification) in ecosystems over time. 4.1.10.F. See Science as Inquiry in the Introduction for grade level indicators. 4.1.12.A. Analyze the significance of biological diversity in an ecosystem. 4.1.12.B. Research solutions to problems caused by interrupting natural cycles. 4.1.12.C. Research how humans affect energy flow within an ecosystem. 4.1.12.E. Research solutions addressing human impacts on ecosystems over time. 4.5.12.D. Analyze the effects of new and emerging technologies on biodiversity in specific ecosystems.

Units of Study:	**Student Objectives:**	**Standards/Anchors:**
Humans and the Environment *Big Idea:* Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	*Essential Question:* How and why do organisms interact with their environment and what are the effects of these interactions? By the end of the unit, students will be able to: ● Explain that ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. ● Describe how significant changes in conditions or population sizes may affect the functioning of an ecosystem's resources and habitat availability. ● Evaluate the impact of laws and regulations on reducing the number of threatened and endangered species. ● Explain how a population size and biodiversity remain relatively constant over time due to complex interactions within ecosystems. ● Research laws and policies that address the sustainable use of natural resources (e.g., solid and liquid waste management, industry, agriculture and enterprise). ● Analyze the role of technology in the reduction of pollution. ● Research and analyze the local, state, and national laws that deal with point and nonpoint source pollution. ● Compare and contrast the environmental effects of different industrial strategies.	4.1.10.E. Analyze how humans influence the pattern of natural changes (e.g. primary / secondary succession and desertification) in ecosystems over time. 4.1.10.F. See Science as Inquiry in the Introduction for grade level indicators. 4.1.12.E. Research solutions addressing human impacts on ecosystems over time. 4.5.10.A. Explain how public policy encourages or discourages the sustainable use of natural resources. 4.5.12.A. Research how technology influences the sustainable use of natural resources. 4.5.10.C. Analyze real-world data and explain how point and nonpoint source pollution can be detected and eliminated. 4.5.12.C. Analyze the costs and benefits of means to control pollution.

Units of Study:	**Student Objectives:**	**Standards/Anchors:**
Natural Resources *Big Idea:* The natural processes on Earth effect and are affected by human activities.	*Essential Question:* How do Earth's processes and human activities affect each other? By the end of the unit, students will be able to: ● Explain how consumption rate affects the sustainability of resource use. ● Evaluate the advantages and disadvantages of using renewable resources such as solar power, wind power, and biofuels. ● Evaluate the effect of consumer demands on the use of natural resources. ● Analyze how technologies such as modern mining, harvesting, and transportation equipment affect the use of our natural resources. ● Describe how local and state agencies manage natural resources. ● Compare the use of natural resources in different countries. ● Analyze the social, economic, and political factors that affect the distribution of natural resources (e.g., wars, political systems, classism, racism). ● Describe the use of a natural resource with an emphasis on the environmental consequences of extracting, processing, transporting, using, and disposing of it. ● Analyze the impact of technology on the management, distribution, and disposal of natural resources.	4.1.10.E. Analyze how humans influence the pattern of natural changes (e.g. primary / secondary succession and desertification) in ecosystems over time. 4.1.10.F. See Science as Inquiry in the Introduction for grade level indicators. 4.3.10.A. Evaluate factors affecting the use of natural resources. 4.3.10.B. Analyze how humans manage and distribute natural resources. 4.3.12.A. Evaluate the advantages and disadvantages of using renewable and nonrenewable resources. 4.3.12.B. Analyze factors that influence the local, regional, national, and global availability of natural resources.

Units of Study:	**Student Objectives:**	**Standards/Anchors:**
Aquatic Resource *Big Idea:* The Earth is a complex and dynamic set of interconnected systems (e.g. geosphere, hydrosphere, atmosphere, biosphere) that interact over a wide range of temporal and spatial scales. Organisms grow, reproduce, and perpetuate their species by obtaining necessary resources through interdependent relationships with other organisms and the physical environment.	*Essential Question:* How and why is Earth constantly changing? *Essential Question:* How and why do organisms interact with their environment and what are the effects of these interactions? By the end of the unit, students will be able to: ● Describe how topography influences the flow of water in a watershed. ● Describe how vegetation affects water runoff. ● Investigate and analyze the effects of land use on the quality of water in a watershed ● Describe how land use decisions affect wetlands ● Examine various public policies relating to wetlands. ● Investigate the intended and unintended effects of public policies and regulations relating to wetlands. ● Explain how limiting factors affect the growth and reproduction of freshwater organisms. ● Assess the intended and unintended effects of public policies and regulations relating to water quality.	4.1.10.E. Analyze how humans influence the pattern of natural changes (e.g. primary / secondary succession and desertification) in ecosystems over time. 4.1.10.F. See Science as Inquiry in the Introduction for grade level indicators. 4.2.10.A. Examine the interactions between abiotic and biotic factors within a watershed. 4.2.12.A. Examine environmental laws related to land use management and its impact on the water quality and flow within a watershed. 4.2.10.B. Examine how human interactions impact wetlands and their surrounding environments. 4.2.12.B. Analyze the effects of policies and regulations at various governmental levels on wetlands and their surrounding environments. 4.2.10.C. Explain the relationship between water quality and the diversity of life in a freshwater ecosystem. 4.2.12.C. Analyze the effects of policies and regulations at various governmental levels on water quality.

