

ENVIRONMENT & ECOLOGY ACADEMIC STANDARDS COVERED BY CREEK CONNECTIONS MODULE ACTIVITIES

Academic Standards for Environment and Ecology

22 Pa. Code, Ch. 4, Appendix B (# 006- 273) Final Form – Annex A July 12, 2001

4.1 Watersheds and Wetlands

4.1.7. GRADE 7

4.1.7.A. Explain the role of the water cycle within a watershed.

- **Explain the water cycle.**

Drinking Water Module: Only a Drop to Drink on Earth

Groundwater Module: Only a Drop to Drink on Earth

- **Explain the water cycle as it relates to a watershed.**

Groundwater Module: Water Cycle Video Quiz

4.1.7.B. Understand the role of the watershed.

- **Identify and explain what determines the boundaries of a watershed.**

Topographic Map Module: Watershed Delineation, Watershed Area, Topo Map Explorer

Watersheds Module: Watershed Demonstration Activity, Puzzle of Pennsylvania Watersheds, Research one of our Watersheds, Sense of Place in Pennsylvania, Creek Geeks Knowledgey-Watershed Version

- **Explain how water enters a watershed.**

Basic Water Chemistry Module: pH Test #4: Acidic Snow Melt

Watershed Module: Watershed Demonstration Activity, Puzzle of Pennsylvania Watersheds, Research one of our Watersheds, Sense of Place in Pennsylvania, Creek Geeks Knowledgey-Watershed Version

- **Explain factors that affect water quality and flow through a watershed.**

Aquatic Life Module: Treatment Plants

Basic Water Chemistry Module: My Stream's Temperatures, Temperature: Air vs. Water vs. More Water, pH People, pH Test #1: Scaling Common Liquids, pH Test #3: Rain, Surface, Ground Water, pH Test #4: Acidic Snow Melt, Acid Buffering Capacity: Ground Water vs. Surface Water, Nutrients: Nutrition or Nuisance?, Nitrates In Our Water, A "Soily" N and P, Hardness Comparisons, Water Chemistry Bingo

Drinking Water Module: Chemical Testing of Drinking Water, Hardness Comparisons, Hardness Evidence Search

Riparian Buffers Module: Buffered Stream/ Healthy Stream, Riparian Buffers Metaphors!, Riparian Videos, Riparian Runoff Rivalry

Stream Geology: Interpreting River Sediments

Water Pollution Module: Pollution P.I., Riverfront Property, Is There AMD In This Stream?, Iron Investigators, Water Pollution Scavenger Hunt, VIDEO-Clean Water

Wetlands Module: Treatment Plants, Wetlands Creek Geek Knowledgey

Watershed Module: Watershed Demonstration Activity, Puzzle of Pennsylvania Watersheds, Research one of our Watersheds, Sense of Place in Pennsylvania, Creek Geek Knowledgey-Watershed Version

4.1.7.C. Explain the effects of water on the life of organisms in a watershed.

- **Explain how water is necessary for all life.**

Water Pollution Module: Parts Per Million, Riverfront Property, VIDEO-Clean Water

- **Explain how the physical components of aquatic systems influence the organisms that live there in terms of size, shape and physical adaptations.**

Aquatic Life Module: Aquatic Insects Parts and Pieces, Create an Aquatic Macroinvertebrate, Microhabitats #1, Cattail Check-up, Sinking Slowly, Life at the Surface, Create a Winter Pond

Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Life at the Surface, Microhabitats #1: Quantitative Study of Microhabitats, Multi-plate Sampling, Artificial Leaf Packs

Freshwater Fish Module: Fishy Who's Who, Create a Winter Pond

Wetlands Module: Cattail Check-up, Wetlands Creek Geek Knowledgey

- **Describe the life cycle of organisms that depend on water.**

Aquatic Life Module: Hooks and Ladders

Aquatic Macroinvertebrates Module: Aquatic Insect Life Cycles

Freshwater Fish Module: Fighting for Life in French Creek, Hooks and Ladders

Wetlands Module: Temporary Wetland Survivor

- **Identify organisms that have aquatic stages of life and describe those stages.**

Aquatic Life Module: Water Plant Art, Micro Odyssey

Aquatic Macroinvertebrates Module: Aquatic Insect Life Cycles

4.1.7.D. Explain and describe characteristics of a wetland.

- **Identify specific characteristics of wetland plants and soils.**

Aquatic Life Module: This Plant Key Is All Wet!, Water Plant Art, Treatment Plants, Cattail Check-up

Riparian Buffers Module: RCE

Wetlands Module: Wetland Observations, Treatment Plants, This Plant Key Is All Wet!, Cattail Check-up, VIDEO – Freshwater Wetlands, Wetlands Creek Geek Knowledgey

- **Recognize the common types of plants and animals.**

Aquatic Life Module: This Plant Key Is All Wet!, Water Plant Art, Micro Odyssey

Riparian Buffers Module: Tree ID, Riparian Round Up

Wetlands Module: Wetland Observations, This Plant Key Is All Wet!, VIDEO – Freshwater Wetlands, Wetlands Creek Geek Knowledgey

- **Describe different types of wetlands.**

Riparian Buffers Module: Riparian Videos

Wetlands Module: Wetland Observations, VIDEO – Freshwater Wetlands, Wetlands Creek Geek Knowledgey

- **Describe the different functions of a wetland.**

Aquatic Life Module: Treatment Plants

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE, Riparian Buffers Metaphors!, Riparian Videos, Wrangling Over Riparian Zones

Water Pollution Module: VIDEO-Clean Water

Wetlands Module: Treatment Plants, Wetland Metaphors!, VIDEO – Freshwater Wetlands

4.1.7.E. Describe the impact of watersheds and wetlands on people.

- **Explain the impact of watersheds and wetlands in flood control, wildlife habitats and pollution abatement.**

Aquatic Life Module: Treatment Plants, Hooks and Ladders

Freshwater Fish Module: Fighting for Life in French Creek, Hooks and Ladders

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE, Riparian Buffers Metaphors!, Riparian Videos, Wrangling Over Riparian Zones, Riparian Runoff Rivalry

Water Pollution Module: VIDEO-Clean Water

Wetlands Module: Treatment Plants, Wetland Metaphors!, VIDEO – Freshwater Wetlands, Town Hall Meeting, Wetlands Creek Geek Knowledgey

- **Explain the influence of flooding on wetlands.**

Wetlands Module: Wetland Observations, Wetland Metaphors!

4.1.10. GRADE 10

4.1.10.A. Describe changes that occur from a stream's origin to its final outflow.

