

Academic Standards for Environment and Ecology

January 2011
Grades 3-8, 10,12



Pennsylvania Department of Education
Patricia L. Vathis, Environment and Ecology Curriculum Advisor

GRADES 5-8, 10, 12
Environment and Ecology
X. TABLE OF CONTENTS

Introduction / Rationale.....	XI.
<u>THE ACADEMIC STANDARDS</u>	
Watersheds.....	4.1.
A. Water Systems	
B. Water Movement	
C. Influence of Humans on a Watershed	
D. Environment as a Real Life Connection	
Sustainable Systems and Practice.....	4.2.
A. Use of Natural Resources	
B. Availability of Renewable and Non-Renewable Resources	
C. Resource Influence on Community Development	
D. Sustainability	
E. Environment as a Real Life Connection	
Ecosystems and Their Interactions.....	4.3.
A. Biotic and Abiotic Interactions in a System	
B. Aquatic, Terrestrial and Human-made Ecosystems	
C. Biodiversity	
D. Environment as a Real Life Connection	
Agriculture and Society	4.4.
A. Importance of Agriculture	
B. Food and Fiber System	
C. Integrated Pest Management	
D. Agricultural Technologies	
E. Applying Both the Social and Natural Sciences	
F. Environment as a Real Life Connection	
Humans and the Environment	4.5.
A. Human Impacts and the Environment	
B. Environmental Health	
C. Laws and Regulations	
D. Use of Integrated Pest Management	
E. Waste Management	
F. Environment as a Real Life Connection	
Glossary.....	XII.

GRADES 5-8, 10, 12

Environment and Ecology

XI. INTRODUCTION

This document includes Environment and Ecology standards that describe what students should know and be able to do in these areas:

- ◊ 4.1. Watersheds
- ◊ 4.2. Sustainable Systems and Practice
- ◊ 4.3. Ecosystems and Their Interactions
- ◊ 4.4. Agriculture and Society
- ◊ 4.5. Humans and the Environment

The Declaration of Rights, Article I of the Pennsylvania Constitution states in Section 27: "The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and aesthetic values of the environment. Pennsylvania's public natural resources are the common property of all people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people." To this end it is our responsibility to develop a citizenry that is aware of and concerned about the total environment and has the knowledge and skills to work toward solutions to current problems and the prevention of new ones.

Environment and Ecology is grounded in the complexity of the world we live in and its sustainability. It examines the world's natural processes and social systems. Environment and Ecology places its main emphasis in the real world. Allowing students to understand, through a sound academic content base, how their everyday lives evolve around their use of the natural world, the resources it provides and the laws that influence it.

These standards establish the essential elements of what students should know and be able to do as they move from third to twelfth grade. The sequential nature of this document reflects the need for rigorous academic content that students will be expected to achieve. The document reinforces all areas across the grade levels with increasing degrees of difficulty as the students mature intellectually.

The study of Environment and Ecology will allow students to be active participants and problem solvers in real issues that affect them, their homes, schools and communities. The very interdisciplinary nature of this field allows teachers and students to use science, technology and social systems as the vehicles to a better tomorrow through the Environment and Ecology Standards.

A glossary is included to assist the reader in understanding terminology contained in the standards.

The Science and Technology and Engineering Education Standards will highlight science as inquiry through the categories of biological, physical chemical, earth and space and technology and engineering. Where appropriate the standard categories may be aligned when developing curriculum. The Environment and Ecology Standards also align with the Social Studies Standards and should again be looked at for curriculum work.

GRADES 8, 10, 12

Environment and Ecology

Environment and Ecology as a Real Life Connection: Understanding the environment and ecology content is enhanced when concepts are grounded in a solid knowledge-based, real-life connections, and meaningful field experiences. The use of this three level approach will help ensure that students develop a deep understanding of environmental content as it relates to the environmental, scientific and social systems. In each of the five major standard categories of environment and ecology, a systems approach has been taken along with opportunities for hands-on, place-based learning to occur. The Environment and Ecology Standards provides teachers with the opportunity to help all students in grades K-12 develop an awareness to action mind set as they move into more challenging content and strategies for maintaining a sustainable environment. These standards will help students use their local community to build toward an in-depth connection to local, state, national and global issues.

Grades K-4	Grades 5-7	Grades 8-10	Grades 11-12
- Identify and explain the pros and cons of applying environmental knowledge to possible solutions to problems. - Ask questions about organisms, the systems they live in and human impacts on these systems. - Understand that all investigations involve asking and answering questions and comparing the answers with what is already known. - Use of the local environment to understand the interactions that take place between biotic and abiotic things. - Use models as useful tools to illustrate concepts and to understand their interdependence. - Understand that change over time occurs in all systems and that these changes affect the environment and its inhabitants. - Apply higher-level thinking and creative problem solving to explore the interface between natural and social systems that comprise their local community. - Use meaningful outdoor experiences to reach for real world solutions to local environmental issues.	- Explain, interpret and apply environmental, social/political, economical or technological knowledge to make and interpret observations and to address solutions to practical problems. - Identify environmental concerns and look for possible solutions based on available resources. - Design and conduct an environmental investigation and understand that the natural and social systems have both a positive and negative impact on sustainability. - Use appropriate tools and technologies to gather, analyze, and interpret data and understand that it enhances accuracy and allows for analytical and quantify results of investigations of terrestrial, aquatic and man-made systems. - Develop descriptions, explanations, and models using evidence and understand that this emphasized evidence, has logically consistent arguments and are based on scientific, environmental and technological principles, models, and theories. - Analyze alternative methods and understand that technological advances allow for greener solutions. - Use meaningful outdoor experiences to enhance the understanding of real world issues. - Understand that sufficient knowledge of ecology will permit the learner to make ecologically sound decisions with respect to humans and the environment.	- Address environmental issues and apply the skill and knowledge necessary to aid in a full understanding of many viewpoints and in making an educated decision. - Identify and investigate environmental issues by sorting out the consequences of the issue, identifying and evaluating alternative solutions and courses of action and working with flexibility, creativity, and openness. - Use decision-making and citizenship skills to form and evaluate personal views, evaluate the need for citizen action, plan and take action and evaluate the results of the action. - Use models, systems and scale to understand the ecological concepts. - Understand that scientists study the natural world and universe using both direct and indirect observations. - Use meaningful outdoor experiences to reach for real world solutions to local, state and national environmental issues.	- Examine the complexity of environmental issues and need for technology driven solutions to ever growing human demands. - Evaluate the current use of renewable and nonrenewable resources and our ability to move toward a sustainable world. - Judge that conclusions are consistent and logical with experimental conditions. - Interpret results of experimental research to predict new information, propose additional investigable questions, or advance a solution. - Use meaningful outdoor experiences to reach for real world solutions to local, state, national and global environmental issues. - Use current research and data to provide the opportunities for solutions to environmental issues and concerns.