Units of Study:	**Student Objectives:**	**Standards/Anchors:**
Agriculture *Big Idea:* The natural processes on Earth effect and are affected by human activities.	*Essential Question:* How do Earth's processes and human activities affect each other? By the end of the unit, students will be able to: ● Evaluate the use of technologies to increase plant and animal productivity. ● Investigate the factors influencing plant and animal growth. (e.g., soil, water, nutrients, and light) ● Analyze how soil types and geographic regions have impacted agriculture in Pennsylvania. ● Explain how different plants and animals in the United States have specific growing requirements related to climate and soil conditions. ● Explain why animal production is dependent upon plant production. ● Describe how humans rely on the food and fiber system. ● Identify Pennsylvania's important agricultural products. ● Investigate resources, their relation to land use, and their impact on the food and fiber system. ● Identify and describe how food safety issues have impacted the food and fiber system.	4.1.10.E. Analyze how humans influence the pattern of natural changes (e.g. primary / secondary succession and desertification) in ecosystems over time. 4.1.10.F. See Science as Inquiry in the Introduction for grade level indicators. 4.4.10.A. Explain the relationships between and among the components of the food and fiber system. (i.e., production, processing, research and development, marketing, distribution, and regulations.) 4.4.12.A. Research and analyze the social, political, economic, and environmental factors that affect agricultural systems. 4.4.10.B. Analyze the effects of agriculture on a society's economy, environment, standard of living, and foreign trade. 4.4.12.B. Research and evaluate laws and policies that affect the food and fiber system. 4.4.10.C. Analyze how agricultural sciences and technologies strive to increase efficiency while balancing the needs of society with the conservation of our natural resources. 4.4.12.C. Analyze research and development initiatives as they relate to agriculture. 4.4.12.D. Describe how policies, regulations, and laws affect the technologies adopted in agriculture.

Instructional Plan:

A typical class will consist of a bell ringer worksheet or questions that serve as a review of past material or as an introduction to that day's lesson. The instruction part of each class period will be devoted to either teacher centered lecture, student group or independent work, and/or activities. After the instruction part, the class will conclude with a review (exit ticket) of the current lesson. Each lesson will utilize a variety of instructional strategies to bolster education and reach all levels of Bloom's taxonomy. With the help of the Special Education Department all work will be adapted or the class will be differentiate for the IEP students in the class.

The structure for each unit will be similar with an introduction, content lesson, and a review with formative assessment. The units will have several introductory lessons during the first few days creating a foundation for the new concepts; including a vocabulary introduction and guided reading. The next few days will include teacher-centered instruction that will include notes and practice worksheets. Finally the students will demonstrate understanding by completing activities, review exercises, and a unit assessment.

Additional assessment may be given at intervals throughout the unit. These assessment would include quizzes, computer activities, and writing samples, that are developed to improve the PSSA Science test scores. Also, a comprehensive final exam will be administered upon completion of the course.

Student Assistance:

Teachers will be available for additional instruction or tutoring before and/or after school. Students may utilize teacher websites and Google Classroom for accessing resources. In addition, supplemental reinforcement exercises may be assigned at the discretion of the instructor.

Assessments and Evaluation:	**Grading:**	**Homework/Procedures:**
Formal and Informal Assessments: ● CDT testing ● Quizzes ● Unit tests ● Unit notes ● GoFormative assessments ● Projects/Laboratory/computer activities ● Checking for understanding ● Final exam	Numerical percentages will be calculated by using a point system. Progress reports will be issued twice each marking period. Report cards will be issued quarterly.	Homework will be assigned as needed, and will consist of written work that will be graded on completeness. Students will be able to seek help either before or after school if necessary to complete the homework.

Student and Parent Communication:

A course syllabus will be reviewed at the beginning of the course. Teachers will make a minimum of three parent communications each week. Grades will be issued every three weeks via progress reports, and quarterly via report cards.