- **Identify Pennsylvania's major watersheds and their related river systems.**
Watershed Module: Watershed Demonstration Activity, Puzzle of Pennsylvania Watersheds, Research one of our Watersheds, Sense of Place in Pennsylvania, Creek Geek Knowledgey-Watershed Version
- **Describe changes by tracing a specific river's origin back to its headwaters including its major tributaries.**
Topographic Map Module: Stream Length, Stream Gradient, Watershed Delineation, Watershed Area, Land Use in Watersheds, Topo Map Explorer
Watershed Module: Watershed Demonstration Activity, Puzzle of Pennsylvania Watersheds, Research one of our Watersheds, Sense of Place in Pennsylvania, Creek Geek Knowledgey-Watershed Version
Stream Geology Module: Flowing Streams, I Live to Sieve Stream Sediments, Settling Sediments, Stream Movement Slide Show, Stream Table- Waterways on the Move

4.1.10.B. Explain the relationship among landforms, vegetation and the amount and speed of water.

- **Analyze a stream's physical characteristics.**
Basic Water Chemistry Module: My Stream's Temperatures, Measuring Turbidity with Filters
Riparian Buffers Module: RCE
Stream Geology Module: Flowing Streams, I Live to Sieve Stream Sediments, Pebble Count Substrate Study, Settling Sediments, Steam Movement Slide Show, Stream Table- Waterways on the Move
- **Describe how topography influences streams.**
Topographic Map Module: Stream Length, Stream Gradient, Watershed Delineation
- **Explain the influence of mountains on precipitation.**
- **Explain how vegetation affects storm water runoff.**
Aquatic Life Module: Treatment Plants
Basic Water Chemistry Module: Nitrates In Our Water, A "Soily" N and P, Measuring Turbidity with Filters
Riparian Buffers Module: Buffered Stream/ Healthy Stream, RCE, Riparian Buffers Metaphors!, Riparian Videos, Riparian Round Up, Riparian Runoff Rivalry
Wetlands Module: Treatment Plants, Wetlands Creek Geek Knowledgey
- **Delineate the boundaries of a watershed.**
Topographic Map Module: Watershed Delineation. Watershed Area, Topo Map Explorer
- **Describe factors that affect the quality of groundwater.**
Basic Water Chemistry Module: Nitrates In Our Water, Hardness Comparisons
Drinking Water Module: Chemical Testing of Drinking Water, Hardness Comparisons, Hardness Evidence Search
- **Explain how the speed of water and vegetation cover relates to erosion.**
Basic Water Chemistry Module: A "Soily" N and P, Measuring Turbidity with Filters
Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE, Riparian Buffers Metaphors!, Riparian Videos, Riparian Runoff Rivalry
Stream Geology Module: Flowing Streams, I Live to Sieve Stream Sediments, Pebble Count Substrate Study, Settling Sediments, Stream Movement Slide Show, Stream Table- Waterways on the Move

4.1.10.C. Describe the physical characteristics of a stream and determine the types of organisms found in aquatic environments.

- **Describe and explain the physical factors that affect a stream and the organisms living there.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs, Microhabitats #1, Life at the Surface, Turbid Vision, Hooks and Ladders, Create a Winter Pond

Aquatic Macroinvertebrate Module: Life at the Surface, Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Microhabitats #1: Quantitative Study of Microhabitats, Multi-plate Sampling, Artificial Leaf Packs, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledgey, Aquatic Insect Lab Practical

Basic Water Chemistry Module: My Stream's Temperatures, Temperature: Air vs. Water vs. More Water, Acid Buffering Capacity: Groundwater vs. Surface Water, Measuring Turbidity with Filters, Turbid Vision

Freshwater Fish Module: Fighting for Life in French Creek, Hooks and Ladders, Create a Winter Pond

Riparian Buffers Module: RCE, EcoTones

Stream Geology Module: Flowing Streams, I Live to Sieve Stream Sediments, Settling Sediments, Stream Movement Slide Show, Stream Table- Waterways on the Move

- **Identify terrestrial and aquatic organisms that live in a watershed.**

Aquatic Life Module: Web of Life, Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs, Microhabitat #2, This Plant Key Is All Wet!, Water Plant Art, Micro Odyssey

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Microhabitats #2: Quantitative Study of Microhabitats, Multi-plate Sampling, Artificial Leaf Packs, Macroinvertebrate Match Game, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledgey, Aquatic Insect Lab Practical

Drinking Water Module: Bacteria Testing in Drinking Water

Riparian Buffers Module: RCE, Tree ID, Riparian Round Up

Wetlands Module: Web of Life, This Plant Key Is All Wet!

- **Categorize aquatic organisms found in a watershed continuum from headwater to mouth (e. g., shredder, predator, decomposer).**

Aquatic Life Module: Microhabitats #1

Aquatic Macroinvertebrates Module: Microhabitats #1: Quantitative Study of Microhabitats, Multi-plate Sampling, Artificial Leaf Packs

Riparian Buffers Module: RipCycles & Nutrient Travels

Topographic Map Module: Stream Order

- **Identify the types of organisms that would live in a stream based on the stream's physical characteristics.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs, Microhabitats #1

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Microhabitats #1: Quantitative Study of Microhabitats, Multi-plate Sampling, Artificial Leaf Packs, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledgey, Aquatic Insect Lab Practical

Riparian Buffers Module: RCE

Stream Geology Module: Flowing Streams, I Live to Sieve Stream Sediments, Settling Sediments, Stream Movement Slide Show, Stream Table- Waterways on the Move

- **Explain the habitat needs of specific aquatic organisms.**

Aquatic Life Module: Create an Aquatic Macroinvertebrate, Microhabitats #1, Microhabitat #2, Hooks and Ladders

Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Microhabitats #1: Quantitative Study of Microhabitats, Microhabitats #2: Quantitative Study of Microhabitats, Multi-plate Sampling, Artificial Leaf Packs

Freshwater Fish Module: Fishy Who's Who, Fighting for Life in French Creek, Hooks and Ladders

Wetlands Module: Temporary Wetland Survivor

4.1.10.D. Describe the multiple functions of wetlands.

- Describe wetlands in terms of their effects (e. g., habitat, flood, buffer zones, prevention areas, nurseries, food production areas).

Riparian Buffers Module: RCE, Riparian Buffers Metaphors, Riparian Videos, RipCycles & Nutrient Travels, Wrangling Over Riparian Zones, Riparian Runoff Rivalry

Wetlands Module: Wetland Metaphors, Wetlands Creek Geek Knowledgey

- Explain how a wetland influences water quality, wildlife and water retention.

Aquatic Life Module: Treatment Plants

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE, Riparian Buffers Metaphors!, Riparian Videos, Wrangling Over Riparian Zones, Riparian Round Up, Riparian Runoff Rivalry

Water Pollution Module: VIDEO-Clean Water

Wetlands Module: Treatment Plants, Wetland Metaphors, Wetlands Creek Geek Knowledgey

- Analyze wetlands through their indicators (e. g., soils, plants, hydrology).

Riparian Buffers Module: Riparian Buffers Module: RCE, Tree ID, Riparian Runoff Rivalry

Wetlands Module: Wetland Observations, Wetlands Creek Geek Knowledgey

4.1.10.E. Identify and describe natural and human events on watersheds and wetlands.

- Describe how natural events affect a watershed (e. g., drought, floods).