GRADES 5-8, 10, 12 Environment and Ecology

Civic and Societal Responsibilities towards the Environment – Many decisions that directly or indirectly affect the balance of our environment are predicated on individual, community, state, national and international decisions. Civic responsibilities go beyond political issues because they have far reaching impacts on the quality of our very existence. Laws and regulations are only as powerful as the actions of each person in enforcing them. The Environment and Ecology Standards bring together the natural and social responsibilities of a nation to make our world sustainable. The standard statement “Humans and the Environment” (4.5.C) will address the area of civic and societal responsibilities towards the environment.

Grades K-4		Grades 5-7		Grades 8-10		Grades 11-12	
- Laws that affect an individual's responsibility at home and in the community. - Laws that affect an individual and the community at the state level.		- The why behind environmental laws and regulations and the role played by state and federal agencies. - The environment laws and who they affect.		The passing and enforcement of environmental laws, rules and regulations and its impacts on individuals and the environment.		Analysis of environmental laws, rules and regulations and their relationship to the environmental sustainability.	

		Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 10	Grade 12
Content Area		4.1.3.D.	4.1.4.D.	4.1.5.D.	4.1.6.D.	4.1.7.D.	4.1.8.D.	4.1.10.D.	4.1.12.D.
		4.2.3.E.	4.2.4.E.	4.2.5.E.	4.2.6.E.	4.2.7.E.	4.2.8.E.	4.2.10.E.	4.2.12.E.
		4.3.3.D.	4.3.4.D.	4.3.5.D.	4.3.6.D.	4.3.7.D.	4.3.8.D.	4.3.10.D.	4.3.12.D.
		4.4.3.F.	4.4.4.F.	4.4.5.F.	4.4.6.F.	4.4.7.F.	4.4.8.F.	4.4.10.F.	4.4.12.F.
		4.5.3.F.	4.5.4.F.	4.5.5.F.	4.5.6.F.	4.5.7.F.	4.5.8.F.	4.5.10.F.	4.5.12.F.

GRADES 5-8, 10, 12 Environment and Ecology

4.1. Watersheds							
4.1.3. GRADE 3	4.1.4. GRADE 4	4.1.5. GRADE 5	4.1.6. GRADE 6	4.1.7. GRADE 7	4.1.8. GRADE 8	4.1.10 GRADE 10	4.1.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							
4.1.3.A Describe and compare different water systems and their components. -lentic and lotic Describe the components of a watershed and its role in everyday life.	4.1.4.A Identify the five major watersheds in Pennsylvania and what determines the boundaries. Identify the biotic and abiotic characteristics of a watershed and their impact on water quality.	4.1.5.A Identify a local watershed and its contributing water sources. Explain the biotic and abiotic differences between lotic and lentic systems.	4.1.6.A Identify how water systems impacted the history on a national and global level. -movement of people -resource availability	4.1.7.A Explain the physical and chemical characteristics of aquatic systems and how they influence the organisms that live there (size, shape and physical adaptations). Compare and contrast the physical differences that occur from headwaters to its major river system.	4.1.8.A Explain stream order and compare and contrast streams of different orders in a watershed; and examine the interactions between abiotic and biotic factors.	4.1.10.A Apply appropriate techniques in the analysis of a watershed using the factors of water quality, biological diversity, erosion and sedimentation. Investigate and analyze the effects of land use on the quality of water in a watershed.	4.1.12.A. Identify and describe the major watersheds in the United States and explain the relationships that exist within each one.
Water Systems							

GRADES 3-8, 10, 12 Environment and Ecology

4.1. Watersheds						
4.1.3. GRADE 3	4.1.4. GRADE 4	4.1.5. GRADE 5	4.1.6. GRADE 6	4.1.7. GRADE 7	4.1.8. GRADE 8	4.1.10 GRADE 10 4.1.12. GRADE 12
Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:						
1. Water Movement	4.1.3.B Explain the path water takes through its various phases. -solid -liquid -gas Identify and explain how water is both a nonrenewable and renewable resource.	4.1.4.B Explain condensation, evaporation, and precipitation, and transpiration. Explain how water flows through a watershed.	4.1.5.B Explain the hydrologic cycle Explain the role energy plays in the rate of motion of water molecules.	4.1.6.B Describe how the biotic, abiotic and human-made components can influence the land and water within the watershed.	4.1.7.B Explain how landforms and vegetation influence the movement of water through lotic and lentic systems. Analyze how man-made or naturally occurring events (such as erosion, floods, and drought) impact other social or natural systems.	Intentionally Blank
					4.1.10.B Analyze how both the quality and quantity of water within a watershed influences human and natural systems. -watershed boundaries -political boundaries Evaluate the interaction between natural events and human-made constructs as it relates to effects on water quality, quantity, and human survival.	4.1.12.B Analyze the physical and chemical characteristics of a lentic/lotic system from headwater to mouth using the river continuum concept.

GRADES 3-8, 10, 12 Environment and Ecology

4.1. Watersheds

4.1.3. GRADE 3	4.1.4. GRADE 4	4.1.5. GRADE 5	4.1.6. GRADE 6	4.1.7. GRADE 7	4.1.8. GRADE 8	4.1.10 GRADE 10	4.1.1. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							

2. Influence of Humans on a Watershed							
4.1.3.C Explain the role of watersheds in everyday life Identify pollutants found in water and their effects on human health. Identify pest control methods that could affect watersheds. Recognize how litter can impact a watershed.	4.1.4.C Describe how human activities can positively or negatively affect water environments. Recognize environmental laws and regulations at the state level to protect water and watersheds.	Intentionally Blank	4.1.6.C Explain the difference between point and non-point source pollution. Identify residential and industrial sources of water pollution and their effects on environmental health. Explain the purpose of environmental laws and regulations and the role of local, state and federal agencies in protection of water and watersheds (Fish and Boat Commission, Department of Environmental Protection, Conservation Districts, EPA)	4.1.7.C Analyze how human actions can influence the watershed. Describe the impact of point and non-point source pollution on water quality (pest management practices, Chesapeake Bay, etc.)	4.1.8.C Investigate and analyze the effects of land use and contaminants on the quantity and quality of water within a watershed. Identify possible effects of water pollution on human health and the economy by investigating pesticides, household chemicals Rx, or medical waste. Evaluate methods used to reduce the impact of human activities on a watershed through mitigation and/or remediation and its role in watershed protection.	4.1.10.C Analyze the role that state and federal governments play in the development and enforcement of environmental laws and regulations relating to water and watersheds. Analyze real world data and explain how point and non-point source pollution can be detected and eliminated.	4.1.12.C Analyze efforts to prevent, minimize and/or reduce water pollution through cost/benefit analysis and risk management. Analyze the role of technology in the reduction of water pollution.

