

APPENDIX B

Academic Standards for Science and Technology

and

Environment and Ecology

Academic Standards for Environment and Ecology



Pennsylvania Department of Education

Academic Standards for Environment and Ecology

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Academic Standards for 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 and Wetlands
- ◇ 4.2. Renewable and Nonrenewable Resources
- ◇ 4.3. Environmental Health
- ◇ 4.4. Agriculture and Society
- ◇ 4.5. Integrated Pest Management
- ◇ 4.6. Ecosystems and their Interactions
- ◇ 4.7. Threatened, Endangered and Extinct Species
- ◇ 4.8. Humans and the Environment
- ◇ 4.9. Environmental Laws and Regulations

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 our impact on its sustainability. The human interactions with the ecosystem and the results of human decisions are the main components of this academic area. Environment and Ecology examines the world with respect to the economic, cultural, political and social structure as well as natural processes and systems. This integration across systems is what sets this academic area apart from all others.

Environment and Ecology places its main emphasis in the real world. It allows students to understand, through a sound academic content base, how their everyday lives evolve around their use of the natural world and the resources it provides. As we move into a more technologically driven society, it is crucial for every student to be aware of his/her dependence on a healthy environment. The 21st century will demand a more sophisticated citizen capable of making sound decisions that will impact our natural systems forever.

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These standards establish the essential elements of what students should know and be able to do at the end of grades four, seven, ten and twelve. The sequential nature of this document reflects the need for rigorous academic content that students will be expected to achieve. The standards will help students understand decision-making processes, the art of compromise and problem solving skills. The document reinforces all areas across the grade levels with increasing degrees of difficulty as the students mature intellectually.

Environment and Ecology is a very engaging academic area that captivates students' innate interests in their surroundings of the natural and built environment. The skills and knowledge that are addressed in this area of study will serve as tools for student participation in a democratic world of constantly evolving issues and concerns. As they achieve these standards, students will become aware of the role they play in the community in reaching decisions related to the environment.

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.

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

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4.1. Watersheds and Wetlands			
4.1.4. GRADE 4	4.1.7. GRADE 7	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>			
<p>A. Identify various types of water environments.</p> <ul style="list-style-type: none"> • Identify the lotic system (e.g., creeks, rivers, streams). • Identify the lentic system (e.g., ponds, lakes, swamps). <p>B. Explain the differences between moving and still water.</p> <ul style="list-style-type: none"> • Explain why water moves or does not move. • Identify types of precipitation. 	<p>A. Explain the role of the water cycle within a watershed.</p> <ul style="list-style-type: none"> • Explain the water cycle. • Explain the water cycle as it relates to a watershed. <p>B. Understand the role of the watershed.</p> <ul style="list-style-type: none"> • Identify and explain what determines the boundaries of a watershed. • Explain how water enters a watershed. • Explain factors that affect water quality and flow through a watershed. 	<p>A. Describe changes that occur from a stream's origin to its final outflow.</p> <ul style="list-style-type: none"> • Identify Pennsylvania's major watersheds and their related river systems. • Describe changes by tracing a specific river's origin back to its headwaters including its major tributaries. <p>B. Explain the relationship among landforms, vegetation and the amount and speed of water.</p> <ul style="list-style-type: none"> • Analyze a stream's physical characteristics. • Describe how topography influences streams. • Explain the influence of mountains on precipitation. • Explain how vegetation affects storm water runoff. • Delineate the boundaries of a watershed. • Describe factors that affect the quality of groundwater. • Explain how the speed of water and vegetation cover relates to erosion. 	<p>A. Categorize stream order in a watershed.</p> <ul style="list-style-type: none"> • Explain the concept of stream order. • Identify the order of watercourses within a major river's watershed. • Compare and contrast the physical differences found in the stream continuum from headwater to mouth. <p>B. Explain the relationships that exist within watersheds in the United States.</p> <ul style="list-style-type: none"> • Understand that various ecosystems may be contained in a watershed. • Examine and describe the ecosystems contained within a specific watershed. • Identify and describe the major watersheds in the United States.