Wetlands Module: Wetland Observations, VIDEO – Freshwater Wetlands

- Identify the effects of humans and human events on watersheds.

Basic Water Chemistry Module: pH Test #3: Rain, Surface, Ground Water, pH Test #4: Acidic Snow Melt, pH Test #5: pH Affects Living Things

Drinking Water Module: Bacteria Testing in Drinking Water

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE, Wrangling Over Riparian Zones, Riparian Round Up, Riparian Runoff Rivalry

Topographic Map Module: Land Use in Watersheds, Topo Map Explorer

Water Pollution Module: Name That Source, Riverfront Property, Water Pollution Scavenger Hunt, VIDEO-Clean Water

Wetlands Module: Wetland Observations, VIDEO – Freshwater Wetlands, Marsh Madness, Town Hall Meeting

4.1.12 GRADE 12

4.1.12.A. Categorize stream order in a watershed.

- Explain the concept of stream order.

Topographic Map Module: Stream Order, Stream Length, Watershed Area, Topo Map Explorer

- Identify the order of watercourses within a major river's watershed.

Topographic Map Module: Stream Order, Stream Length, Watershed Area, Topo Map Explorer

- Compare and contrast the physical differences found in the stream continuum from headwater to mouth.

Topographic Map Module: Stream Order, Stream Length, Stream Gradient, Watershed Area, Topo Map Explorer

4.1.12.B. Explain the relationships that exist within watersheds in the United States.

- Understand that various ecosystems may be contained in a watershed.

Riparian Buffers Module: EcoTones, Riparian Round Up

Wetlands Module: Temporary Wetland Survivor, Wetlands Creek Geek Knowledgey

- **Examine and describe the ecosystems contained within a specific watershed.**

Riparian Buffers Module: EcoTones, Riparian Round Up

Wetlands Module: Temporary Wetland Survivor, Wetlands Creek Geek Knowledgey

- **Identify and describe the major watersheds in the United States.**

Watershed Module: Watershed Demonstration Activity, Puzzle of Pennsylvania Watersheds, Research one of our Watersheds, Sense of Place in Pennsylvania, Creek Geek Knowledgey-Watershed Version

4.1.12.C. Analyze the parameters of a watershed.

- **Interpret physical, chemical and biological data as a means of assessing the environmental quality of a watershed.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs, When the Oxygen is Gone

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Multi-plate Sampling, Artificial Leaf Packs, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledgey, Aquatic Insect Lab Practical

Basic Water Chemistry Module: My Stream's Temperatures, pH People, pH Test #1: Scaling Common Liquids, pH Test #2: Manipulating a liquid's pH, pH Test #3: Rain, Surface, Ground Water, pH Test #4: Acidic Snow Melt, pH Test #5: pH Affects Living Things, Acid Buffering Capacity: Groundwater vs. Surface Water, Parts Per Million, Nitrates In Our Water, A "Soily" N and P, Measuring Turbidity with Filters, Hardness Comparisons, Water Chemistry Bingo

Drinking Water Module: Bacteria Testing in Drinking Water, Chemical Testing of Drinking Water, Hardness Comparisons, Hardness Evidence Search

Freshwater Fish Module: When the Oxygen is Gone

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE

Stream Geology: Interpreting River Sediments

Water Pollution Module: Pollution P.I., Is There AMD In This Stream?, Iron Investigators

- **Apply appropriate techniques in the analysis of a watershed (e. g., water quality, biological diversity, erosion, sedimentation).**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledgey, Aquatic Insect Lab Practical

Basic Water Chemistry Module: My Stream's Temperatures, Nitrates In Our Water, A "Soily" N and P, Measuring Turbidity with Filters, Hardness Comparisons

Drinking Water Module: Hardness Comparisons, Hardness Evidence Search

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE

Stream Geology: Interpreting River Sediments

Water Pollution Module: Pollution P.I., Is There AMD In This Stream?, Iron Investigators

4.1.12.D. Analyze the complex and diverse ecosystems of wetlands.

- **Explain the functions of habitat, nutrient production, migration stopover and groundwater recharge as it relates to wetlands.**

Riparian Buffers Module: RCE, Riparian Buffers Metaphors!, Riparian Videos, RipCycles & Nutrient Travels, Wrangling Over Riparian Zones

Wetlands Module: Wetland Metaphors!, Wetlands Creek Geek Knowledgey

- **Explain the dynamics of a wetland ecosystem.**

Riparian Buffers Module: EcoTones, RipCycles

- **Describe and analyze different types of wetlands.**

Riparian Buffers Module: RCE

Wetlands Module: Wetland Observations, VIDEO – Freshwater Wetlands, Wetlands Creek Geek Knowledge

4.1.12.E. Evaluate the trade-offs, costs and benefits of conserving watersheds and wetlands.

- **Evaluate the effects of natural events on watershed and wetlands.**

Topographic Map Module: Land Use in Watersheds

- **Evaluate the effects of human activities on watersheds and wetlands.**

Aquatic Life Module: Treatment Plants, Hooks and Ladders

Freshwater Fish Module: Fighting for Life in French Creek, Hooks and Ladders

Riparian Buffers Module: Buffered Stream, Healthy Stream, RCE, Riparian Buffers Metaphors!, RipCycles & Nutrient Travels, Wrangling Over Riparian Zones, Riparian Round Up, Riparian Runoff Rivalry

Topographic Map Module: Land Use in Watersheds, Topo Map Explorer

Water Pollution Module: Riverfront Property, Creek Geek Knowledge

Wetlands Module: Treatment Plants, Marsh Madness, Town Hall Meeting

4.2. Renewable and Nonrenewable Resources

4.2.7. GRADE 7

4.2.7.A. Know that raw materials come from natural resources.

- Identify resources used to provide humans with energy, food, housing and water.
- Explain how plants and animals maybe 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

4.2.7.B. Examine the renewability of resources.

- 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 alternative fuels.

4.2.7.C. Explain natural resource distribution.

- Distinguish between readily available and less accessible resources.
Drinking Water Module: Only a Drop to Drink on Earth
Groundwater Module: Only a Drop to Drink on Earth
- 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.
Riparian Buffers Module: Wrangling Over Riparian Zones
Water Pollution Module: Riverfront Property, Creek Geek Knowledge, Water Pollution Scavenger Hunt

4.2.7.D. Describe the role of recycling and waste management.

- 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.

4.2.10. GRADE 10

4.2.10.A. Explain that renewable and nonrenewable resources supply energy and materials.

- 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.

4.2.10.B. Evaluate factors affecting availability of natural resources.

- Describe natural occurrences that may affect the natural resources.
Drinking Water Module: Only a Drop to Drink on Earth, Water Treatment in the Classroom
Groundwater Module: Only a Drop to Drink on Earth
- Analyze technologies that affect the use of our natural resources.
Drinking Water Module: Water Treatment in the Classroom
- Evaluate the effect of consumer desires on various natural resources.