Student Expectations and Classroom Rules of Conduct

Students will appropriately participate and follow all policies as outlined in the Shamokin Student Handbook, which contains procedures regarding absences, classroom behavior, make-up of work, academic integrity and all other student conduct guidelines.

Addendum
Environmental Science Scope and Sequence

CONTENT	Skill #	SKILLS	STANDARD(s)
Organisms and Their Environments	1.01	Define environment.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.02	Differentiate between the abiotic and biotic factors of an ecosystem.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.03	Compare and contrast the interactions of biotic and abiotic components in an ecosystem.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.04	Analyze the effects of abiotic factors on specific organisms and ecosystems.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.05	Examine and explain how organisms modify their environments to sustain their needs.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.06	List the levels of organization in an ecosystem.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.07	Describe how the availability of resources affects the organisms in an ecosystems.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.08	Describe the different types of niches and explored role of individual species within a community.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.09	List the different types of symbiotic, competition, and predator-prey relationships.	4.3.10.A; 4.6.10.B; 4.3.10.C
	1.10	Describe the first three levels of ecological organization: species, populations, and communities.	4.3.10.A; 4.6.10.B; 4.3.10.C
CONTENT	Skill #	SKILLS	STANDARD(s)
Forestry	2.01	Identify common species of trees.	4.3.10.A
	2.02	Identify properties of trees that are used in identification of specific species.	4.3.10.A

	2.03	Understand the value and uses of timber	4.3.10.A
	2.04	Understand the role of trees/forest to wildlife.	4.3.10.A
	2.05	Explain typical tree growth and life cycle.	4.3.10.A; 3.1.10.A
	2.06	Recognize defects that affect a tree's health, quality and resource potential.	4.3.10.A; 3.1.10.A
	2.07	Explain the cause and effect relationship between environmental factors (light, soil, and moisture), and tree growth.	4.3.10.A; 3.1.10.A
CONTENT	Skill #	SKILLS	STANDARD(s)
Human Population Issues	3.01	Describe the current population situation in the United States and the rest of the world.	4.7.10.B
	3.02	Analyze how the age distribution of a population and the status and role of women in a culture affect population growth projections.	4.7.10.B
	3.03	Compare and contrast the population growth pictures of the developed countries and developing countries of the world.	4.7.10.B
	3.04	Describe the implications of the demographic transition concept.	4.7.10.B
	3.05	Explain ways that a growing human population will affect the ecosystems of the world.	4.7.10.B
	3.06	Explain how developed nations of the world will be under greater pressure to share their abundance with less-developed nations.	4.7.10.B
	3.07	Describe the history of energy consumption of the human population from the beginning of civilization to present day patterns.	4.7.10.B
	3.08	Compare the energy use of developed countries (U.S. and European countries) to the energy use of developing countries.	4.7.10.B
CONTENT	Skill #	SKILLS	STANDARD(s)

Agriculture and Society	4.01	List the physical, chemical, and biological factors involved in soil formation.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.02	Explain the importance of humus to soil fertility.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.03	Explain how soil structure and soil texture influence soil atmosphere and soil water.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.04	Explain the role of living organisms in soil formation and fertility.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.05	Describe the various layers in a soil profile.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.06	Analyze the modern soil and nutrient management practices used by farmers to protect soil from erosion.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.07	Analyze and explain how farm efficiencies have changed human nutrition.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.08	Identify a specific commodity, its origin and its steps in production.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.09	Compare and analyze the cost of a commodity to its production cost.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.10	Identify and describe how food safety issues have impacted production in agriculture.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.11	Describe the historical background of where farming was at before the Green Revolution, back when the European settlers were first moving into the Midwest Plains of the United States.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.12	Understand the importance of soil, plant crops, and the tremendous amount of change that has occurred in farming technology since the 1960s.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.13	Describe the future of farming, specifically in regards to the increased proliferation of Genetically Modified Organisms.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.14	Explain the historical background on the breeding and domestication of cattle, pigs, and poultry from their wild ancestors.	3.5.10.A; 4.4.10.B; 4.1.10.B
	4.15	Understand the basic principles behind how these animals are raised, what they are fed, and any external drugs (hormones or antibiotics) that are administered.	3.5.10.A; 4.4.10.B; 4.1.10.B