GRADES 8, 10, 12 Environment and Ecology

4.1. Watersheds						
4.1.3. GRADE 3	4.1.4. GRADE 4	4.1.5. GRADE 5	4.1.6. GRADE 6	4.1.7. GRADE 7	4.1.8. GRADE 8	4.1.10 GRADE 10
Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:						
4.1.3.D See Environment as a Real Life Connection and Civic and Societal Responsi- bilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.1.4.D See Environment as a Real Life Connection and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.1.5.D See Environment as a Real Life Connection and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.1.6.D See Environment as a Real Life Connection and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.1.7.D See Environment as a Real Life Connection and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.1.8.D See Environment as a Real Life Connection and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.1.10.D See Environment as a Real Life Connection and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)
3. Environment as a Real Life Connection and Civic and Societal Responsibilities						
4.1.12.D See Environment as a Real Life Connection and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)						

GRADES 8, 10, 12 Environment and Ecology

4.2. Sustainable Systems and Practices						
4.2.3. GRADE 3	4.2.4. GRADE 4	4.2.5. GRADE 5	4.2.6. GRADE 6	4.2.7. GRADE 7	4.2.8. GRADE 8	4.2.10 GRADE 10
4.2.3.A Identify how the environment provides for the needs of people in their daily lives. Identify products and by-products derived from natural resources (e.g., wood, energy, minerals, metals, plastics, food, etc.)	4.2.4.A Identify resources humans take from the environment for their survival. Identify how people use resources in sustainable and non-sustainable ways.	Intentionally Blank	4.2.6.A Examine how historical events have shaped the sustainable use of natural resources. Describe how the development of civilization affects the use of natural resources and the impacts on the environment.	4.2.7.A Describe how natural resources influence the culture, recreation and quality of life in a community. Explain how consumption may or may not impact the availability of natural resources.	4.2.8.A Analyze how man-made systems have impacted the management and distribution of natural resources. Explain how renewable and non-renewable resources supply energy and materials.	4.2.10.A Explain how Best Management Practices can be used to mitigate environmental problems and the over use of our natural resources. Analyze factors affecting availability of renewable and non-renewable resources.
1. Use of Natural Resources						
						4.2.12.A Compare and contrast the access to and availability of natural resources on socio-economic issues within communities.

GRADES 8, 10, 12

4.2. Sustainable Systems and Practices

2. Availability of Renewable and Non-Renewable Resources															
4.2.3. GRADE 3		4.2.4. GRADE 4		4.2.5. GRADE 5		4.2.6. GRADE 6		4.2.7. GRADE 7		4.2.8. GRADE 8		4.2.10 GRADE 10		4.2.12. GRADE 12	
4.2.3.B Identify the difference between a renewable and non-renewable resource.		4.2.4.B Define and identify renewable and non-renewable resources that can be found in Pennsylvania. Identify resources that have limited life spans that impact availability for human use.		4.2.5.B Explain how energy comes from natural resources; identify energy uses. Identify renewable and non-renewable sources of energy.		4.2.6.B Identify key geographic locations of renewable and non-renewable resources needed to sustain our quality of life (e.g., water, coal, fossil fuels, lumber, plastics, plants, animals).		4.2.7.B Compare and contrast the characteristics of renewable or nonrenewable and the time span needed to regenerate the resource. -forest -wildlife -fossil fuels -soils Explain the distribution and management of natural resources (i.e., conservation and preservation).		4.2.8.B Compare and contrast the use and availability of renewable and non-renewable resources in other countries. Evaluate the advantages and disadvantages of using renewable and non-renewable energy sources from production to end user.		4.2.10.B Explain positive and negative impacts on our renewable and nonrenewable resources when using solar, wind, bio-fuels, fossil fuels and nuclear . Explain how the availability of renewable and non-renewable resources affects energy production and use.		4.2.12.B Identify the consequences of continuing to use nonrenewable resources for our needs and wants. Analyze the social, economic, and political factors that affect the distribution of natural resources which should include wars, political systems, eco-justice, etc.	

GRADES 8, 10, 12 Environment and Ecology

4.2. Sustainable Systems and Practices						
4.2.3. GRADE 3	4.2.4. GRADE 4	4.2.5. GRADE 5	4.2.6. GRADE 6	4.2.7. GRADE 7	4.2.8. GRADE 8	4.2.10 GRADE 10
4.2.3.C Describe jobs people have in the local community that are related to natural resources.	4.2.4.C Explain how the availability of natural resources influenced the early settlements in Pennsylvania. Identify early industries that developed as a result of availability of natural resources like coal, steel and trapping.	4.2.5.C Describe how a home energy audit is done and changes made for a sustainable use of the resource.	Intentionally Blank	4.2.7.C Explain how the scarcity of a resource can affect the stability of a community. Identify current industries that are directly related to natural resources in the United States. Describe how green solutions for a green environment are being used at the local and state level.	4.2.8.C Analyze the consumption of natural resources in the local community building and describe a plan of action for green solutions. Explain how a school building's heating, lighting, waste and water systems can be more sustainable both environmentally and cost wise.	4.2.10.C Explain how access to and the availability of natural resources affects the growth and development of today's economy. Explain how mismanagement of resources affects the growth, health and development of an area (e.g., Centralia, Donora, Love Canal, Dust Bowl, Chernobyl)
3. Resource Influence on Community Development						
4.2.12. GRADE 12						
4.2.12.C Describe natural resources as world-wide commodities. Describe global distribution of natural resources on the development and political stability of areas throughout the world.						

