

# Saint Patrick High School

## Curriculum Guide: Environmental Science

<b>Department:</b>	Science	<b>Grade and Level:</b>	9th-10th grade
<b>Class:</b>	Environmental Science	<b>Term (Semester or Year):</b>	Semester

<b>Required Text:</b>	• Pearson: Environmental Science by Jay Withgott
<b>Additional Resources (i.e. texts, materials, apps, etc.):</b>	iPad Apps Showbie GoodReader Pages iMovie iBooks iTunes U Keynote BookPress Educreations Nearpod

### Course Description

Environmental Science combines both Earth and Life Science concepts to teach students methodologies and principles that help them understand the interrelationships of the natural world and to identify natural and human-made environmental challenges. Students will seek to examine the risks associated with these environmental challenges and devise solutions for resolving or preventing them. Environmental science will be inquiry driven and interdisciplinary, investigating topics such as: global water resources, energy flow, ecosystem diversity, human energy use, and human impact on the broader environment.

### Academic Standards Addressed:

**NGSS:**

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.

HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.

HS-LS2-6. 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.

HS-LS2-7. Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-8. Evaluate the evidence for the role of group behavior on individual and species' chances to survive and reproduce.

HS-LS4-6. Create or revise a simulation to test a solution to mitigate adverse impacts of human activity on biodiversity.

HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.

HS-ESS3-5. 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's systems.

HS-ESS3-1. 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-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.

HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.

HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.

HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

## **Unit Themes (Table of Contents)**

<b>Theme 1:</b>	<b>Earth Systems and Resources</b>
-----------------	------------------------------------

<b>Theme 2:</b>	<b>The Living World</b>
<b>Theme 3:</b>	<b>Populations</b>
<b>Theme 4:</b>	<b>Land and Water Use</b>
<b>Theme 5:</b>	<b>Energy Resources and Consumption</b>
<b>Theme 6:</b>	<b>Pollution and Human Impact</b>
<b>Theme 7</b>	<b>Climate</b>

## **Agreed Upon Assessments**

Forms of assessments may include but are not limited to....

- Objective tests
- Projects
- Essays
- Lectures/Discussions
- Group Projects
- Presentations
- Research Papers/Projects
- Homework Assignments
- Primary Source Document Analysis
- Supplemental Readings

## **Research and Writing Expectations**

Students have 4 quarter projects that require them to do scientific research on various topics. Projects are inquiry based and students must reflect their findings through scientific writing or presentations. Each project has specific research guidelines and directions to use.

<b>Unit 1:</b>	<b>Earth Systems and Resources</b>	<b>Duration:</b>	15 days
----------------	------------------------------------	------------------	---------

### **Specific Unit Standards:**

- HS-ESS2-2. Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems.
- HS-ESS2-3. Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
- HS-ESS2-5. Plan and conduct an investigation of the properties of water and its effects on Earth materials and surface processes.
- HS-ESS2-6. Develop a quantitative model to describe the cycling of carbon among the hydrosphere, atmosphere, geosphere, and biosphere.

### **Essential Questions:**

- How do the abiotic geologic cycles of the earth impact earth's living systems? Can we even distinguish between them?

### **Affirmation Statements/Objectives**

Students will be able to...:

- Describe the influence of matter and energy cycles on weather, climate, and the environment.
- Explain how matter cycles between living systems and the physical environment.
- Describe how human activities such as agriculture and industry impact the biogeochemical cycles of matter

### **Common Assessments:**

- Unit Exam
- Unit Project

<b>Unit 2:</b>	<b>The living world</b>	<b>Duration:</b>	15 days
----------------	-------------------------	------------------	---------

### **Specific Unit Standards:**

- HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
- HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
- HS-LS2-6. 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.

### **Essential Questions:**

- What is the essential action taking place when an organism on one trophic level consumes another?
- What is the fundamental relationship between consumers and producers

### **Affirmation Statements/Objectives:**

Students will be able to...:

- Distinguish between the biotic and abiotic factors in an ecosystem.
- Examine how interactions between a species and its environment define the species' niche.
- Describe the difference between a species, a population, a community and an ecosystem.
- Explain how organisms have adapted to their environments using examples from the diversity of living things.
- Trace the flow of energy in a food chain.
- Recognize the relationship between diversity and stability in ecosystems.
- Identify the different trophic levels in a food pyramid.
- Define the term "biomass" and its relationship to a food pyramid.
- Describe the major types of interactions between species (e.g., competition, predation, symbiotic relationships).
- Compare the process of ecological succession in terrestrial and aquatic biomes.
- Explain how and why some biomes have been intensely exploited.

### **Common Assessments:**

- Unit Exam
- Unit Project

<b>Unit 3:</b>	Populations	<b>Duration:</b>	15 days
----------------	-------------	------------------	---------

### Specific Unit Standards:

- HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
- HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales.
- HS-LS2-6. 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.
- HS-LS2-8. Evaluate evidence for the role of group behavior on individual and species' chances to survive and reproduce.

### Essential Questions:

- How does an environment impact population growth and vice versa?