	4.16	Comparisons will also be drawn to free-range, cage-free, and other alternative forms of raising animals for food.	3.5.10.A; 4.4.10.B; 4.1.10.B
CONTENT	Skill #	SKILLS	STANDARD(s)
Environmental Toxins and Pollution	5.01	Explore both the living and non-living causes of disease in the environment.	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
	5.02	Compares major diseases caused by parasites, bacteria, and viruses, Examples of emerging diseases, such as swine influenza and SARS are discussed.	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
	5.03	Understand chemical toxins, how they are evaluated, and the different effects on the human body; including risk assessment and how we prioritize health issues.	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
	5.04	Describe how Rachel Carson's Silent Spring change the view of pesticides and started the "environmental movement."	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
	5.05	Using the Donora fluoride fog disaster, and the great London Smog of 1952, Illustrate the dire health and environmental effects of air pollution when it is unregulated.	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
	5.06	Understand the Clean Air Act and its subsequent amendments.	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
	5.07	List specific pollutants, such as sulfur dioxide and carbon monoxide, that are controlled by the Clean Air Act.	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
	5.08	Identify the primary sources of each pollutant and what steps have been taken to reduce the emissions of each (locally and globally).	3.1.10.C; 4.2.10.D; 4.3.10.B; 3.1.10.C; 4.3.10.C
CONTENT	Skill #	SKILLS	STANDARD(s)
Aquatic Ecosystems and Pollution	6.01	Understand the importance of water, its role in climate, and its distribution around Earth and in Pennsylvania	3.5.10.D; 4.4.10.B; 4.1.10.B

	6.02	Classify aquatic ecosystems based on their nutrient availability, salinity, and available sunlight. Both aquatic ecosystems and freshwater ecosystems are included.	3.5.10.D; 4.4.10.B; 4.1.10.B
	6.03	Explain the different methods of fishing, including longline and trawling. They will also examine some of the data behind what happened in Newfoundland, and learn about the increasing use of fish farming, or aquaculture.	3.5.10.D; 4.4.10.B; 4.1.10.B
	6.04	Evaluate some different options on a restaurant's menu and determine which fish are the most ecologically friendly.	3.5.10.D; 4.4.10.B; 4.1.10.B
	6.05	Explore the dangers of fishing to aquatic habitat.	3.5.10.D; 4.4.10.B; 4.1.10.B
	6.06	Learn about the different reservoirs of water, how they relate to the water cycle, and how we access them.	3.5.10.D; 4.4.10.B; 4.1.10.B
	6.07	Distinguish between point and nonpoint sources of all the major types of pollution that will cause impaired waters.	3.5.10.D; 4.4.10.B; 4.1.10.B
	6.08	List examples of different types of pollutants, ranging from inorganic salts and acids to organics such as sewage.	3.5.10.D; 4.4.10.B; 4.1.10.B
	6.09	Understand oil pollution in the ocean, with the Exxon Valdez and Deepwater Horizon spills serving as examples of what can go wrong	3.5.10.D; 4.4.10.B; 4.1.10.B
CONTENT	Skill #	SKILLS	STANDARD(s)
Fossil Fuels and Energy	7.01	Understand the origins and applications of each of the three fossil fuels, including coal, crude oil, and natural gas.	4.2.10.C; 4.4.10.C, 3.8.10.C
	7.02	Describe surface and subsurface coal mining, oil drilling and spills, and the debate over hydraulic fracturing.	4.2.10.C; 4.4.10.C, 3.8.10.C
	7.03	Discuss challenges faced by our society as we try to harness renewable forms of energy.	4.2.10.C; 4.4.10.C, 3.8.10.C
	7.04	List the three main energy needs we have: electricity, heat, and fuel for transportation.	4.2.10.C; 4.4.10.C, 3.8.10.C

	7.05	Potential applications for each energy source, including solar, wind, and biomass, are given. List and describe the challenges in using each resource.	4.2.10.C; 4.4.10.C, 3.8.10.C
	7.06	Determine the importance of energy conservation and energy efficiency.	4.2.10.C; 4.4.10.C, 3.8.10.C
	7.07	Compare nuclear reactor to fossil fuel power plant.	4.2.10.C; 4.4.10.C, 3.8.10.C
	7.08	Describe how uranium is much more energy-dense than fossil fuels and the fission reaction produces very little air pollution.	4.2.10.C; 4.4.10.C, 3.8.10.C
	7.09	Describe how nuclear accidents are among the most damaging singular events that have ever occurred.	4.2.10.C; 4.4.10.C, 3.8.10.C
CONTENT	Skill #	SKILLS	STANDARD(s)
Climate Change	8.01	Describe the greenhouse effect and basic background on the specific gases in the atmosphere that create it.	3.5.10.C
	8.02	Understand how temperature and carbon dioxide are related to global warming.	3.5.10.C
	8.03	Describe how global warming is related to changes in the hydrologic cycle such as increased hurricane strength, droughts, heavy precipitation events, the great ocean conveyor, and El Nino.	3.5.10.C
		Describe how humans can take action to deal with issues that create climate change.	3.5.10.C