GRADES 8, 10, 12 Environment and Ecology

4.2. Sustainable Systems and Practices						
4.2.3. GRADE 3	4.2.4. GRADE 4	4.2.5. GRADE 5	4.2.6. GRADE 6	4.2.7. GRADE 7	4.2.8. GRADE 8	4.2.10 GRADE 10
4.2.3.D. Identify human activities that both positively and negatively affect natural resources.	4.2.4.D Identify various land uses in the community and their impact on a sustainable community. Describe how recycling, waste reduction, composting, reuse and reduce, planting of trees, etc., help manage resources in sustainable ways.	Intentionally Blank	4.2.6.D Explain the importance of maintaining the natural resource at local and state levels.	4.2.7.D Describe how human-made systems like transportation, waste management, agriculture, energy grids, etc. are connected to natural resources and their impacts on the environment. Describe how people have altered the environment to meet their needs. Describe management practices that help restore or sustain natural resources.	4.2.8.D Describe how land use affects natural resources and community sustainability (e.g., water, soil, animals, and plants). Define and give examples of sustainable practices that will have a positive impact on the environment. Explain how human made systems impact the management and distribution of natural resources through extraction, use and disposal.	4.2.10.D Explain how the exploitation of natural resources affects the quality of the environment through practices like acid mine drainages, forest fragmentation, air/water pollution. Analyze past and present management practices and their effect on natural resources and the sustainability of the environment. Explain how appropriate management practices can minimize negative impacts on the environment.
4. Sustainability						4.2.12.D Analyze practices used in the restoration and/or reclamation of exploited resources.

GRADES 3-8, 10, 12 Environment and Ecology

4.2. Sustainable Systems and Practices						
4.2.3. GRADE 3	4.2.4. GRADE 4	4.2.5. GRADE 5	4.2.6. GRADE 6	4.2.7. GRADE 7	4.2.8. GRADE 8	4.2.10 GRADE 10
4.2.3.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.2.4.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.2.5.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.2.6.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.2.7.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.2.8.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.2.10.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)
5, Environment as a Real Life Connection and Civic and Societal Responsibilities						
4.2.12.E See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)						

GRADES 3-8, 10, 12 Environment and Ecology

4.3. Ecosystems and Their Interactions							
4.3.3. GRADE 3	4.3.4. GRADE 4	4.3.5. GRADE 5	4.3.6. GRADE 6	4.3.7. GRADE 7	4.3.8. GRADE 8	4.3.10 GRADE 10	4.3.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							
1. Biotic and Abiotic Interactions in a System							
4.3.3.A Identify and describe the basic needs of plants, animals and humans (i.e., food, water, shelter, space and arrangement). Identify and describe natural and manmade terrestrial systems (e.g., forest, meadow, farm, city) and their biotic and abiotic parts. Identify the sun as a source of energy for most living things. Describe a simple food chain.	4.3.4.A Describe how living things are dependent on both biotic and abiotic parts in the environment for survival. Identify and describe a local aquatic system (e.g., bogs, swamps, ponds, rivers) and its biotic and abiotic parts. Describe the importance of insects in an ecosystem both terrestrial and aquatic. Explain the process of photosynthesis and it affect on natural and manmade systems. Identify the water, carbon/dioxide and nutrient cycles in a ecosystem.	4.3.5.A Identify and explain characteristics of biotic and abiotic components of an ecosystem and their interactions. Demonstrate the dependency of living components on the abiotic components. Explain energy flow through a food web.	4.3.6.A Compare and contrast the major ecosystems of Pennsylvania. Identify niches for producers, consumers and decomposers within an ecosystem. Explain the importance of the predator/prey relationship and how it maintains the balances within ecosystems. Describe and explain the role of cycles within an ecosystem (carbon dioxide/oxygen, carbon and water).	4.3.7.A Analyze the interdependence of an ecosystem. Describe how the availability of resources affects organisms in an ecosystem. Understand limiting factors and predict their effects on an organism. Describe the flow of energy and matter from organism to organism within an ecosystem.	Intentionally Blank	4.3.10.A Identify the major factors that determine a biome (temperature and precipitation) and the affects of latitude and longitude. Compare different biomes and identify their inhabitant. Explain the concept of carrying capacity in an ecosystem. Identify limiting factors and their impact on carrying capacity and population dynamics. Describe the connections between the carbon dioxide/oxygen, carbon and water cycles to global systems.	4.3.12.A Evaluate the causes of a population fluctuation within a local ecosystem. Analyze the impact of cycles on the ecosystem. Evaluate the efficiency of energy flow within an ecosystem.

GRADES 3-8, 10, 12 Environment and Ecology

4.3. Ecosystems and Their Interactions						
4.3.3. GRADE 3	4.3.4. GRADE 4	4.3.5. GRADE 5	4.3.6. GRADE 6	4.3.7. GRADE 7	4.3.8. GRADE 8	4.3.10 GRADE 10 4.3.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>						
						Explain how energy is converted from one form to another in a food web by evaluating the efficiency of energy flow within a food web.

GRADES 8, 10, 12 Environment and Ecology

4.3. Ecosystems and Their Interactions							
4.3.3. GRADE 3	4.3.4. GRADE 4	4.3.5. GRADE 5	4.3.6. GRADE 6	4.3.7. GRADE 7	4.3.8. GRADE 8	4.3.10 GRADE 10	4.3.12. GRADE 12
Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:							
4.3.3.B Identify characteristics of a local terrestrial and human-made ecosystems (e.g., meadow, field, forest, farm, zoo) and identify the organisms that live there. Describe what is meant by nocturnal and diurnal and give examples of each.	4.3.4.B Identify what is meant by a wetland and the important role it plays within an ecosystem. Identify characteristics of a local aquatic ecosystems e.g., (pond, lake, swamp, bog) and identify the organisms that live there (fish, reptiles, amphibians, insects, and plants). Recognize the impact of wetlands on animals, plants and people.	4.3.5.B Describe the levels of organization in a given ecosystem (species, populations, community). Explain how ecosystems change over time. Explain that ecosystems change over time due to natural and or human influences (seasons, fire, land use).	4.3.6.B Identify and explain the succession stages in an ecosystem. Explain how change in a terrestrial/aquatic environment can affect the system. Explain how land uses can change the dynamics of living systems.	4.3.7.B Identify and describe natural and human events that change aquatic, terrestrial, and human-made ecosystems. Describe the different functions of a wetland (e.g., habitat, flood control, buffer zones, prevention areas, nurseries, food production areas) and explain characteristics of wetland plants, animals and soils.	4.3.8.B Compare the stages of succession and how they influence the cycles existing in an ecosystem. Examine the types of organism found in aquatic, terrestrial, and human-made ecosystems. Analyze the positive and negative impacts of outside influences on an ecosystem. Explain how land use within a watershed will influence water quality, wildlife and water retention. Explain the impact erosion and sedimentation has on ecosystems.	4.3.10.B Evaluate the impacts of removing an essential species from a local ecosystem (i.e., keystone species, primary producers). Determine the effects human actions have on ecosystems (e.g., development, pollution, hydroelectric dams, wind turbines, forest fragmentation). Identify a specific environmental impact and predict what change may occur to affect homeostasis. Explain the consequences of interrupting natural cycles.	4.3.12.B Explain the functions of habitat, nutrient production, migration stopover and groundwater recharge as it relates to aquatic, terrestrial, and human-made ecosystems. Analyze how human actions and natural changes affect the balance within an ecosystem.