4.2.10.C. Analyze how man-made systems have impacted the management and distribution of natural resources.

- 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.

4.2.10.D. Explain different management alternatives involved in recycling and solid waste management.

- 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.

4.2.12. GRADE 12

4.2.12.A. Analyze the use of renewable and nonrenewable resources.

- Explain the effects on the environment and sustainability through the use of nonrenewable resources.
- Evaluate the advantages and disadvantages of reusing our natural resources.

4.2.12.B. Analyze factors affecting the availability of renewable and nonrenewable resources.

- 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.

Drinking Water Module: Only a Drop to Drink on Earth

Groundwater Module: Only a Drop to Drink on Earth

4.2.12.C. Analyze factors that influence the availability of natural resources.

- **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.**

4.2.12.D. Evaluate solid waste management practices.

- **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.**

4.3. Environmental Health

4.3.7. GRADE 7

4.3.7.A. Identify environmental health issues.

- **Identify various examples of long-term pollution and explain their effects on environmental health.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledge, Aquatic Insect Lab Practical

Basic Water Chemistry Module: pH Test #3: Rain, Surface, Ground Water, pH Test #4: Acidic Snow Melt, pH Test #5: pH Affects Living Things

Water Pollution Module: Parts Per Million, Pollution P.I., Acid Rain Effects

- **Identify diseases that have been associated with poor environmental quality.**

Drinking Water Module: Search for the Epidemic Source

Water Pollution Module: Parts Per Million, Super Sleuths, Creek Geek Knowledge

- **Describe different types of pest controls and their effects on the environment.**

- **Identify alternative products that can be used in life to reduce pollution.**

Water Pollution Module: Pollution Limbo

4.3.7.B. Describe how human actions affect the health of the environment.

- **Identify land use practices and their relation to environmental health.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Turbid Vision

Aquatic Macroinvertebrates Module: Aquatic Macroinvertebrate Sampling, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledge, Aquatic Insect Lab Practical

Basic Water Chemistry Module: Nitrates In Our Water, A "Soily" N and P, Measuring Turbidity with Filters, Turbid Vision, Water Chemistry Bingo

Riparian Buffers Module: Buffered Stream, Healthy Stream, RCE, Riparian Videos, RipCycles & Nutrient Travels, Wrangling Over Riparian Zones, Riparian Round Up, Riparian Runoff Rivalry

Topographic Map Module: Land Use in Watersheds, Topo Map Explorer

Water Pollution Module: Name That Source, Pollution Limbo, Pollution P.I., Riverfront Property, Creek Geek Knowledge, Water Pollution Scavenger Hunt, VIDEO-Clean Water

- **Explain how natural disasters affect environmental health.**

- **Identify residential and industrial sources of pollution and their effects on environmental health.**

Basic Water Chemistry Module: Nitrates In Our Water, A "Soily" N and P

Riparian Buffers Module: Riparian Runoff Rivalry

Water Pollution Module: Name That Source, Pollution Limbo, Riverfront Property, Acid Rain Effects, Is There AMD In This Stream, Creek Geek Knowledge, Water Pollution Scavenger Hunt

- **Explain the difference between point and nonpoint source pollution.**

Basic Water Chemistry Module: Nitrates In Our Water, A "Soily" N and P, Measuring Turbidity with Filters

Riparian Buffers Module: Riparian Videos, Riparian Runoff Rivalry

Water Pollution Module: Name That Source, Riverfront Property, Creek Geek Knowledge, Water Pollution Scavenger Hunt

- **Explain how nonpoint source pollution can affect the water supply and air quality.**

Basic Water Chemistry Module: Nitrates In Our Water, A "Soily" N and P, Measuring Turbidity

with Filters

Riparian Buffers Module: Riparian Runoff Rivalry

Water Pollution Module: Name That Source, Pollution P.I., Riverfront Property, Acid Rain Effects, Is There AMD In This Stream?, Creek Geek Knowledgey, Water Pollution Scavenger Hunt

Wetlands Module: Town Hall Meeting

- **Explain how acid deposition can affect water, soil and air quality.**

Basic Water Chemistry Module: pH People, pH Test #2: Manipulating a liquid's pH, pH Test #3: Rain, Surface, Ground Water, pH Test #4: Acidic Snow Melt, pH Test #5: pH Affects Living Things, Acid Buffering Capacity: Groundwater vs. Surface Water

Water Pollution Module: Pollution P.I., Acid Rain Effects

- **Explain the relationship between resource use, reuse, recycling and environmental health.**

4.3.7.C. Explain biological diversity.

- **Explain the complex, interactive relationships among members of an ecosystem.**

Aquatic Life Module: Web of Life, Quick Frozen Critters, Competing for Food, Micro Odyssey

Aquatic Macroinvertebrates Module: Macroinvertebrate Match Game

Freshwater Fish Module: Fish Food!, Fishy Freeze Tag, Hide and Seek, How Old Is That Fish?

Riparian Buffers Module: Tree ID

Wetlands Module: Web of Life

- **Explain how diversity affects ecological integrity of the natural resources.**

Aquatic Life Module: Pollution Tolerance Index – Bag of Bugs

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Macroinvertebrate Match Game

Riparian Buffers Module: Tree ID

4.3.10. GRADE 10

4.3.10.A. Describe environmental health issues.

- **Identify the effects on human health of air, water and soil pollution and the possible economic costs to society.**

Basic Water Chemistry Module: Nitrates In Our Water

Water Pollution Module: Parts Per Million, Pollution Limbo, Pollution P.I., Super Sleuths, Creek Geek Knowledgey

- **Describe how indoor pollution may affect human health (e. g., dust mites, fumes, cat dandruff).**

- **Explain the costs and benefits of cleaning up contaminants.**

Water Pollution Module: Pollution Limbo

- **Explain how common household cleaning products are manufactured and how to dispose of their by-products after use.**

4.3.10.B. Explain how multiple variables determine the effects of pollution on environmental health, natural processes and human practices.

- **Explain how human practices affect the quality of the water and soil.**

Aquatic Life Module: Turbid Vision

Basic Water Chemistry Module: pH Test #2: Manipulating a liquid's pH, pH Test #3: Rain, Surface, Ground Water, pH Test #4: Acidic Snow Melt, pH Test #5: pH Affects Living Things,

Nutrients: Nutrition or Nuisance?, Nitrates In Our Water, A "Soily" N and P, Measuring Turbidity with Filters, Turbid Vision, Water Chemistry Bingo

Drinking Water Module: Search for the Epidemic Source

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE, Riparian Videos, Wrangling Over Riparian Zones, Riparian Round Up, Riparian Runoff Rivalry
Topographic Map Module: Land Use in Watersheds, Topo Map Explorer
Water Pollution Module: Name That Source, Pollution Limbo, Pollution P.I., Creek Geek Knowledgey, Water Pollution Scavenger Hunt, VIDEO-Clean Water

- **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.**

Wetlands Module: Town Hall Meeting

- **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.**

4.3.10.C. Explain biological diversity as an indicator of a healthy environment.

