



VALWOOD

GO BEYOND

Environmental Science Curriculum

Environmental Science Overview

Course Description	Topics at a Glance
<p>Environmental Science is a course intended to build understanding of scientific processes and concepts and prepare high school students to seek solutions to problems that they will likely face in their lifetime. ES is designed to build interest in sciences for students who are not attracted to the typical scientific disciplines of Physics, Biology, and Chemistry and allow students the opportunity to connect what they are learning to real-world issues and problems.</p>	<ul style="list-style-type: none"> ● Environmental Issues and the human population ● Earth's natural resources ● Ecosystem structure and diversity ● Population dynamics in ecosystems ● Land and water use ● Energy resources and consumption ● Pollution types ● Impacts of the environment on human health ● Global climate change ● Sustaining biodiversity
Assessments	
<ul style="list-style-type: none"> ● Teacher made Assessments ● Assessments adopted from course materials 	
Standard	Big Ideas in Environmental Science
<p>2. Life Science</p>	<ol style="list-style-type: none"> 1. Explain and illustrate with examples how living systems interact with the biotic and abiotic environment 2. Investigate the flow of energy and cycling of matter within an ecosystem 3. Describe stability and change in ecosystems. 4. Understand availability, allocation, and conservation of energy and other resources. 5. Evaluate effects of human activities and technology on ecosystems.

1. Environmental Science

Students know and understand how living things interact with each other and their environment, the processes and interactions of Earth's systems, and helps students appreciate the dynamic relationships and complexity of the world. Students understand how society manages its scarce resources, how people make decisions.

Valwood Graduate Competencies

The Valwood graduate competencies are the preschool through twelfth-grade concepts and skills that all graduates will be able to demonstrate.

Valwood Graduate Competencies in the Environmental Science standard:

- Explain and illustrate with examples how living systems interact with the biotic and abiotic environment
- Describe stability and change in ecosystems
- Understand availability, allocation, and conservation of energy and other resources
- Evaluate effects of human activities and technology on ecosystems

Content Area: Science - Environmental Science	
Standard: 1. Environmental Science	
Valwood Graduates: Describe stability and change in ecosystems	
GRADE LEVEL EXPECTATION	
Concepts and skills students master: 1. Matter and energy conversions underlie all ecological processes.	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students can: <ol style="list-style-type: none"> a. Analyze how energy flows through trophic levels b. Analyze and interpret data from experiments on ecosystems c. Develop, communicate, and justify an evidence-based scientific explanation showing how ecosystems follow the laws of conservation of matter and energy d. Define and distinguish between matter and energy, and how they are cycled or converted through life processes e. Describe how carbon, nitrogen, phosphorus, and water cycles work f. Analyze how energy flows through trophic levels h. Describe how human activity has affected the biogeochemical cycles and propose possible solutions to those changes which have had negative impacts 	Inquiry Questions: <ol style="list-style-type: none"> 1. How does a change in abiotic factors influence the stability or progression of an ecosystem? 2. What happens when the cycling of matter in ecosystems is disrupted? 3. What energy transformations occur in ecosystems? 4. How does a specific change within an ecosystem impact the ecosystem as a whole?
	Relevance and Application: <ol style="list-style-type: none"> 1. When the matter or energy flow in an ecosystem is disturbed, there are measurable effects such as the eutrophication of water. 2. Matter and energy are cycled in natural systems such as wetlands in both similar and different ways than in human-managed systems such as waste water treatment plants.
	Nature of Discipline: <ol style="list-style-type: none"> 1. Address differences between experiments where variables can be controlled and those where extensive observations on a highly variable natural system are necessary to determine what is happening 2. Share experimental data, and respectfully discuss conflicting results emulating the practice of scientists.

Content Area: Science - Environmental Science

Standard: 1. Environmental Science

Valwood Graduates:

Explain and illustrate with examples how living systems interact with the biotic and abiotic environment

GRADE LEVEL EXPECTATION

Concepts and skills students master:

2. The size and persistence of populations depend on their interactions with each other and on the abiotic factors in an ecosystem

Evidence Outcomes

Students can:

- Evaluate data and assumptions regarding different scenarios for future human population growth and their projected consequences
- Discuss the environmental impacts of human population growth
- Understand exponential and logistic growth rates and be able to mathematically determine rate of growth in a population

21st Century Skills and Readiness Competencies

Inquiry Questions:

- To what degree is disturbance a “natural” component of ecosystem level processes?
- How does the growth rate within a population change over time?

Relevance and Application:

- Earth’s carrying capacity is limited.
- Exponential human population growth has directly impacted the biosphere.
- Exploration of possible alternative resources is vital.
- Using resources in a sustainable manner allows for continued use of the resource.
- The extraction of resources by humans impacts ecosystems.

Nature of Discipline:

- Critically evaluate scientific explanations in popular media to determine if the research methodology and evidence presented are appropriate and sufficient to support the claims.