2. Aquatic, Terrestrial, & Human-Made Ecosystems

2. Aquatic, Terrestrial, & Human-Made Ecosystems

GRADES 8, 10, 12 Environment and Ecology

4.3. Ecosystems and Their Interactions							
4.3.3. GRADE 3	4.3.4. GRADE 4	4.3.5. GRADE 5	4.3.6. GRADE 6	4.3.7. GRADE 7	4.3.8. GRADE 8	4.3.10 GRADE 10	4.3.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							
4.3.3.C Explain what happens to an organism when its needs can not be met. Identify differences in living things and describe how adaptations are important for survival.	4.3.4.C Explain why plants and animals are different colors, shapes and sizes and how these differences relate to their survival. Identify plants and animals that are threatened, endangered or extinct.	4.3.5.C Define the concept of endangered and extinct species. Explain the differences among threatened, endangered and extinct species. Identify adaptations in plants and animals. Describe an organism's adaptations for survival in its habitat.	4.3.6.C Understand levels of ecosystem organization (individuals, populations, communities and ecosystems). Explain the complex, interactive relationships among members of ecosystems (symbiosis). Define the terms native, invasive and exotic species and identify Pennsylvania's species. Explain factors that could cause a species' population to increase or decrease.	4.3.7.C Explain biological diversity and its effects on ecological integrity of the natural resources. Identify generalists and specialists as survival strategies used by organisms. Describe how a particular trait may be selected over time and account for a species' adaptation. Explain the role of individual variations in natural selections. Explain natural or human actions in relation to the loss of biodiversity. Explain why one species may be more susceptible to becoming endangered than another species.	4.3.8.C Analyze biological diversity's role as it relates to the stability of an biome. Describe an organism's adaptations for survival in its habitat. Explain how management practices may influence the success of specific species. Explain how invasive species are introduced and their impacts on the environment. Compare and contrast animals and plants that have very specific survival requirements with those that have more general requirements for survival.	4.3.10.C Identify and explain criteria used by scientists for categorizing organisms as threatened, endangered or extinct. Explain how structure, function and behavior of plants and animals affect their ability to survive. Examine the influence of wildlife management in preserving species in Pennsylvania (e.g. bobcat, elk, bald eagle, fisher). Analyze the influence of zoos in relationships to threatened and endangered species. Explain how habitat loss can affect the interaction among species and the population of a species.	4.3.12.C Examine and explain how a specialized interaction between two species may affect the survival of both species. Examine the effects of threatened, endangered or extinct species both natural and human caused, on the environment. Analyze management strategies regarding threatened and endangered. Examine the influence of wildlife management in preserving different species in Pennsylvania (e.g. bobcat, elk, bald eagle, fisher).
3. Biodiversity							18
Draft							July 2010

GRADES 3-8, 10, 12 Environment and Ecology

4.3. Ecosystems and Their Interactions						
4.3.3. GRADE 3	4.3.4. GRADE 4	4.3.5. GRADE 5	4.3.6. GRADE 6	4.3.7. GRADE 7	4.3.8. GRADE 8	4.3.10 GRADE 10 4.3.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>						
4.3.3.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.3.4.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.3.5.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.3.6.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.3.7.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.3.8.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.3.10.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5) 4.3.12.D See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)

GRADES 8, 10, 12 Environment and Ecology

4.4. Agriculture and Society								
	4.4.3. GRADE 3	4.4.4. GRADE 4	4.4.5. GRADE 5	4.4.6. GRADE 6	4.4.7. GRADE 7	4.4.8. GRADE 8	4.4.10 GRADE 10	4.4.12. GRADE 12
Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:								
1. Importance of Agriculture	4.4.3.A Identify people's basic needs of food, water, shelter, space arranged for survival.	4.4.4.A Describe how agriculture provides for basic needs and wants including food, clothing, shelter, and cultural traditions at the local and state level.	Intentionally Blank	4.4.6.A Describe how agriculture provides for basic needs and wants including food, clothing, shelter, and cultural traditions at the national or global levels.	4.4.7.A Describe the economic importance and society's standard of living in relation to agriculture.	Intentionally Blank	4.4.10.A Analyze the effects of agriculture on a society's economy, environment, standard of living and foreign trade.	4.4.12.A Research and analyze the social, political, economic and environmental factors that affect agricultural systems.
	4.4.3.B Identify agriculture as a living system and that food and fiber originate from plants and animals. Identify products and by-products of the agricultural system. Identify what plants and animals need to grow.	4.4.4.B Explain how the agricultural system is dependent on clean air, water and soil for maximum production. Identify Pennsylvania's food and fiber products and explain their journey from the farm to the consumer. Explain why animal production is dependent on plant production.	Intentionally Blank	4.4.6.B Explain how the agricultural system provides for food and fiber production, and distribution, and consumption at state and national levels.	4.4.7.B Explain how environmental conditions (i.e., soils, weather, water), impact Agricultural systems' production, cost, and quality. Research positive and negative impacts of buying local. -food -commodities	4.4.8.B Explain how agricultural systems use research, marketing and development to distribute products. Explain the functions of the components of the food and fiber system.	4.4.10.B 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.B Analyze and research the social, political and economic factors that affect agricultural systems.
2. Food and Fiber System								