- **Explain species diversity.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Macroinvertebrate Mayhem, Pollution Tolerance Index – Bag of Bugs

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Macroinvertebrate Match Game, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledgey, Aquatic Insect Lab Practical
Riparian Buffers Module: Tree ID

- **Analyze the effects of species extinction on the health of an ecosystem.**

Aquatic Life Module: Competing for Food

Aquatic Macroinvertebrates Module: Macroinvertebrate Match Game

Riparian Buffers Module: Tree ID

4.3.12. GRADE 12

4.3.12.A. Analyze the complexity of environmental health issues.

- **Identify environmental health issues and explain how they have been addressed on a worldwide level.**

Water Pollution Module: Super Sleuths

- **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.**

Basic Water Chemistry Module: pH Test #3: Rain, Surface, Ground Water, Nitrates In Our Water

Drinking Water Module: Chemical Testing of Drinking Water

Water Pollution Module: Pollution Limbo

- **Explain the relationship between wind direction and velocity as it relates to dispersal and occurrence of pollutants.**

Basic Water Chemistry Module: pH Test #4: Acidic Snow Melt

- **Explain the different disposal methods used for toxic and hazardous waste.**

4.3.12.B. Analyze the local, regional and national impacts of environmental health.

- **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 point and nonpoint source pollution; evaluate the costs and benefits of these laws.**

Wetlands Module: Town Hall Meeting

- **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.**

4.3.12.C. Analyze the need for a healthy environment.

- **Research the relationship of some chronic diseases to an environmental pollutant.**

Drinking Water Module: Search for the Epidemic Source, Bacteria Testing in Drinking Water

- **Explain how man-made systems may affect the environment.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling

Aquatic Macroinvertebrates Module: Aquatic Macroinvertebrate Sampling, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledge, Aquatic Insect Lab Practical

Drinking Water Module: Bacteria Testing in Drinking Water

Water Pollution Module: Pollution P.I.

4.4. Agriculture and Society

4.4.7. GRADE 7

4.4.7.A. Explain society's standard of living in relation to agriculture.

- 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.

4.4.7.B. Investigate how agricultural science has recognized the various soil types found in Pennsylvania.

- Explain the importance of particle sizes in different soil types.
Groundwater Module: Porosity & Permeability
- Determine how water has influenced the development of Pennsylvania soil types.
Groundwater Module: Porosity & Permeability
- 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.

4.4.7.C. Explain agricultural systems' use of natural and human resources.

- Analyze the needs of plants and animals as they relate to climate and soil conditions.
Riparian Buffers Module: Tree ID
- 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.
Riparian Buffers Module: Wrangling Over Riparian Zones, Riparian Runoff Rivalry

4.4.7.D. Explain the improvement of agricultural production through technology.

- Compare the technologies that have advanced agricultural production.
- Explain how energy sources have changed to meet agricultural technology.

4.4.10. GRADE 10

4.4.10.A. Describe the importance of agriculture to society.

- 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.

4.4.10.B. Assess the influence of agricultural science on farming practices.

- 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.
- Analyze and explain how farm efficiencies have changed human nutrition.

4.4.10.C. Explain the functions of the components of the food and fiber system.

- 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.

4.4.10.D. Analyze the efforts of increased efficiency in agriculture through technology.

- 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 energy sources involved in the production of food and fiber.

4.4.12. GRADE 12

4.4.12.A. Analyze the management practices in the agriculture business.

- 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.

4.4.12.B. Describe how agricultural science has influenced Biotechnology.

- 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 in shifting metabolism to increase muscle mass and reduce fat in farm animals.

4.4.12.C. Analyze and research the social, political and economic factors that affect agricultural systems.

- 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).**

4.4.12.D. Analyze research and development activities as they relate to agriculture.

- **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.**

4.5. Integrated Pest Management

4.5.7. GRADE 7

4.5.7.A. Explain benefits and harmful effects of pests.

- 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.

4.5.7.B. Explain how pest management affects the environment.

- 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.

4.5.7.C. Explain various integrated pest management practices used in society.

- 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.

4.5.10. GRADE 10

4.5.10.A. Identify similar classifications of pests that may or may not have similar effects on different regions.

- Identify environmental effect(s) of pests on different regions of the world.
- Identify introduced species that are classified as pests in their new environments.

4.5.10.B. Analyze health benefits and risks associated with integrated pest management.

- 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.

4.5.10.C. Determine the effects of integrated pest management practices on society over time.

- 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.

4.5.12. GRADE 12

4.5.12.A. Research integrated pest management systems.

- **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.**

4.5.12.B. Research and analyze integrated pest management practices globally.

- **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.**

4.5.12.C. Analyze the historical significance of integrated pest management on society.

- **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 plight).**
- **Research and analyze the long-**
- **term effects of pest management practices on the environment.**

4.6. Ecosystems and their Interactions

4.6.7. GRADE 7

4.6.7.A. Explain the flows of energy and matter from organism to organism within an ecosystem.

- **Identify and explain the characteristics of biotic and abiotic.**
Riparian Buffers Module: RCE, RipCycles & Nutrient Travels
- **Describe and explain the adaptations of plants and animals to their environment.**
Aquatic Life Module: Quick Frozen Critters, Create an Aquatic Macroinvertebrate, Microhabitats #1, Microhabitats #2, Cattail Check-up, Sinking Slowly, Life at the Surface
Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Life at the Surface, Microhabitats #1: Quantitative Study of Microhabitats, Microhabitats #2: Quantitative Study of Microhabitats
Freshwater Fish Module: Fishy Adaptations, Fishy Freeze Tag, Hide and Seek, How Old Is That Fish?
Wetlands Module: Cattail Check-up, Wetlands Creek Geek Knowledgey
- **Demonstrate the dependency of living components in the ecosystem on the nonliving components.**
Aquatic Life Module: Quick Frozen Critters, Life at the Surface, When the Oxygen is Gone, Turbid Vision, Create a Winter Pond
Basic Water Chemistry Module: Nutrients: Nutrition or Nuisance?, Turbid Vision
Freshwater Fish Module: Fishy Freeze Tag, When the Oxygen is Gone, Create a Winter Pond
Riparian Buffers Module: RipCycles & Nutrient Travels
Wetlands Module: Temporary Wetland Survivor
- **Explain energy flow through a food web.**
Aquatic Life Module: Web of Life, Competing for Food, Micro Odyssey
Aquatic Macroinvertebrate Module: Life at the Surface
Freshwater Fish Module: Fish Food!
Riparian Buffers Module: RipCycles & Nutrient Travels
Wetlands Module: Web of Life
- **Explain the importance of the predator/prey relationship and how it maintains the balances within ecosystems.**
Aquatic Life Module: Quick Frozen Critters, Competing for Food
Freshwater Fish Module: Fishy Freeze Tag
- **Understand limiting factors and predict their effects on an organism.**
Aquatic Life Module: Quick Frozen Critters, Competing for Food
Freshwater Fish Module: Fishy Freeze Tag
Riparian Buffers Module: RipCycles & Nutrient Travels
- **Identify niches for producers, consumers and decomposers within an ecosystem.**
Aquatic Life Module: Web of Life, Micro Odyssey
Freshwater Fish Module: Fish Food!
Riparian Buffers Module: Riparian Round Up
Wetlands Module: Web of Life
- **Compare and contrast the major ecosystems of Pennsylvania.**
- **Identify the major characteristics of a biome.**
- **Compare and contrast different biomes and their characteristics.**
- **Identify the relationship of abiotic and biotic components and explain their interaction in an ecosystem.**
Aquatic Life Module: Create an Aquatic Macroinvertebrate, When the Oxygen is Gone, Turbid Vision, Create a Winter Pond

Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate

Basic Water Chemistry Module: Plants, Fish, and pH, Nutrients: Nutrition or Nuisance?, Turbid Vision

Freshwater Fish Module: When the Oxygen is Gone, Create a Winter Pond

Riparian Buffers Module: RipCycles & Nutrient Travels

- **Explain how different soil types determine the characteristics of ecosystems.**

4.6.7.B. Explain the concepts of cycles.

- **Identify and explain cycles within an ecosystem.**

Aquatic Macroinvertebrates Module: Aquatic Insect Life Cycles

Basic Water Chemistry Module: Plants, Fish, and pH, Nutrients: Nutrition or Nuisance?

Riparian Buffers Module: RipCycles & Nutrient Travels

- **Analyze the role of different cycles within an ecosystem.**

Aquatic Macroinvertebrates Module: Aquatic Insect Life Cycles

Basic Water Chemistry Module: Plants, Fish, and pH, Nutrients: Nutrition or Nuisance?

Riparian Buffers Module: RipCycles & Nutrient Travel, Riparian Round Up

4.6.7.C. Explain how ecosystems change over time.

- **Explain how ecosystems change.**

Aquatic Life Module: Macroinvertebrate Mayhem

Basic Water Chemistry Module: Plants, Fish, and pH, Nutrients: Nutrition or Nuisance?

- **Identify the succession stages of a given ecosystem.**

Aquatic Life Module: Macroinvertebrate Mayhem

- **Explain how specific organisms may change an ecosystem.**

Aquatic Life Module: Macroinvertebrate Mayhem

- **Explain a change in an ecosystem that relates to humans.**

Aquatic Life Module: Macroinvertebrate Mayhem

Riparian Buffers Module: RCE, Riparian Buffers Metaphors!, RipCycles & Nutrient Travels, Riparian Round Up

4.6.10. GRADE 10

4.6.10.A. Explain the biotic and abiotic components of an ecosystem and their interaction.

- **Identify the major biomes and explain their similarities and differences.**

Freshwater Fish Module: Create a Winter Pond

- **Compare and contrast the interactions of biotic and abiotic components in an ecosystem.**

Aquatic Life Module: Quick Frozen Critters, Create an Aquatic Macroinvertebrate, Microhabitats #1

Freshwater Fish Module: Fishy Freeze Tag, Create a Winter Pond

Riparian Buffers Module: RipCycles & Nutrient Travels

- **Analyze the effects of abiotic factors on specific ecosystems.**

Aquatic Life Module: Quick Frozen Critters, Create an Aquatic Macroinvertebrate, Microhabitats #1

Basic Water Chemistry Module: My Stream's Temperatures

Freshwater Fish Module: Fishy Freeze Tag, Create a Winter Pond

Riparian Buffers Module: RipCycles & Nutrient Travels

- **Describe how the availability of resources affects organisms in an ecosystem.**

Aquatic Life Module: Competing for Food, Create an Aquatic Macroinvertebrate, Microhabitats #1, When the Oxygen is Gone

- Basic Water Chemistry Module: Nutrients: Nutrition or Nuisance?*
Freshwater Fish Module: When the Oxygen is Gone, Create a Winter Pond
Riparian Buffers Module: RipCycles & Nutrient Travels
Wetlands Module: Temporary Wetland Survivor
- **Explain energy flow in a food chain through an energy pyramid.**
Aquatic Life Module: Web of Life, Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond
Wetlands Module: Web of Life
 - **Evaluate the efficiency of energy flow in a food chain.**
Aquatic Life Module: Web of Life, Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond
Wetlands Module: Web of Life
 - **Explain the concept of carrying capacity in an ecosystem.**
Aquatic Life Module: Competing for Food, Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond
 - **Explain trophic levels.**
Aquatic Life Module: Web of Life, Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond
Riparian Buffers Module: RipCycles & Nutrient Travels
Wetlands Module: Web of Life
 - **Identify a specific environmental impact and predict what change may take place to affect homeostasis.**
Aquatic Life Module: Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond
 - **Examine and explain how organisms modify their environments to sustain their needs.**
Aquatic Life Module: Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond
Riparian Buffers Module: RipCycles & Nutrient Travels
 - **Assess the effects of latitude and altitude on biomes.**
Aquatic Life Module: Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond
 - **Interpret possible causes of population fluctuations.**
Aquatic Life Module: Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Finding the Way Home, Create a Winter Pond
 - **Explain how erosion and sedimentation have changed the quality of soil related habitats.**
Aquatic Life Module: Create an Aquatic Macroinvertebrate, Microhabitats #1
Freshwater Fish Module: Create a Winter Pond

4.6.10.B. Explain how cycles affect the balance in an ecosystem.

- **Describe an element cycle and its role in an ecosystem.**
Basic Water Chemistry Module: Plants, Fish, and pH, Nutrients: Nutrition or Nuisance?
Riparian Buffers Module: RipCycles & Nutrient Travels
- **Explain the consequences of interrupting natural cycles.**
Basic Water Chemistry Module: Plants, Fish, and pH, Nutrients: Nutrition or Nuisance?
Riparian Buffers Module: RipCycles & Nutrient Travels, Riparian Round Up

4.6.10.C. Analyze how ecosystems change over time.

- **Identify and explain the succession stages in an ecosystem.**
Riparian Buffers Module: Riparian Round Up

- **Identify causes of succession.**
Riparian Buffers Module: Riparian Round Up
- **Analyze consequences of interrupting natural cycles.**
Riparian Buffers Module: RipCycles & Nutrient Travels, Riparian Round Up

4.6.12. GRADE 12

4.6.12.A. Analyze the interdependence of an ecosystem.