Content Area: Science - Environmental Science

Standard: 1. Environmental Science

Valwood Graduates:

Explain and illustrate with examples how living systems interact with the biotic and abiotic environment

GRADE LEVEL EXPECTATION

Concepts and skills students master:

3. The structure of ecosystems depend on interactions of biotic factors and abiotic factors in an ecosystem

Evidence Outcomes	21st Century Skills and Readiness Competencies
<p>Students can:</p> <ol style="list-style-type: none">Analyze and interpret data about the impact of removing keystone species from an ecosystem or introducing non-native species into an ecosystemDescribe or evaluate communities in terms of primary and secondary succession as they progress over timeExamine, evaluate, question, and ethically use information from a variety of sources and media to investigate ecosystem interactionsExamine how interactions between a species and its environment define the species' niche.Explain how organisms have adapted to their environments using examples from the diversity of living things.	<p>Inquiry Questions:</p> <ol style="list-style-type: none">1. How do keystone species maintain balance in ecosystems?2. How does the introduction of a non-native species influence the balance of an ecosystem?3. How is the succession of local organisms altered in an area that is disturbed or destroyed?4. What are the interspecific relationships within a community?5. How does modern agriculture affect biodiversity?
	<p>Relevance and Application:</p> <ol style="list-style-type: none">1. Using resources in a sustainable manner allows for continued use of the resource.2. The extraction of resources by humans impacts ecosystems.3. Globalization and human error can dramatically impact ecosystems by transporting living things.
	<p>Nature of Discipline:</p> <ol style="list-style-type: none">1. Critically evaluate scientific explanations in popular media to determine if the research methodology and evidence presented are appropriate and sufficient to support the claims.

Content Area: Science - Environmental Science

Standard: 1. Environmental Science

Valwood Graduates:

Describe stability and change in ecosystems

GRADE LEVEL EXPECTATION:

Concepts and skills students master:

4. Natural systems change over time and space and environmental systems vary in ability to recover from disturbances.

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation that shows climate is a result of energy transfer among the atmosphere, hydrosphere, geosphere and biosphere
- b. Explain the effect of human influences on the atmosphere
- c. Analyze and interpret data on Earth's atmosphere
- d. Identify mechanisms in the past and present that have changed Earth's climate
- e. Analyze the effect of human influences on water supply
- f. Analyze how water is used in society and how water use affects ecosystems.
- g. Explain the effect of human influences on land.
- h. Analyze how land is used and how land use affects ecosystems.

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How can changes in the ocean create climate change?
2. How have climates changed over Earth's history?
3. How does climate change impact all of Earth's systems?
4. How have climate changes impacted human society?

Relevance and Application:

1. Much of the data we receive about the ocean and the atmosphere are from satellites.
2. Human actions such as burning fossil fuels might impact Earth's climate.
3. Technological solutions and personal choices such as driving higher mileage cars and using less electricity could reduce the human impact on climate.

Nature of Discipline:

1. Examine how models are used in predicting the impacts of climate change.
2. Critically evaluate scientific claims in popular media and by peers regarding climate and climate change, and determine if the evidence presented is appropriate and sufficient to support the claims.

Content Area: Science - Environmental Science

Standard: 1. Environmental Science

Valwood Graduates:

Understand availability, allocation, and conservation of energy and other resources

GRADE LEVEL EXPECTATION:

Concepts and skills students master:

4. Management of common resources whether renewable or nonrenewable is essential for sustainability.

Evidence Outcomes

Students can:

- a. Develop, communicate, and justify an evidence-based scientific explanation regarding the costs and benefits of exploration, development, and consumption of renewable and nonrenewable resources
- b. Evaluate positive and negative impacts on the geosphere, atmosphere, hydrosphere, and biosphere in regards to resource use
- c. Create a plan to reduce environmental impacts due to resource consumption
- d. Analyze and interpret data about the effect of resource consumption and development on resource reserves to draw conclusions about sustainable use
- e. Evaluate the relative merit of alternative energy options as a means of finding sustainable non-polluting energy

21st Century Skills and Readiness Competencies

Inquiry Questions:

1. How do humans use resources?
2. How can humans reduce the impact of resource use?
3. How are resources used in our community?
4. What are the advantages and disadvantages of using different types of energy?

Relevance and Application:

1. Technologies have had a variety of impacts on how resources are located, extracted, and consumed.
2. Technology development has reduced the pollution, waste, and ecosystem degradation caused by extraction and use.

Nature of Discipline:

1. Infer assumptions behind emotional, political, and data-driven conclusions about renewable and nonrenewable resource use.
2. Critically evaluate scientific claims in popular media and by peers, and determine if evidence presented is appropriate and sufficient to support the claims.

Content Area: Science – Environmental Science	
Standard: 1. Environmental Science	
Valwood Graduates: Evaluate effects of human activities and technology on ecosystems	
Grade Level Expectation: Concepts and skills students master: 5. Humans alter natural systems and technology has enabled humans to increase both the rate and scale of their impact on the environment	
Evidence Outcomes	21st Century Skills and Readiness Competencies
Students Can: <ol style="list-style-type: none"> a. Identify how land is used and how land use affects ecosystems. b. Summarize the positive and negative effects of urban planning. c. Explain the negative effects of agriculture on the land and the benefits of sustainable agriculture. Explain how altering the environment has brought prosperity to some places and created environmental dilemmas for others d. Research and interpret multiple viewpoints on issues that shaped the current policies and programs for resource use e. Define sustainability and explain how an individual's actions may influence sustainability f. Evaluates how location, carrying capacity, physiological density, rural to urban migration, urban planning, and different types of economic activity influence urban growth. 	Inquiry Questions: <ol style="list-style-type: none"> 1. What will happen if farm land degrades around the world? 2. What might happen if we thought locally and acted globally? 3. What are the maximum limits of human activity the environment can withstand without deterioration?
	Relevance and Application: <ol style="list-style-type: none"> 1. Individual actions affect the local environment and global community such as the impact of recycling and consumption of resources. 2. Technology can support invention and influence how humans modify the environment in both positive and negative ways such as renovation of existing buildings to "green" technologies 3. Current changes in urban growth and population should be used to make plans for future enhancements to an urban landscape.
	Nature of Discipline: <ol style="list-style-type: none"> 1. Study how the physical environment is modified by human activities, including how human societies value and use natural resources. 2. Evaluate major areas of environmental and societal interaction.