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<p>C. Identify living things found in water environments.</p> <ul style="list-style-type: none"> • Identify fish, insects and amphibians that are found in fresh water. • Identify plants found in fresh water. <p>D. Identify a wetland and the plants and animals found there.</p> <ul style="list-style-type: none"> • Identify different kinds of wetlands. • Identify plants and animals found in wetlands. • Explain wetlands as habitats for plants and animals. 	<p>C. Explain the effects of water on the life of organisms in a watershed.</p> <ul style="list-style-type: none"> • Explain how water is necessary for all life. • Explain how the physical components of aquatic systems influence the organisms that live there in terms of size, shape and physical adaptations. • Describe the life cycle of organisms that depend on water. • Identify organisms that have aquatic stages of life and describe those stages. <p>D. Explain and describe characteristics of a wetland.</p> <ul style="list-style-type: none"> • Identify specific characteristics of wetland plants and soils. • Recognize the common types of plants and animals. • Describe different types of wetlands. • Describe the different functions of a wetland. 	<p>C. Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments.</p> <ul style="list-style-type: none"> • Describe and explain the physical factors that affect a stream and the organisms living there. • Identify terrestrial and aquatic organisms that live in a watershed. • Categorize aquatic organisms found in a watershed continuum from headwater to mouth (e.g., shredder, predator, decomposer). • Identify the types of organisms that would live in a stream based on the stream's physical characteristics. • Explain the habitat needs of specific aquatic organisms. <p>D. Describe the multiple functions of wetlands.</p> <ul style="list-style-type: none"> • Describe wetlands in terms of their effects (e.g., habitat, flood, buffer zones, prevention areas, nurseries, food production areas). • Explain how a wetland influences water quality, wildlife and water retention. • Analyze wetlands through their indicators (e.g., soils, plants, hydrology). 	<p>C. Analyze the parameters of a watershed.</p> <ul style="list-style-type: none"> • Interpret physical, chemical and biological data as a means of assessing the environmental quality of a watershed. • Apply appropriate techniques in the analysis of a watershed (e.g., water quality, biological diversity, erosion, sedimentation). <p>D. Analyze the complex and diverse ecosystems of wetlands.</p> <ul style="list-style-type: none"> • Explain the functions of habitat, nutrient production, migration stopover and groundwater recharge as it relates to wetlands. • Explain the dynamics of a wetland ecosystem. • Describe and analyze different types of wetlands.
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<p>E. Recognize the impact of watersheds and wetlands on animals and plants.</p> <ul style="list-style-type: none">• Explain the role of watersheds in everyday life.• Identify the role of watersheds and wetlands for plants and animals.	<p>E. Describe the impact of watersheds and wetlands on people.</p> <ul style="list-style-type: none">• Explain the impact of watersheds and wetlands in flood control, wildlife habitats and pollution abatement.• Explain the influence of flooding on wetlands.	<p>E. Identify and describe natural and human events on watersheds and wetlands.</p> <ul style="list-style-type: none">• Describe how natural events affect a watershed (e.g., drought, floods).• Identify the effects of humans and human events on watersheds.	<p>E. Evaluate the trade-offs, costs and benefits of conserving watersheds and wetlands.</p> <ul style="list-style-type: none">• Evaluate the effects of natural events on watershed and wetlands.• Evaluate the effects of human activities on watersheds and wetlands.
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4.2. Renewable and Nonrenewable Resources			
4.2.4. GRADE 4	4.2.7. GRADE 7	4.2.10. GRADE 10	4.2.12. 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>			
<p>A. Identify needs of people.</p> <ul style="list-style-type: none"> • Identify plants, animals, water, air, minerals and fossil fuels as natural resources. • Explain air, water and nutrient cycles. • Identify how the environment provides for the needs of people. <p>B. Identify products derived from natural resources.</p> <ul style="list-style-type: none"> • Identify products made from trees. • Identify by-products of plants and animals. • Identify the sources of manmade products (e.g., plastics, metal, aluminum, fabrics, paper, cardboard). 	<p>A. Know that raw materials come from natural resources.</p> <ul style="list-style-type: none"> • Identify resources used to provide humans with energy, food, housing and water. • Explain how plants and animals may be classified as natural resources. • Compare means of growing or acquiring food. • Identify fiber and other raw materials used in clothing and shelter production. • Identify types of minerals and fossil fuels used by humans. <p>B. Examine the renewability of resources.</p> <ul style="list-style-type: none"> • Identify renewable resources and describe their uses. • Identify nonrenewable resources and describe their uses. • Compare finished products to their original raw material. • Identify the waste derived from the use of renewable and nonrenewable resources. • Determine how consumption may impact the availability of resources. • Compare the time spans of renewability for fossil fuels and 	<p>A. Explain that renewable and nonrenewable resources supply energy and materials.</p> <ul style="list-style-type: none"> • Identify alternative sources of energy. • Identify and compare fuels used in industrial and agricultural societies. • Compare and contrast the cycles of various natural resources. • Explain food and fiber as renewable resources. <p>B. Evaluate factors affecting availability of natural resources.</p> <ul style="list-style-type: none"> • Describe natural occurrences that may affect the natural resources. • Analyze technologies that affect the use of our natural resources. • Evaluate the effect of consumer desires on various natural resources. 	<p>A. Analyze the use of renewable and nonrenewable resources.</p> <ul style="list-style-type: none"> • Explain the effects on the environment and sustainability through the use of nonrenewable resources. • Evaluate the advantages and disadvantages of reusing our natural resources. <p>B. Analyze factors affecting the availability of renewable and nonrenewable resources.</p> <ul style="list-style-type: none"> • Evaluate the use of natural resources and offer approaches for using them while diminishing waste. • Compare the economics of different areas based on the availability and accessibility of the natural resources.