- **Analyze the relationships among components of an ecosystem.**
Aquatic Life Module: Web of Life, Quick Frozen Critters, Competing for Food, Create an Aquatic Macroinvertebrate, Microhabitats #1, Microhabitat #2, Cattail Check-up, Micro Odyssey, Life at the Surface, When the Oxygen is Gone, Create a Winter Pond
Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Life at the Surface, Microhabitats #1: Quantitative Study of Microhabitats, Microhabitats #2: Quantitative Study of Microhabitats
Basic Water Chemistry Module: Plants, Fish, and pH, Nutrients: Nutrition or Nuisance?, A "Soily" N and P
Freshwater Fish Module: Fish Food!, Fishy Freeze Tag, Hide and Seek, How Old Is That Fish?, When the Oxygen is Gone, Create a Winter Pond
Riparian Buffers Module: RipCycles & Nutrient Travels
Wetlands Module: Web of Life, Cattail Check-up
- **Evaluate the efficiency of energy flow within an ecosystem.**
Aquatic Life Module: Web of Life
Wetlands Module: Web of Life
- **Explain limiting factors and their impact on carrying capacity.**
Aquatic Life Module: Quick Frozen Critters, Competing for Food
Freshwater Fish Module: Fishy Freeze Tag
- **Understand how biological diversity impacts the stability of an ecosystem.**
Aquatic Macroinvertebrates Module: Macroinvertebrate Match Game
Riparian Buffers Module: Tree ID
- **Analyze the positive or negative impacts of outside influences on an ecosystem.**
Aquatic Life Module: Pollution Tolerance Index – Bag of Bugs, Turbid Vision
Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?
Basic Water Chemistry Module: Turbid Vision
Riparian Buffers Module: RipCycles & Nutrient Travels, Riparian Round Up
- **Analyze how different land use practices can affect the quality of soils.**

4.6.12.B. Analyze the impact of cycles on the ecosystem.

- **Evaluate the materials necessary for natural cycles.**
Riparian Buffers Module: RipCycles & Nutrient Travels
- **Explain the processes involved in the natural cycles.**
Riparian Buffers Module: RipCycles & Nutrient Travels, Riparian Round Up

4.6.12.C. Analyze how human action and natural changes affect the balance within an ecosystem.

- **Analyze the effects of substances that move through natural cycles.**
Aquatic Life Module: Macroinvertebrate Mayhem
Basic Water Chemistry Module: Nutrients: Nutrition or Nuisance?
Freshwater Fish Module: Hooks and Ladders
Riparian Buffers Module: RipCycles & Nutrient Travels
- **Analyze the effects of natural occurrences and their effects on ecosystems.**

Aquatic Life Module: Macroinvertebrate Mayhem
Basic Water Chemistry Module: Nutrients: Nutrition or Nuisance?
Freshwater Fish Module: Hooks and Ladders
Riparian Buffers Module: RipCycles & Nutrient Travels

- **Analyze effects of human action on an ecosystem.**

Aquatic Life Module: Macroinvertebrate Mayhem, Pollution Tolerance Index – Bag of Bugs, Turbid Vision

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?

Basic Water Chemistry Module: Nutrients: Nutrition or Nuisance?, Turbid Vision

Freshwater Fish Module: Hooks and Ladders

Riparian Buffers Module: Riparian Buffers Metaphors!, RipCycles & Nutrient Travels, Riparian Round Up

- **Compare the stages of succession and how they influence the cycles existing in an ecosystem.**

Aquatic Life Module: Macroinvertebrate Mayhem

Freshwater Fish Module: Hooks and Ladders

4.7. Threatened, Endangered and Extinct Species

4.7.7. GRADE 7

4.7.7.A. Describe diversity of plants and animals in ecosystems.

- **Select an ecosystem and describe different plants and animals that live there.**
Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs, Microhabitat #2, This Plant Key Is All Wet!, Micro Odyssey
Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Aquatic Macroinvertebrate Sampling, Microhabitats #2: Quantitative Study of Microhabitats, Macroinvertebrate Match Game, Aquatic Bug Background Research, Aquatic Insect Creek Geek Knowledgey, Aquatic Insect Lab Practical
Riparian Buffers Module: EcoTones, Tree ID, Riparian Round Up
Wetlands Module: Temporary Wetland Survivor, This Plant Key Is All Wet!
- **Identify adaptations in plants and animals.**
Aquatic Life Module: Quick Frozen Critters, Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Microhabitat #2, Cattail Check-up, Sinking Slowly, Life at the Surface
Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Life at the Surface, Microhabitats #2: Quantitative Study of Microhabitats
Freshwater Fish Module: Fishy Who's Who, Fishy Adaptations, Fishy Freeze Tag
Wetlands Module: Cattail Check-up, Wetlands Creek Geek Knowledgey
- **Recognize that adaptations are developed over long periods of time and are passed on from one generation to the next.**
Aquatic Life Module: Quick Frozen Critters
Freshwater Fish Module: Fishy Freeze Tag
- **Understand levels of ecosystem organization (e. g., individuals, populations, species).**

4.7.7.B. Explain how species of living organisms adapt to their environment.

- **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.**
Aquatic Life Module: Quick Frozen Critters
Freshwater Fish Module: Fishy Adaptations, Fishy Freeze Tag
- **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.**
Aquatic Life Module: Macroinvertebrate Mayhem
- **Explain how living things respond to changes in their environment.**
Aquatic Life Module: Quick Frozen Critters, Macroinvertebrate Mayhem, Pollution Tolerance Index – Bag of Bugs, When the Oxygen is Gone, Hooks and Ladders, Create a Winter Pond
Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?
Basic Water Chemistry Module: pH Test #5: pH Affects Living Things
Freshwater Fish Module: Fishy Who's Who, Fishy Freeze Tag, Fighting for Life in French Creek, Hooks and Ladders, Finding the Way Home, When the Oxygen is Gone, Create a Winter Pond
Wetlands Module: Temporary Wetland Survivor
- **Explain how one species may survive an environmental change while another might not.**

Aquatic Life Module: Macroinvertebrate Mayhem, Pollution Tolerance Index – Bag of Bugs, Hooks and Ladders

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?

Freshwater Fish Module: Fighting for Life in French Creek, Hooks and Ladders

4.7.7.C. Explain natural or human actions in relation to the loss of species.

- **Identify natural or human impacts that cause habitat loss.**

Freshwater Fish Module: Finding the Way Home

- **Explain how habitat loss can affect the interaction among species and the population of a species.**

Riparian Buffers Module: RCE, Riparian Buffers Metaphors!, Wrangling Over Riparian Zones

- **Analyze and explain the changes in an animal population over time.**

Freshwater Fish Module: Finding the Way Home

- **Explain how a habitat management practice affects a population.**

- **Explain the differences among threatened, endangered and extinct species.**

Freshwater Fish Module: Finding the Way Home

- **Identify Pennsylvania plants and animals that are on the threatened or endangered list.**

- **Describe state laws passed regarding threatened and endangered species in Pennsylvania.**

Wetlands Module: Marsh Madness, Town Hall Meeting

- **Explain why one species may be more susceptible to becoming endangered than another species.**

Aquatic Life Module: Microhabitats #1

Aquatic Macroinvertebrates Module: Microhabitats #1: Quantitative Study of Microhabitats

4.7.10. GRADE 10

4.7.10.A. Explain the significance of diversity in ecosystems.