GRADES 8, 10, 12 Environment and Ecology

4.4. Agriculture and Society								
4.4.3. GRADE 3		4.4.4. GRADE 4	4.4.5. GRADE 5	4.4.6. GRADE 6	4.4.7. GRADE 7	4.4.8. GRADE 8	4.4.10 GRADE 10	4.4.12. GRADE 12
Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:								
3. Integrated Pest Management as it relates to Agriculture		4.4.3.C Identify various plants and animals that humans may call beneficial and those they call pest. Investigate how pest are controlled in your home (inside and outside).	4.4.4.C Determine the circumstances that cause humans to identify an organism as a pest. Explain integrated pest management (IPM) and how it occurs in your school.	4.4.5.C Investigate how integrated pest management practices are used in agricultural systems (cultural, physical, mechanical, biological, chemical).	4.4.6.C Analyze pest management practices, past and present, and their short- and long-term effects on the environment.	Intentionally Blank	4.4.10.C Research and design an effective IPM plan for non-agriculture or agricultural situations (e.g., home, garden, school building, greenhouse) and describe rather mechanical, biological, or chemical methods are used.	4.4.12.C. Evaluate pest management using methods such as cost/benefit analysis, cumulative effects analysis, environmental impact analysis, ethical analysis, and risk analysis.
4. Agricultural Technologies		4.4.3.D Identify the technology (energy consumption, tools and machinery) commonly used in agricultural processes.	4.4.4.D Identify how technology affects the development of civilizations through agricultural production.	4.4.5.D Describe how technology in agriculture (food and fiber) systems has changed over time.	4.4.6.D Compare several technological advancements and their affects on the growth of agriculture.	4.4.7.D Describe the positive and negative effects of technology used in agriculture. (e.g., bio-technology)	4.4.10.D Evaluate the pros and cons of the use of technologies to increase plant and animal productivity. Describe how agricultural science has influenced biotechnology	4.4.12.D Describe how policies, regulations, and laws affect the technologies adopted in agriculture.

GRADES 8, 10, 12 Environment and Ecology

4.4. Agriculture and Society								
4.4.3. GRADE 3	4.4.4. GRADE 4	4.4.5. GRADE 5	4.4.6. GRADE 6	4.4.7. GRADE 7	4.4.8. GRADE 8	4.4.10 GRADE 10	4.4.12. GRADE 12	
Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:								
5. Applying Both the Social/Natural Sciences	4.4.3.E Identify common plants and animals found in Pennsylvania agricultural ecosystems.	4.4.4.E Identify the natural resources used to produce food and fiber products (soil, water, energy, etc.).	4.4.5.E Explain how the plants and animals raised are related to the geographic region and natural resources.	4.4.6.E Describe what natural resources are needed to produce plants and animals and how this relates to the geographic regions. Describe the role soil plays in determining what is grown.	4.4.7.E Analyze the needs of plants and animals as they relate to available natural resources. Analyze how soil types and geographic regions have impacted agriculture in Pennsylvania	4.4.8.E Intentionally Blank	4.4.10.E 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.E Analyze research and development initiatives as they relate to agriculture.
	4.4.3.F See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.4.4.F See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.4.5.F See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.4.6.F See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.4.7.F See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.4.8.F See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.4.10.F See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.4.12.. See <i>Environment as a Real Life Connection and Civic and Societal Responsibilities</i> towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)
6. Environment as a Real Life Connection and Civic and Societal Responsibilities								

GRADES 8, 10, 12

Environment and Ecology

4.5. Humans and the Environment							
4.5.3. GRADE 3	4.5.4. GRADE 4	4.5.5. GRADE 5	4.5.6. GRADE 6	4.5.7. GRADE 7	4.5.8. GRADE 8	4.5.10 GRADE 10	4.5.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							
4.5.3.A Describe how the environment provides human needs. Identify examples of how human activities within a community affect the environment. -litter -recycling -land use	4.5.4.A Explain how the demand for natural resources impacts its availability. Describe how human activities can positively or negatively affect terrestrial and aquatic environments.	Intentionally Blank	4.5.6.A Explain how humans use resources in their environment and how they can reduce pollution. Describe how humans cause pollution (air, land, water)	4.5.7.A Explain the factors that influence the supply and demand of resources and its impact on society's uses. Identify residential agricultural and industrial sources of terrestrial and aquatic pollution and their impact on the environment.	4.5.8.A Analyze how human needs relate to both sustainability of natural resources and environmental conditions throughout the world. Evaluate methods used to reduce the impact of human activities on a watershed through mitigation and/or remediation and its role in watershed protection.	4.5.10.A Discuss possible solutions for balancing the supply and demand of natural resources Analyze real world data and explain how point and non-point source pollution can be detected and eliminated.	4.5.12.A Analyze the relationship between population density and resource use and management. Analyze efforts to prevent, minimize and/or reduce water pollution through cost/benefit analysis and risk management.
1. Human Impacts on the Environment							

GRADES 8, 10, 12 Environment and Ecology

4.5. Humans and the Environment							
4.5.3. GRADE 3	4.5.4. GRADE 4	4.5.5. GRADE 5	4.5.6. GRADE 6	4.5.7. GRADE 7	4.5.8. GRADE 8	4.5.10 GRADE 10	4.5.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							
4.5.3.B Identify different types of air, water and land pollution and their possible source.	4.5.4.B Identify how the health of living systems can be affected by changes through pollution in their environment. Explain what is meant by point and non-point source pollution. Identify signal words on pest labels that warn of potential health risk. - danger-poison	Intentionally Blank	4.5.6.B Describe how over time human activities on both terrestrial and aquatic systems affect the health of the environment at local, regional, and national levels. Explain the difference between point and non-point source pollution.	4.5.7.B Identify various examples of long-term pollution found in the air, water and soil and explain its effects on environmental health. -droughts -flood -human actions Describe the impact of point and non-point pollution on water quality (pest management practices, Chesapeake Bay, etc.) Identify specific pests that are vectors of disease and a health risk.	4.5.8.B Investigate and analyze the effects of land use and contaminants on the quantity and quality of water within a watershed by investigating -pesticides, -household chemicals -Rx, or -medical waste. Explain what is meant by assessing your carbon footprint. Identify and explain the health risks associated with pests (example would be asthma).	4.5.10.B Analyze how human activities may cause changes in global environments. Describe the risk associated with point and non-point source pollutants in the air and water and on the land. Analyze the effects of species extinction on the health of an ecosystem.	4.5.12.B Analyze the role of technology in the reduction of all types of pollution and its effects on living systems.