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<p>C. Know that some natural resources have limited life spans.</p> <ul style="list-style-type: none"> • Identify renewable and nonrenewable resources used in the local community. • Identify various means of conserving natural resources. • Know that natural resources have varying life spans. <p>D. Identify by-products and their use of natural resources.</p> <ul style="list-style-type: none"> • Understand the waste stream. • Identify those items that can be recycled and those that can not. • Identify use of reusable products. • Identify the use of compost, landfills and incinerators. 	<p style="text-align: center;">alternative fuels.</p> <p>C. Explain natural resource distribution.</p> <ul style="list-style-type: none"> • Distinguish between readily available and less accessible resources. • Identify the locations of different concentrations of fossil fuels and mineral resources. • Analyze the effects of management practices on air, land and water in forestry, agriculture, fisheries, wildlife, mining and food and fiber production that is unique to different climates. <p>D. Describe the role of recycling and waste management.</p> <ul style="list-style-type: none"> • Identify materials that can be recycled in the community. • Explain the process of closing the loop in recycling. • Compare the decomposition rates of different organic materials. • Describe methods that could be used to reuse materials for new products. • Evaluate the costs and benefits of disposable products. 	<p>C. Analyze how man-made systems have impacted the management and distribution of natural resources.</p> <ul style="list-style-type: none"> • Explain the complete cycle of a natural resource, from extraction to disposal, detailing its uses and effects on the environment. • Analyze energy uses and energy conservation in different regions. • Examine conservation practices in different countries. • Analyze the costs and benefits of different man-made systems and how they use renewable and nonrenewable natural resources. • Analyze the impact of information systems on management and distribution of natural resources. <p>D. Explain different management alternatives involved in recycling and solid waste management.</p> <ul style="list-style-type: none"> • Analyze the manufacturing process (before, during and after) with consideration for resource recovery. • Compare various methods dealing with solid waste (e.g., incineration, compost, land application). • Differentiate between pre/post-consumer and raw materials. • Illustrate how one natural resource can be managed through reduction, recycling, reuse or use. 	<p>C. Analyze factors that influence the availability of natural resources.</p> <ul style="list-style-type: none"> • Compare the use of natural resources in different countries. • Determine how delivery systems influence the availability of resources at the local, regional and national level. <p>D. Evaluate solid waste management practices.</p> <ul style="list-style-type: none"> • Examine and explain the path of a recyclable material from collection to waste, reuse or recycling identifying the market forces. • Understand current regulations concerning recycling and solid waste. • Research new technologies in the use, reuse or recycling of materials.
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4.3. Environmental Health			
4.3.4. GRADE 4	4.3.7. GRADE 7	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>			
<p>A. Know that plants, animals and humans are dependent on air and water.</p> <ul style="list-style-type: none"> • Know that all living things need air and water to survive. • Describe potentially dangerous pest controls used in the home. • Identify things that cause sickness when put into the air, water or soil. • Identify different areas where health can be affected by air, water or land pollution. • Identify actions that can prevent or reduce waste pollution. <p>B. Identify how human actions affect environmental health.</p> <ul style="list-style-type: none"> • Identify pollutants. • Identify sources of pollution. • Identify litter and its effect on the environment. • Describe how people can reduce 	<p>A. Identify environmental health issues.</p> <ul style="list-style-type: none"> • Identify various examples of long-term pollution and explain their effects on environmental health. • Identify diseases that have been associated with poor environmental quality. • Describe different types of pest controls and their effects on the environment. • Identify alternative products that can be used in life to reduce pollution. <p>B. Describe how human actions affect the health of the environment.</p> <ul style="list-style-type: none"> • Identify land use practices and their relation to environmental health. • Explain how natural disasters affect environmental health. 	<p>A. Describe environmental health issues.</p> <ul style="list-style-type: none"> • Identify the effects on human health of air, water and soil pollution and the possible economic costs to society. • Describe how indoor pollution may affect human health (e.g., dust mites, fumes, cat dandruff). • Explain the costs and benefits of cleaning up contaminants. • Explain how common household cleaning products are manufactured and how to dispose of their by-products after use. <p>B. Explain how multiple variables determine the effects of pollution on environmental health, natural processes and human practices.</p> <ul style="list-style-type: none"> • Explain how human practices affect the quality of the water and soil. 	<p>A. Analyze the complexity of environmental health issues.</p> <ul style="list-style-type: none"> • Identify environmental health issues and explain how they have been addressed on a worldwide level. • Analyze efforts to prevent, control and/or reduce pollution through cost and benefit analysis and risk management. • Describe the impact of occupational exposures as they relate to environmental health issues. • Identify invisible pollutants and explain their effects on human health. • Explain the relationship between wind direction and velocity as it relates to dispersal and occurrence of pollutants. • Explain the different disposal methods used for toxic and hazardous waste. <p>B. Analyze the local, regional and national impacts of environmental health.</p> <ul style="list-style-type: none"> • Analyze the cost of natural disasters in both dollars and loss of natural habitat. • Research and analyze the local, state and national laws that deal with