### Affirmation Statements/Objectives:

Students will be able to...:

- Describe the factors that limit the growth of a population.
- Diagram the three phases of an exponential growth curve and indicate carrying capacity.
- Define demography.
- Describe the factors that affect the growth of the human population.
- Construct age pyramids for an underdeveloped and developed country and analyze population trends.
- Describe problems resulting from rapid human population growth.
- Analyze strategies countries may use to reduce population growth

### Common Assessments:

- Unit Exam
- Unit Project

<b>Unit 4:</b>	Land and Water Use	<b>Duration:</b>	15 days
----------------	--------------------	------------------	---------

## Specific Unit Standards:

- HS-ESS3-1. 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-ESS3-3. Create a computational simulation to illustrate the relationships among the management of natural resources, the sustainability of human populations, and biodiversity.

## Essential Questions:

- How does human activity impact earth's ground and surface water?
- What steps can be taken to lower these human impacts?

## Affirmation Statements/Objectives:

Students will be able to...:

- Identify how land is used and how land use affects ecosystems.
- Summarize the positive and negative effects of urban planning.
- Explain the negative effects of agriculture on the land and the benefits of sustainable agriculture.
- Describe the characteristics of soil composition.
- Identify underlying reasons for solid waste pollution.
- Compare and contrast biodegradable and nonbiodegradable wastes and their significance in landfills.
- Identify and explain methods for reducing the volume of waste.
- Trace the water cycle from land (include groundwater) to sea, to atmosphere, etc.
- Identify how water is used in society and how water use affects ecosystems.
- List the major water pollutants and their sources and relate them to human and environmental health.
- Describe environmental conditions and human activities that cause groundwater pollution.
- Relate the importance of wetlands to the health of aquatic ecosystems, especially estuaries.

## Common Assessments:

- Unit Exam
- Unit Project

<b>Unit 5:</b>	Energy Resources	<b>Duration:</b>	15 days
----------------	------------------	------------------	---------

## Specific Unit Standards:

- HS-ESS3-1. 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-ESS3-2. Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.\*

**Essential Questions:**

- How does our use of energy resources impact earth’s environment? What are some ways to mitigate this impact?
- How do our traditional sources of energy production compare with newer technologies?

**Affirmation Statements/Objectives:**

Students will be able to...:

- Identify and describe the different types of nonrenewable resources.
- Describe the most common methods of mining and their environmental consequences.
- Describe the nuclear fission process.
- List the advantages and disadvantages of the nuclear fission process including safety concerns and radioactive waste disposal.
- Compare and contrast the advantages and disadvantages of nonrenewable and renewable resources.
- List the major types of renewable resources and compare their advantages and disadvantages (solar, wind, water, geothermal, biomass, tidal power, etc.)
- Summarize the recent advances in alternative fuel research.

**Common Assessments:**

- Unit Exam
- Unit Project

<b>Unit 6:</b>	Pollution and Human Impact	<b>Duration:</b>	15 days
----------------	----------------------------	------------------	---------

**Specific Unit Standards:**

- HS-ESS3-1. 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-ESS3-4. Evaluate or refine a technological solution that reduces impacts of human activities on natural systems.

- HS-ESS3-6. Use a computational representation to illustrate the relationships among Earth systems and how those relationships are being modified due to human activity.

### Essential Questions:

- What do we classify pollution as?
- How does human activity contribute to pollution? How can we reduce the level of pollution we produce without reducing economic growth?

### Affirmation Statements:

Students will be able to...:

- Explain habitat destruction and the loss of biodiversity, and how they are related to the endangerment of species.
- Distinguish between the natural rate of extinction and the accelerated rate due to human impact.
- Identify methods of decreasing the impacts of humans on the rate of extinction.
- Explain the causes of deforestation and its effects on biodiversity.
- Research the history of environmental legislation in the U.S.
- Interpret state, federal, and international environmental laws (Clean Air Act, Clean Water Act, Endangered Species Act, Kyoto Protocol, etc.)
- Recognize impacts of individual choices on the environment.
- Define principles of sustainable development and how its implementation can maintain the environment.

### Common Assessments:

- Unit Exam
- Unit Project

<b>Unit 7:</b>	<b>Climate</b>	<b>Duration:</b>	15 days
----------------	----------------	------------------	---------

### Specific Unit Standards:

- HS-ESS2-4. Use a model to describe how variations in the flow of energy into and out of Earth's systems result in changes in climate.
- HS-ESS3-5. 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's systems.

## **Essential Questions:**

- What are the major factors impacting earth's climate?
- How does human activity impact earth's climate? What are some ways to reduce this impact?

## **Affirmation Statements:**

Students will be able to...:

- Students will be able to explain the elements of climate and analyze what impacts earth's climate.
- Students will be able to identify various sources of evidence used to chart climate and apply the evidence to determine the proximate and ultimate causes of changes.
- Students will be able to analyze the impact of climate change on environmental, biological and social systems.
- Students will be able to compare climate change mitigation and adaptations strategies (macro and micro) in light of environmental, economic, political, and ethical impact.
- Students will use data and evidence to justify claims relating to climate, climate change, and mitigation.

## **Common Assessments:**

- Unit Exam
- Unit Project