GRADES 8, 10, 12 Environment and Ecology

4.5. Humans and the Environment							
4.5.3. GRADE 3	4.5.4. GRADE 4	4.5.5. GRADE 5	4.5.6. GRADE 6	4.5.7. GRADE 7	4.5.8. GRADE 8	4.5.10 GRADE 10	4.5.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							
4.5.3.C Identify environmental laws that affect our communities and state. -recycling/litter -animal protection -clean water	4.5.4.C Recognize environmental laws and regulations at the state level to protect land, air and water. Identify local and state laws that protect plants and animals.	4.5.5.C 1. Identify the state agencies that protect plants and animals in Pennsylvania. (See glossary for agencies)	4.5.6.C Explain the purpose of environmental laws and regulations and the role of local, state and federal agencies in its protection. (See glossary for agencies)	4.5.7.C Identify and explain environmental laws and regulations -Clean Air Act, -Clean Water Act, -Recycling Act, -Threatened Endangered Species Act.	4.5.8.C Analyze the roles that local, state, and federal governments play in the development and enforcement of environmental laws. Describe state laws and regulations regarding hunting, trapping, fishing and non-game species in Pennsylvania. Explain the positive and negative impact associated with passing and enforcing environmental laws and regulations.	4.5.10.C Explain the positive and negative impacts associated with passing environmental laws and regulations. Research and evaluate laws and policies that affect the food and fiber system. Describe how national interests lead to agreements and conflicts between and among countries.	4.5.12.C Analyze environmental laws and regulations as they relate to environmental issues and their impacts on the environment. Identify laws, agreements or treaties at international levels regarding threatened or endangered species.
3. Laws and Regulations							

GRADES 8, 10, 12 Environment and Ecology

4.5. Humans and the Environment									
4.5.3. GRADE 3	4.5.4. GRADE 4	4.5.5. GRADE 5	4.5.6. GRADE 6	4.5.7. GRADE 7	4.5.8. GRADE 8	4.5.10 GRADE 10	4.5.12. GRADE 12	Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:	
4. Use of Integrated Pest Management	4.5.D Identify those things we call "pest". (e.g., mouse, roach, poison ivy, mosquitoes) that are used in our everyday lives.	4.5.4.D Identify and describe different methods of controlling pests in the home or school. Explain how and why people control pests (compete for resources or health concerns).	Intentionally Blank	Intentionally Blank	4.5.7.D Explain how pests and pest control measures affect humans and the environment. Identify and explain risks associated with the use of pest management practices over time on terrestrial and aquatic systems.	Intentionally Blank	4.5.10.D Research and analyze the long-term effects of pest management practices on the environment. Analyze the risks and benefits to the environment and society associated with alternative practices used in integrated pest management.	4.5.12.D Research and analyze integrated pest management practices globally.	
	4.5.3.E Identify those items that can be recycled and those that can not. Identify litter and its effect on the environment.	4.5.4.E Describe what is meant by reduce, reuse or recycle. Identify sources of waste derived from the use of natural resources. -renewable -nonrenewable	4.5.4.E Identify and propose solutions for a waste issue in the school through (e.g., recycling, composting, reusing).	4.5.6.E Explain the concept of closing the loop through recycling, reducing, and reusing of resources.	4.5.7.E Identify the waste derived from the use of natural resources and the technologies needed for disposal. Explain how food waste generated in the school can be recycled through composting.	4.5.8.E 1. Explain the complete cycle of a natural resource from extraction to disposal; detailing itsits uses and effects on the environment.	4.5.10.E Explain different management alternatives involved in recycling and solid waste management. Compare and contrast waste generated from various sources of energy.	4.5.12.E Research the impact of new and emerging technologies in the use, reuse, recycling and disposal of materials.	
5. Waste Management									

GRADES 5-8, 10, 12

Environment and Ecology

4.5. Humans and the Environment							
4.5.3. GRADE 3	4.5.4. GRADE 4	4.5.5. GRADE 5	4.5.6. GRADE 6	4.5.7. GRADE 7	4.5.8. GRADE 8	4.5.10 GRADE 10	4.5.12. GRADE 12
<i>Pennsylvania's public schools shall teach, challenge and support every student to realize his or her maximum potential and to acquire the knowledge and skills needed to:</i>							
4.5.3.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.5.4.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.5.5.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.5.6.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.5.7.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.5.8.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.5.10.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)	4.5.12.F See <i>Environment as a Real Life Connection</i> and Civic and Societal Responsibilities towards the Environment in the Introduction for grade level indicators. (As indicated on page 4 and 5)
6. Environment as a Real Life Connection and Civic and Societal Responsibilities							

GRADES 5-8, 10, 12

Environment and Ecology

XII. GLOSSARY

Abiotic:

A nonliving factor or element (e.g., light, water, heat, rock, energy, mineral).

Adaptation:

Special, inherited characteristics that helps an organism better survive in its environment and which is developed over time.

Agriculture:

The production of food, feed, fiber, and other goods by the systematic growing/harvesting of plants, animals and other life forms.

Aquatic:

Growing, living in, or frequenting water.

Best Management Practices (BMP):

Methods that have been determined to be the most effective, practical means of preventing or reducing pollution and improving efficiency.

Biological Diversity (Biodiversity):

The variety of species, their genetic make-up, and the natural communities in which they occur; the variety of life on earth.

Biomes:

Geographic region of Earth that is inhabited by a community of distinct types of plants and associated animal species. There are forest, grassland, desert, highland and ice cap biomes on land and freshwater (streams, rivers, lakes, ponds and wetlands) and marine biomes that are saltwater.

Biotechnology:

Management or manipulation of living organisms for the benefit of people.

Biotic:

An environmental factor related to or produced by living organisms.

Buffer Zone:

A designated land or water area, along the perimeter of some land use, the use of which is regulated so as to resist, absorb, or otherwise preclude unwanted development or other intrusions (visual, noise, recreational use) into areas beyond the strip of undisturbed vegetation that retards the flow of runoff water, causing deposition of transported material and thereby reducing sediment in receiving streams.

Camouflage:

Color, tones, patterns, shapes or behavior that enable an organism to blend in with its surroundings. Some organisms, for example, have a skin or coat color that enables them to hide from predators.

Carbon Cycle:

The circulation and recycling of carbon atoms, especially through the processes of photosynthesis, respiration and decomposition.

GRADES 5-8, 10, 12

Environment and Ecology

Carrying Capacity:

The maximum number of individuals or inhabitants that a given environment can support without detrimental effects.

Compost:

Decomposed organic material resulting from the breakdown by living beings (mostly microbes) and used to enrich or improve the consistency and content of soil for growing.

Condensation:

The process by which a vapor becomes a liquid; the opposite of evaporation.

Consumer:

Person buying goods or services for personal needs or to use in the production of other goods for resale.

Decomposer:

An organism, often microscopic in size, that obtains nutrients by consuming dead organic matter, thereby making nutrients accessible to other organisms; examples of decomposers include fungi, scavengers, rodents, and other animals.

Distributor:

Person who distributes commodities to the consumer or to a retailer.

Diurnal:

Active by daylight; the opposite of nocturnal.

Ecosystem:

The interacting system of a biological community and its nonliving environment; also, the place where these interactions occur.

Endangered Species:

A species that is in danger of extinction throughout all or a significant portion of its range.