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<p>pollution.</p> <p>C. Understand that the elements of natural systems are interdependent.</p> <ul style="list-style-type: none"> • Identify some of the organisms that live together in an ecosystem. • Understand that the components of a system all play a part in a healthy natural system. • Identify the effects of a healthy environment on the ecosystem. 	<ul style="list-style-type: none"> • Identify residential and industrial sources of pollution and their effects on environmental health. • Explain the difference between point and nonpoint source pollution. • Explain how nonpoint source pollution can affect the water supply and air quality. • Explain how acid deposition can affect water, soil and air quality. • Explain the relationship between resource use, reuse, recycling and environmental health. <p>C. Explain biological diversity.</p> <ul style="list-style-type: none"> • Explain the complex, interactive relationships among members of an ecosystem. • Explain how diversity affects ecological integrity of the natural resources. 	<ul style="list-style-type: none"> • Identify evidence of natural events around the world and their effects on environmental health (e.g., Yellowstone National Park fires). • Identify local and state environmental regulations and their impact on environmental health. • Analyze data and explain how point source pollution can be detected and eliminated. • Identify and explain ways of detecting pollution by using state-of-the-art technologies. <p>C. Explain biological diversity as an indicator of a healthy environment.</p> <ul style="list-style-type: none"> • Explain species diversity. • Analyze the effects of species extinction on the health of an ecosystem. 	<p>point and nonpoint source pollution; evaluate the costs and benefits of these laws.</p> <ul style="list-style-type: none"> • Explain mitigation and its role in environmental health. • Explain industry’s initiatives to meet state and federal mandates on clean air and water. • Describe the impacts of point and nonpoint source pollution on the Chesapeake Bay. • Identify and evaluate the costs and benefits of laws regulating air and water quality and waste disposal. <p>C. Analyze the need for a healthy environment.</p> <ul style="list-style-type: none"> • Research the relationship of some chronic diseases to an environmental pollutant. • Explain how man-made systems may affect the environment.
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4.4. Agriculture and Society			
4.4.4. GRADE 4	4.4.7. GRADE 7	4.4.10. GRADE 10	4.4.12. 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>			
<p>A. Know the importance of agriculture to humans.</p> <ul style="list-style-type: none"> • Identify people's basic needs • Explain the influence of agriculture on food, clothing, shelter and culture from one area to another. • Know how people depend on agriculture. <p>B. Identify the role of the sciences in Pennsylvania agriculture.</p> <ul style="list-style-type: none"> • Identify common animals found on Pennsylvania farms. • Identify common plants found on Pennsylvania farms. • Identify the parts of important agricultural related plants 	<p>A. Explain society's standard of living in relation to agriculture.</p> <ul style="list-style-type: none"> • Compare and contrast agricultural changes that have been made to meet society's needs. • Compare and contrast how animals and plants affect agricultural systems. • Compare several technological advancements and their effect(s) on the historical growth of agriculture. • Compare different environmental conditions related to agricultural production, cost and quality of the product. <p>B. Investigate how agricultural science has recognized the various soil types found in Pennsylvania.</p> <ul style="list-style-type: none"> • Explain the importance of particle sizes in different soil types. • Determine how water has influenced the development of Pennsylvania soil types. 	<p>A. Describe the importance of agriculture to society.</p> <ul style="list-style-type: none"> • Identify the major cash crops of Pennsylvania. • Identify what percentage of the United States' population is involved in the food and fiber industry. • Compare and contrast the influence of agriculture on a nation's culture, standard of living and foreign trade. • Identify laws that affect conservation and management of food and fiber production in the local area and analyze their impact. • Compare a contemporary economic issue in agriculture to its historical origin. <p>B. Assess the influence of agricultural science on farming practices.</p> <ul style="list-style-type: none"> • Compare the practices of no-till farming to traditional soil preparation (e.g., plow, disc). • Analyze and explain the various practices of nutrient management on the farm. 	<p>A. Analyze the management practices in the agriculture business.</p> <ul style="list-style-type: none"> • Define the components of an agriculture system that would result in a minimal waste of resources. • Identify the diversity in crop production and analyze the advantages and disadvantages of such diversity. • Research and analyze environmental practices related to agricultural systems. • Analyze the effects of agricultural practices on the economy. • Analyze the impact of nutrient management laws on Pennsylvania agriculture. • Assess the role of agriculture cooperatives. <p>B. Describe how agricultural science has influenced biotechnology.</p> <ul style="list-style-type: none"> • Investigate how bio-engineered crops may influence the food supply. • Analyze the use of specific bacteria for the control of agricultural pests. • Evaluate the use of feed additives

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<p>(i.e., corn, soybeans, barley).</p> <ul style="list-style-type: none"> Identify a fiber product from Pennsylvania farms. <p>C. Know that food and fiber originate from plants and animals.</p> <ul style="list-style-type: none"> Define and identify food and fiber. Identify what plants and animals need to grow. Identify agricultural products that are local and regional. Identify an agricultural product based on its origin. Describe several products and tell their origins. Describe the journey of a local agricultural product from production to the consumer. <p>D. Identify technology and energy use associated with agriculture.</p> <ul style="list-style-type: none"> Identify the various tools and machinery necessary for farming. Identify the types of energy used in producing food and fiber. Identify tools and machinery used in the production of agricultural products. 	<ul style="list-style-type: none"> Investigate how soil types have influenced the plant types used on Pennsylvania farms. Analyze how soil types and geographic regions have impacted the profitability of Pennsylvania farms. <p>C. Explain agricultural systems' use of natural and human resources.</p> <ul style="list-style-type: none"> Analyze the needs of plants and animals as they relate to climate and soil conditions. Identify the plants and animals that can be raised in the area and explain why. Identify natural resources necessary for agricultural systems. Compare the need for crop production to the need for animal production. Define issues associated with food and fiber production. <p>D. Explain the improvement of agricultural production through technology.</p> <ul style="list-style-type: none"> Compare the technologies that have advanced agricultural production. Explain how energy sources have changed to meet agricultural technology. 	<ul style="list-style-type: none"> Analyze and explain how farm efficiencies have changed human nutrition. <p>C. Explain the functions of the components of the food and fiber system.</p> <ul style="list-style-type: none"> Compare and analyze growing conditions in the United States to determine which plants and animals are most suitable to each region. Compare the management practices needed for a commodity (i.e., production, processing, research and development, marketing, distribution and regulations). Identify a commodity, its origin and its steps of production. Compare and analyze the cost of a commodity to its production cost. Identify and describe how food safety issues have impacted production in agriculture. <p>D. Analyze the efforts of increased efficiency in agriculture through technology.</p> <ul style="list-style-type: none"> Compare various technological advancements and analyze each for its contribution toward labor and cost efficiency. Compare the current market value of both natural and alternative 	<p>in shifting metabolism to increase muscle mass and reduce fat in farm animals.</p> <p>C. Analyze and research the social, political and economic factors that affect agricultural systems.</p> <ul style="list-style-type: none"> Analyze the costs and benefits associated with agriculture practices and how they affect economic and human needs. Analyze the costs and benefits of agriculture research practices in society. Research the use of by-products that are the results of agriculture production (e.g., manure handling, bird feathers). <p>D. Analyze research and development activities as they relate to agriculture.</p> <ul style="list-style-type: none"> Analyze the role of research, development and technology as it relates to the food and fiber system. Research and analyze energy sources used and/or generated by producing, processing and marketing agricultural products.
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		energy sources involved in the production of food and fiber.	
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4.5. Integrated Pest Management			
4.5.4. GRADE 4	4.5.7. GRADE 7	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>			
<p>A. Know types of pests.</p> <ul style="list-style-type: none"> • Identify classifications of pests. • Identify and categorize pests. • Know how pests fit into a food chain. <p>B. Explain pest control.</p> <ul style="list-style-type: none"> • Know reasons why people control pests. • Identify different methods for controlling specific pests in the home, school and community. • Identify chemical labels (e.g., caution, poison, warning). 	<p>A. Explain benefits and harmful effects of pests.</p> <ul style="list-style-type: none"> • Identify different examples of pests and explain the beneficial or harmful effects of each. • Identify several locations where pests can be found and compare the effects the pests have on each location. <p>B. Explain how pest management affects the environment.</p> <ul style="list-style-type: none"> • Explain issues related to integrated pest management including biological technology, resistant varieties, chemical practices, medical technology and monitoring techniques. • Describe how integrated pest management and related technology impact human activities. • Identify issues related to integrated pest management that affect the environment. 	<p>A. Identify similar classifications of pests that may or may not have similar effects on different regions.</p> <ul style="list-style-type: none"> • Identify environmental effect(s) of pests on different regions of the world. • Identify introduced species that are classified as pests in their new environments. <p>B. Analyze health benefits and risks associated with integrated pest management.</p> <ul style="list-style-type: none"> • Identify the health risks associated with chemicals used in common pesticides. • Assess various levels of control within different integrated pest management practices including increased immunity to pesticides, food safety, sterilization, nutrient management and weed control. 	<p>A. Research integrated pest management systems.</p> <ul style="list-style-type: none"> • Analyze the threshold limits of pests and the need for intervention in a managed environment. • Research the types of germicides and analyze their effects on homes industry, hospitals and institutions. • Design and explain an integrated pest management plan that uses a range of pest controls. <p>B. Research and analyze integrated pest management practices globally.</p> <ul style="list-style-type: none"> • Research worldwide integrated pest management systems and evaluate the level of impact. • Research and analyze the international regulations that exist related to integrated pest management. • Explain the complexities associated with moving from one level of control to the next with different integrated pest management practices and compare the related costs of each system.

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<p>C. Understand society’s need for integrated pest management.</p> <ul style="list-style-type: none"> • Identify integrated pest management practices in the home. • Identify integrated pest management practices outside the home. 	<p>C. Explain various integrated pest management practices used in society.</p> <ul style="list-style-type: none"> • Compare and contrast integrated pest management monitoring methods utilized in different community settings. • Compare integrated pest management to past practices. • Compare and analyze the long-term effects of using integrated pest management products. 	<p>C. Determine the effects of integrated pest management practices on society over time.</p> <ul style="list-style-type: none"> • Analyze the risks to the environment and society associated with alternative practices used in integrated pest management. • Analyze the benefits to the environment and society associated with alternative practices used in integrated pest management. 	<p>C. Analyze the historical significance of integrated pest management on society.</p> <ul style="list-style-type: none"> • Explain the dynamics of integrated pest management practices and their relative effects upon society. • Identify historic events affecting integrated pest management and cite the practices used (e.g., avian flu, bubonic plague, potato blight). • Research and analyze the long-term effects of pest management practices on the environment.
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4.6. Ecosystems and their Interactions			
4.6.4. GRADE 4	4.6.7. GRADE 7	4.6.10. GRADE 10	4.6.12. 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>			
<p>A. Understand that living things are dependent on nonliving things in the environment for survival.</p> <ul style="list-style-type: none"> • Identify and categorize living and nonliving things. • Describe the basic needs of an organism. • Identify basic needs of a plant and an animal and explain how their needs are met. • Identify plants and animals with their habitat and food sources. • Identify environmental variables that affect plant growth. • Describe how animals interact with plants to meet their needs for shelter. • Describe how certain insects interact with soil for their needs. • Understand the components of a food chain. • Identify a local ecosystem and its living and nonliving components. • Identify a simple ecosystem and its living and nonliving components. • Identify common soil textures. • Identify animals that live 	<p>A. Explain the flows of energy and matter from organism to organism within an ecosystem.</p> <ul style="list-style-type: none"> • Identify and explain the characteristics of biotic and abiotic. • Describe and explain the adaptations of plants and animals to their environment. • Demonstrate the dependency of living components in the ecosystem on the nonliving components. • Explain energy flow through a food web. • Explain the importance of the predator/prey relationship and how it maintains the balances within ecosystems. • Understand limiting factors and predict their effects on an organism. • Identify niches for producers, consumers and decomposers within an ecosystem. • Compare and contrast the major ecosystems of Pennsylvania. • Identify the major characteristics of a biome. • Compare and contrast different 	<p>A. Explain the biotic and abiotic components of an ecosystem and their interaction.</p> <ul style="list-style-type: none"> • Identify the major biomes and explain their similarities and differences. • Compare and contrast the interactions of biotic and abiotic components in an ecosystem. • Analyze the effects of abiotic factors on specific ecosystems. • Describe how the availability of resources affects organisms in an ecosystem. • Explain energy flow in a food chain through an energy pyramid. • Evaluate the efficiency of energy flow in a food chain. • Explain the concept of carrying capacity in an ecosystem. • Explain trophic levels. • Identify a specific environmental impact and predict what change may take place to affect homeostasis. • Examine and explain how organisms modify their 	<p>A. Analyze the interdependence of an ecosystem.</p> <ul style="list-style-type: none"> • Analyze the relationships among components of an ecosystem. • Evaluate the efficiency of energy flow within an ecosystem. • Explain limiting factors and their impact on carrying capacity. • Understand how biological diversity impacts the stability of an ecosystem. • Analyze the positive or negative impacts of outside influences on an ecosystem. • Analyze how different land use practices can affect the quality of soils.