Environment:

The total of the surroundings (air, water, soil, vegetation, people, wildlife) influencing each living being's existence, including physical, biological and all other factors; the surroundings of a plant or animal, including other plants or animals, climate and location.

Environmental Health:

A study of the things that cause sickness when put into the air, water or soil and its positive or negative effects on living and nonliving systems.

Environmental Agencies:

State: Fish and Boat and Game Commissions, Departments of Agriculture, Environmental Protection and Conservation and Natural Resources. Federal: US Environmental Protection, US Fish and Wildlife and US Department of Agriculture

Environmental Laws and Regulations:

Environmental, economic, legal and political elements that govern human actions regarding the environment.

Evaporation:

The conversion of a liquid into a vapor (a gaseous state) usually through the application of heat energy; the opposite of condensation.

Extinction:

The complete elimination of a species from the earth.

GRADES 5-8, 10, 12

Environment and Ecology

- Fiber:**
- 1) Threadlike rows of cells in foods that gives texture and substance, or bulk, which is important in a healthy diet;
 - 2) Slender, threadlike structure combining with other fibers in the form of weaving, knitting, or otherwise intertwining.

Food Web: The set of organism relationships often based on who-eats whom or which organisms cycle a particular nutrient within and ecological community.

Food and Fiber System: Food and fiber systems, or agriculture, encompass all the processes necessary to bring food and fiber products to the consumer; including production, processing, research, development, distribution, and marketing.

Fossil Fuels: Fuels found in the earth that are made from remains of plants and animals that lived millions of years ago.

Green Building: Green Building is the practice of designing, planning, and constructing buildings where the priority and emphasis is placed on the current and future environmental impact of the building.

Groundwater: Water that infiltrates the soil and is located in underground reservoirs called aquifers.

Habitat: Consists of food, water, shelter, and space in a suitable arrangement.

Integrated Pest Management: A variety of control methods including cultural, mechanical, biological, and chemicals to control pest population.

Landfill: A place permitted by a solid waste regulatory agency (environmental protection) where unwanted materials are deposited, compacted and covered with dirt.

Lentic: A system relating to or living in still water (pond, lake, wetland).

Limiting Factors: Chemical or physical factors that limit the existence, growth, abundance, or distribution of an organism.

Lotic: A system relating to or living in actively moving water (river, stream, creek).

Macro-invertebrate: Usually referring to aquatic environments, an invertebrate organism visible without the aid of a microscope.

Migration: Movement, often in a group from one place to another (e.g., geese, butterflies).

Mitigation: The policy of constructing or creating man-made habitats, such as wetlands, to replace those lost to development.

Natural Resources: Any material produced by nature that can be used to produce goods or provide services.

GRADES 5-8, 10, 12

Environment and Ecology

The role played by an organism in an ecosystem; its food preferences, requirements for shelter, special behaviors, and the timing of its activities (e.g., nocturnal, diurnal), interaction with other organisms and its habitat.

Nocturnal:

Active by night; the opposite of diurnal.

Non-Point Source Pollution:

Contamination that originates from many locations that all discharge into a location (e.g., air, lake, stream, land area).

Nonrenewable Resources:

Substances (e.g., oil, gas, coal, copper, gold) that, once used, cannot be replaced in this geological age.

Organism:

A form of life considered as an entity; an animal, plant, fungus, protist, or bacteria.

Pest:

A label applied to an organism when it becomes a nuisance or is detrimental to humans and human concerns (e.g., competes with humans for some resource, causes damage, carries germs/diseases, etc).

Point Source Pollution:

Pollutants discharged from a single identifiable location (e.g., smoke stack, pipes, ditches, channels, sewers, tunnels, containers of various types).

Predators:

Animals that live by capturing and feeding on other animals.

Prey:

Animal hunted or caught for food.

Producers:

Plants that perform photosynthesis and provide food to consumers.

Population Dynamics:

A description of the ways in which a given population's numbers grow and shrink over time, as controlled by birth, death and emigration.

Recycling:

Collecting and reprocessing a resource or product to make new products.

Regulation:

A rule or order issued by an executive authority or regulatory agency of a government and having the force of law.

Renewable Resource:

A naturally occurring raw material or form of energy that will be replenished through natural ecological cycles or sound management practices (e.g., the sun, wind, water, trees).

Risk Management:

A strategy developed to reduce or control the chance of harm or loss to one's health or life; the process of identifying, evaluating, and selecting and implementing actions to reduce the risk to human health and to ecosystems.

GRADES 8, 10, 12

Environment and Ecology

Shredders: Macro-invertebrates with chewing mouthparts that allow them to feed on and process coarse particulate organic matter in finer particles. They are usually found toward the headwaters of a stream.

Solid Waste: Any of a wide variety of solid materials, as well as some contained liquids, which are discarded or rejected as being spoiled, unless, worthless, or in excess.

Stewardship: The concept of responsible caretaking; the concept is based on the premise that we do not own the resources, but are managers of resources and are responsible to future generations for their conditions.

Stream Order: Energy and nutrient flow that increases as water moves toward the oceans [e.g., the smallest stream (primary) that ends when rivers flow into oceans].

Succession: The series of changes that occur in an ecosystem with the passing of time.

Sustainability: Maintaining resources in such a way to be able to renew themselves over time or to keep in existence and supply with necessities.

Technology: The application of knowledge to the practical aims of human life or to changing and manipulating the human environment. Technology is a broad concept that deals with a species' usage and knowledge of tools and crafts, and how it affects a species' ability to control and adapt to its environment.

Textile: A flexible material comprised of a network of natural or artificial fibers.

Topography: The physical features of a place or the study and depiction of physical features, including terrain relief.

Trophic Level: The feeding level an organism occupies in the food chain.

Tributary: A stream that contributes its flow to a larger stream, river or lake.

Vector of Disease: A living organism that carries and can transmit an infectious agent.

Water Cycle: The cycle by which water evaporates from soils, vegetation, oceans, and other bodies of water; accumulates as water vapor in clouds; returns to the Earth, oceans, and other bodies of water as rain and snow; and runs off as river flow, through the soil or an aquifer.

Waste Management: Administration of the reduction, collection, separation, storage, transportation, transfer, processing, treatment, and disposal of waste.

GRADES 5-8, 10, 12

Environment and Ecology

Watershed: The land area from which surface runoff drains into a stream, channel, lake, reservoir, or other body of water; also called a drainage basin.

Waste Stream: The flow of (waste) materials from generation, collection, and separation to disposal.

Wetlands: Lands where water saturation is the dominant factor determining the nature of the soil development and the plant and animal communities (e.g., sloughs, estuaries, marshes).