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<ul style="list-style-type: none"> • underground. <p>B. Understand the concept of cycles.</p> <ul style="list-style-type: none"> • Explain the water cycle. • Explain the carbon dioxide/oxygen cycle (photosynthesis). <p>C. Identify how ecosystems change over time.</p>	<p>biomes and their characteristics.</p> <ul style="list-style-type: none"> • Identify the relationship of abiotic and biotic components and explain their interaction in an ecosystem. • Explain how different soil types determine the characteristics of ecosystems. <p>B. Explain the concepts of cycles.</p> <ul style="list-style-type: none"> • Identify and explain cycles within an ecosystem. • Analyze the role of different cycles within an ecosystem. <p>C. Explain how ecosystems change over time.</p> <ul style="list-style-type: none"> • Explain how ecosystems change. • Identify the succession stages of a given ecosystem. • Explain how specific organisms may change an ecosystem. • Explain a change in an ecosystem that relates to humans. 	<p>environments to sustain their needs.</p> <ul style="list-style-type: none"> • Assess the effects of latitude and altitude on biomes. • Interpret possible causes of population fluctuations. • Explain how erosion and sedimentation have changed the quality of soil related habitats. <p>B. Explain how cycles affect the balance in an ecosystem.</p> <ul style="list-style-type: none"> • Describe an element cycle and its role in an ecosystem. • Explain the consequences of interrupting natural cycles. <p>C. Analyze how ecosystems change over time.</p> <ul style="list-style-type: none"> • Identify and explain the succession stages in an ecosystem. • Identify causes of succession. • Analyze consequences of interrupting natural cycles. 	<p>B. Analyze the impact of cycles on the ecosystem.</p> <ul style="list-style-type: none"> • Evaluate the materials necessary for natural cycles. • Explain the processes involved in the natural cycles. <p>C. Analyze how human action and natural changes affect the balance within an ecosystem.</p> <ul style="list-style-type: none"> • Analyze the effects of substances that move through natural cycles. • Analyze the effects of natural occurrences and their effects on ecosystems. • Analyze effects of human action on an ecosystem. • Compare the stages of succession and how they influence the cycles existing in an ecosystem.
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4.7. Threatened, Endangered and Extinct Species			
4.7.4. GRADE 4	4.7.7. GRADE 7	4.7.10. GRADE 10	4.7.12. 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>			
<p>A. Identify differences in living things.</p> <ul style="list-style-type: none"> • Explain why plants and animals are different colors, shapes and sizes and how these differences relate to their survival. • Identify characteristics that living things inherit from their parents. • Explain why each of the four elements in a habitat is essential for survival. • Identify local plants or animals and describe their habitat. <p>B. Know that adaptations are important for survival.</p> <ul style="list-style-type: none"> • Explain how specific adaptations can help a living organism to survive. • Explain what happens to a living thing when its food, water, shelter or space is changed. 	<p>A. Describe diversity of plants and animals in ecosystems.</p> <ul style="list-style-type: none"> • Select an ecosystem and describe different plants and animals that live there. • Identify adaptations in plants and animals. • Recognize that adaptations are developed over long periods of time and are passed on from one generation to the next. • Understand levels of ecosystem organization (e.g., individuals, populations, species). <p>B. Explain how species of living organisms adapt to their environment.</p> <ul style="list-style-type: none"> • Explain the role of individual variations in natural selection. • Explain how an adaptation is an inherited structure or behavior that helps an organism survive and reproduce. • Describe how a particular trait may be selected over time and account for a species' adaptation. • Compare and contrast animals and plants that have very specific survival requirements with those that have more general requirements for survival. 	<p>A. Explain the significance of diversity in ecosystems.</p> <ul style="list-style-type: none"> • Explain the role that specific organisms have in their ecosystem. • Identify a species and explain what effects its increase or decline might have on the ecosystem. • Identify a species and explain how its adaptations are related to its niche in the environment. <p>B. Explain how structure, function and behavior of plants and animals affect their ability to survive.</p> <ul style="list-style-type: none"> • Describe an organism's adaptations for survival in its habitat. • Compare adaptations among species. 	<p>A. Analyze biological diversity as it relates to the stability of an ecosystem.</p> <ul style="list-style-type: none"> • Examine and explain what happens to an ecosystem as biological diversity changes. • Explain the relationship between species' loss and bio-diversity. • Examine and explain how a specialized interaction between two species may affect the survival of both species. <p>B. Examine the effects of extinction, both natural and human caused, on the environment.</p> <ul style="list-style-type: none"> • Predict how human or natural action can produce change to which organisms cannot adapt. • Identify species that became extinct through natural causes and explain how that occurred. • Identify a species that became extinct due to human actions and explain what occurred.

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<p>C. Define and understand extinction.</p> <ul style="list-style-type: none"> • Identify plants and animals that are extinct. • Explain why some plants and animals are extinct. • Know that there are local and state laws regarding plants and animals. 	<p style="padding-left: 20px;">for survival.</p> <ul style="list-style-type: none"> • Explain how living things respond to changes in their environment. • Explain how one species may survive an environmental change while another might not. <p>C. Explain natural or human actions in relation to the loss of species.</p> <ul style="list-style-type: none"> • Identify natural or human impacts that cause habitat loss. • Explain how habitat loss can affect the interaction among species and the population of a species. • Analyze and explain the changes in an animal population over time. • Explain how a habitat management practice affects a population. • Explain the differences among threatened, endangered and extinct species. • Identify Pennsylvania plants and animals that are on the threatened or endangered list. • Describe state laws passed regarding threatened and endangered species in Pennsylvania. • Explain why one species may be more susceptible to becoming endangered than another species. 	<p>C. Identify and explain why adaptations can lead to specialization.</p> <ul style="list-style-type: none"> • Explain factors that could lead to a species' increase or decrease. • Explain how management practices may influence the success of specific species. • Identify and explain criteria used by scientists for categorizing organisms as threatened, endangered or extinct. 	<p>C. Analyze the effects of threatened, endangered or extinct species on human and natural systems.</p> <ul style="list-style-type: none"> • Identify and explain how a species' increase, decline or elimination affects the ecosystem and/or human social, cultural and economic structures. • Explain why natural populations do not remain constant. • Analyze management strategies regarding threatened or endangered species. • Identify laws, agreements or treaties at national or international levels regarding threatened or endangered species. • Analyze the role of zoos and wildlife preserves on species that have been identified as threatened or endangered. • Examine the influence of wildlife management in preserving different species in Pennsylvania (e.g., bobcat, elk, bald eagle).
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4.8. Humans and the Environment			
4.8.4. GRADE 4	4.8.7. GRADE 7	4.8.10. GRADE 10	4.8.12. 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>			
<p>A. Identify the biological requirements of humans.</p> <ul style="list-style-type: none"> • Explain how a dynamically changing environment provides for sustainability of living systems. • Identify several ways that people use natural resources. <p>B. Know that environmental conditions influence where and how people live.</p> <ul style="list-style-type: none"> • Identify how regional natural resources influence what people use. • Explain the influence of climate on how and where people live. 	<p>A. Describe how the development of civilization relates to the environment.</p> <ul style="list-style-type: none"> • Explain how people use natural resources in their environment. • Locate and identify natural resources in different parts of the world. • Compare and contrast how people use natural resources throughout the world. <p>B. Explain how people use natural resources.</p> <ul style="list-style-type: none"> • Describe how natural resources are used for survival. • Explain how natural resources and technological changes have affected the development of civilizations. • Explain how climate and extreme weather events (e.g., drought, flood) influence people's lives. 	<p>A. Analyze how society's needs relate to the sustainability of natural resources.</p> <ul style="list-style-type: none"> • Explain why some societies have been unable to meet their natural resource needs. • Compare and contrast the use of natural resources and the environmental conditions in several countries. • Describe how uses of natural resources impact sustainability. <p>B. Analyze the relationship between the use of natural resources and sustaining our society.</p> <ul style="list-style-type: none"> • Explain the role of natural resources in sustaining society. • Analyze the effects of a natural resource's availability on a community or region. 	<p>A. Explain how technology has influenced the sustainability of natural resources over time.</p> <ul style="list-style-type: none"> • Describe how technology has changed the use of natural resources by business and industry. • Analyze the effect of natural resource conservation on a product over time (e.g., automobile manufacturing, aluminum can recycling, paper products). <p>B. Analyze technology's role on natural resource sustainability.</p> <ul style="list-style-type: none"> • Explain how technology has decreased the use of raw natural resources. • Explain how technology has impacted the efficiency of the use of natural resources. • Analyze the role of technology in the reduction of pollution.

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<p>C. Explain how human activities may change the environment.</p> <ul style="list-style-type: none"> • Identify everyday human activities and how they affect the environment. • Identify examples of how human activities within a community affect the natural environment. <p>D. Know the importance of natural resources in daily life.</p> <ul style="list-style-type: none"> • Identify items used in daily life that come from natural resources. • Identify ways to conserve our natural resources. • Identify major land uses in the community. 	<p>C. Explain how human activities may affect local, regional and national environments.</p> <ul style="list-style-type: none"> • Describe what effect consumption and related generation of wastes have on the environment. • Explain how a particular human activity has changed the local area over the years. <p>D. Explain the importance of maintaining the natural resources at the local, state and national levels.</p> <ul style="list-style-type: none"> • Explain how human activities and natural events have affected ecosystems. • Explain how conservation practices have influenced ecosystems. • Define the roles of Pennsylvania agencies that deal with natural resources. 	<p>C. Analyze how human activities may cause changes in an ecosystem.</p> <ul style="list-style-type: none"> • Analyze and evaluate changes in the environment that are the result of human activities. • Compare and contrast the environmental effects of different industrial strategies (e.g., energy generation, transportation, logging, mining, agriculture). <p>D. Explain how the concept of supply and demand affects the environment.</p> <ul style="list-style-type: none"> • Identify natural resources for which societal demands have been increasing. • Identify specific resources for which human consumption has resulted in scarcity of supply (e.g., buffalo, lobsters). • Describe the relationship between population density and resource use and management. 	<p>C. Analyze how pollution has changed in quality, variety and toxicity as the United States developed its industrial base.</p> <ul style="list-style-type: none"> • Analyze historical pollution trends and project them for the future. • Compare and contrast historical and current pollution levels at a given location. <p>D. Analyze the international implications of environmental occurrences.</p> <ul style="list-style-type: none"> • Identify natural occurrences that have international impact (e.g., El Nino, volcano eruptions, earthquakes). • Analyze environmental issues and their international implications.
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4.9. Environmental Laws and Regulations			
4.9.4. GRADE 4	4.9.7. GRADE 7	4.9.10. GRADE 10	4.9.12. 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>			
<p>A. Know that there are laws and regulations for the environment.</p> <ul style="list-style-type: none"> • Identify local and state laws and regulations regarding the environment. • Explain how the recycling law impacts the school and home. • Identify and describe the role of a local or state agency that deals with environmental laws and regulations. 	<p>A. Explain the role of environmental laws and regulations.</p> <ul style="list-style-type: none"> • Identify and explain environmental laws and regulations (e.g., Clean Air Act, Clean Water Act, Recycling and Waste Reduction Act, Act 26 on Agricultural Education). • Explain the role of local and state agencies in enforcing environmental laws and regulations (e.g., Department of Environmental Protection, Department of Agriculture, Game Commission). 	<p>A. Explain why environmental laws and regulations are developed and enacted.</p> <ul style="list-style-type: none"> • Explain the positive and negative impacts associated with passing environmental laws and regulations. • Understand conflicting rights of property owners and environmental laws and regulations. • Analyze the roles that local, state and federal governments play in the development and enforcement of environmental laws. • Identify local and state environmental regulations and their impact on environmental health. • Explain the positive and negative impacts of the Endangered Species Act. 	<p>A. Analyze environmental laws and regulations as they relate to environmental issues.</p> <ul style="list-style-type: none"> • Analyze and explain how issues lead to environmental law or regulation (e.g., underground storage tanks, regulation of water discharges, hazardous, solid and liquid industrial waste, endangered species). • Compare and contrast environmental laws and regulations that may have a positive or negative impact on the environment and the economy. • Research and describe the effects of an environmental law or regulation and how it has impacted the environment.

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XII. GLOSSARY

Abiotic:	A nonliving factor or element (e.g., light, water, heat, rock, energy, mineral).
Acid deposition:	Precipitation with a pH less than 5.6 that forms in the atmosphere when certain pollutants mix with water vapor.
Biological diversity:	The variety and complexity of species present and interacting in an ecosystem and the relative abundance of each.
Biotic:	An environmental factor related to or produced by living organisms.
Closing the loop:	A link in the circular chain of recycling events that promotes the use of products made with recycled materials.
Commodities:	Economic goods or products before they are processed and/or given a brand name, such as a product of agriculture.
Composting:	The process of mixing decaying leaves, manure and other nutritive matter to improve and fertilize soil.
Consumer:	1) Those organisms that obtain energy by feeding on other organisms and their remains. 2) a 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.
Delineate:	To trace the outline; to draw; to sketch; to depict or picture.
Ecosystem:	A community of living organisms and their interrelated physical and chemical environment.
Endangered species:	A species that is in danger of extinction throughout all or a significant portion of its range.

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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.
Equilibrium:	The ability of an ecosystem to maintain stability among its biological resources (e.g., forest, fisheries, crops) so that there is a steady optimum yield.
Extinction:	The complete elimination of a species from the earth.
Groundwater:	Water that infiltrates the soil and is located in underground reservoirs called aquifers.
Hazardous waste:	A solid that, because of its quantity or concentration or its physical, chemical or infectious characteristics, may cause or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed.
Homeostasis:	The tendency for a system by resisting change to remain in a state of equilibrium.
Incinerating:	Burning to ashes; reducing to ashes.
Integrated pest management:	A variety of pest control methods that include repairs, traps, bait, poison, etc. to eliminate pests.
Lentic:	Relating to or living in still water
Lotic:	Relating to or living in actively moving water.
Mitigation:	The policy of constructing or creating man-made habitats, such as wetlands, to replace those lost to development.
Niche (ecological):	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.
Nonpoint source Pollution:	Contamination that originates from many locations that all discharge into a location (e.g., a lake, stream, land area).

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Nonrenewable resources:	Substances (e.g., oil, gas, coal, copper, gold) that, once used, cannot be replaced in this geological age.
Point source pollution:	Pollutants discharged from a single identifiable location (e.g., pipes, ditches, channels, sewers, tunnels, containers of various types).
Pest:	A label applied to an organism when it is in competition with humans for some resource.
Recycling:	Collecting and reprocessing a resource or product to make into 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:	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, selecting and implementing actions to reduce risk to human health and to ecosystems.
Shredder:	Through chewing and/or grinding, microorganisms feed on non-woody coarse particulate matter, primarily leaves.
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:	The ability to keep in existence or maintain. A sustainable ecosystem is one that can be maintained.
Trophic levels:	The role of an organism in nutrient and energy flow within an ecosystem (e.g., herbivore, carnivore, decomposer).
Waste Stream:	The flow of (waste) materials from generation, collection and separation to disposal.
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.

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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).