- **Explain the role that specific organisms have in their ecosystem.**

Aquatic Life Module: Web of Life, Macroinvertebrate Mayhem, Microhabitat #2, Cattail Check-up, Micro Odyssey

Aquatic Macroinvertebrates Module: Microhabitats #2: Quantitative Study of Microhabitats

Freshwater Fish Module: Fish Food!

Wetlands Module: Web of Life, Cattail Check-up

- **Identify a species and explain what effects its increase or decline might have on the ecosystem.**

Aquatic Life Module: Macroinvertebrate Mayhem

- **Identify a species and explain how its adaptations are related to its niche in the environment.**

Aquatic Life Module: Macroinvertebrate Mayhem, Aquatic Insects Parts and Pieces, Create an Aquatic Macroinvertebrate, Microhabitat #2, Cattail Check-up, Sinking Slowly, Life at the Surface

Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Microhabitats #2: Quantitative Study of Microhabitats

Freshwater Fish Module: Fishy Who's Who, Fishy Adaptations, Cattail Check-up

4.7.10.B. Explain how structure, function and behavior of plants and animals affect their ability to survive.

- **Describe an organism's adaptations for survival in its habitat.**

Aquatic Life Module: Quick Frozen Critters, Aquatic Insects Parts and Pieces, Create an Aquatic Macroinvertebrate, Microhabitats #1, Microhabitat #2, Cattail Check-up, Sinking Slowly, Life at the Surface

Aquatic Macroinvertebrates Module: Aquatic Insect Parts and Pieces, Create an Aquatic Macroinvertebrate, Life at the Surface, Microhabitats #1: Quantitative Study of Microhabitats, Microhabitats #2: Quantitative Study of Microhabitats

Freshwater Fish Module: Fishy Who's Who, Fishy Adaptations, Fishy Freeze Tag, Hide and Seek, How Old Is That Fish?

Wetlands Module: Cattail Check-up, Wetlands Creek Geek Knowledge

- **Compare adaptations among species.**

Aquatic Life Module: Quick Frozen Critters, Microhabitats #1, Microhabitat #2, Cattail Check-up, Sinking Slowly

Aquatic Macroinvertebrates Module: Microhabitats #1: Quantitative Study of Microhabitats, Microhabitats #2: Quantitative Study of Microhabitats

Freshwater Fish Module: Fishy Who's Who, Fishy Adaptations, Fishy Freeze Tag

Wetlands Module: Cattail Check-up

4.7.10.C. Identify and explain why adaptations can lead to specialization.

- **Explain factors that could lead to a species' increase or decrease.**

Aquatic Life Module: Microhabitats #1, When the Oxygen is Gone, Hooks and Ladders

Freshwater Fish Module: Fighting for Life in French Creek, Hooks and Ladders, Finding the Way Home, When the Oxygen is Gone

- **Explain how management practices may influence the success of specific species.**

Riparian Buffers Module: Riparian Videos, Microhabitats #1, Hooks and Ladders

Freshwater Fish Module: Fighting for Life in French Creek, Hooks and Ladders, Finding the Way Home

- **Identify and explain criteria used by scientists for categorizing organisms as threatened, endangered or extinct.**

Aquatic Life Module: Microhabitats #1

4.7.12. GRADE 12

4.7.12.A. Analyze biological diversity as it relates to the stability of an ecosystem.

- **Examine and explain what happens to an ecosystem as biological diversity changes.**

Aquatic Life Module: Aquatic Macroinvertebrate Sampling, Pollution Tolerance Index – Bag of Bugs

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Macroinvertebrate Match Game, Aquatic Bug Background Research

Riparian Buffers Module: Tree ID

- **Explain the relationship between species' loss and biodiversity.**

Aquatic Life Module: Pollution Tolerance Index – Bag of Bugs

Aquatic Macroinvertebrates Module: Pollution Tolerance Index -Bag of Bugs, How Sensitive Are They?, Macroinvertebrate Match Game

Riparian Buffers Module: Tree ID

- **Examine and explain how a specialized interaction between two species may affect the survival of both species.**

Aquatic Macroinvertebrates Module: Aquatic Macroinvertebrate Sampling

4.7.12.B. Examine the effects of extinction, both natural and human caused, on the environment.

- **Predict how human or natural actions can produce change to which organisms cannot adapt.**
- **Identify species that became extinct through natural causes and explain how that occurred.**
Freshwater Fish Module: Fishy Who's Who
- **Identify a species that became extinct due to human actions and explain what occurred.**
Freshwater Fish Module: Fishy Who's Who

4.7.12.C. Analyze the effects of threatened, endangered or extinct species on human and natural systems.

- **Identify and explain how a species' increase, decline or elimination affects the ecosystem and/ or human social, cultural and economic structures.**
Freshwater Fish Module: Finding the Way Home
- **Explain why natural populations do not remain constant.**
Freshwater Fish Module: Finding the Way Home
- **Analyze management strategies regarding threatened or endangered species.**
- **Identify laws, agreements or treaties at national or international levels regarding threatened or endangered species.**
Wetlands Module: Town Hall Meeting
- **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).**

4.8. Humans and the Environment

4.8.7. GRADE 7

4.8.7.A. Describe how the development of civilization relates to the environment.

- 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.

4.8.7.B. Explain how people use natural resources.

- Describe how natural resources are used for survival.
- Explain how natural resources and technological changes have affected the development of civilizations.

Drinking Water Module: Water Treatment in the Classroom

- Explain how climate and extreme weather events (e. g., drought, flood) influence people's lives.

4.8.7.C. Explain how human activities may affect local, regional and national environments.

- Describe what effect consumption and related generation of wastes have on the environment.

Drinking Water Module: Money Down the Drain

- Explain how a particular human activity has changed the local area over the years.

Riparian Buffers Module: RCE, Riparian Round Up, Riparian Runoff Rivalry

Topographic Map Module: Land Use in Watersheds, Topo Map Explorer

Water Pollution Module: Riverfront Property

4.8.7.D. Explain the importance of maintaining the natural resources at the local, state and national levels.

- Explain how human activities and natural events have affected ecosystems.

Riparian Buffers Module: Riparian Buffers Metaphors!, RipCycles & Nutrient Travels, Riparian Round Up, Riparian Runoff Rivalry

- Explain how conservation practices have influenced ecosystems.

Riparian Buffers Module: Riparian Videos, Riparian Runoff Rivalry

Water Pollution Module: VIDEO-Clean Water

- Define the roles of Pennsylvania agencies that deal with natural resources.

Wetlands Module: Marsh Madness, Town Hall Meeting, Wetlands Creek Geek Knowledgey

4.8.10. GRADE 10

4.8.10.A. Analyze how society's needs relate to the sustainability of natural resources.

- 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.

4.8.10.B. Analyze the relationship between the use of natural resources and sustaining our society.

- Explain the role of natural resources in sustaining society.
- Analyze the effects of a natural resource's availability on a community or region.

4.8.10.C. Analyze how human activities may cause changes in an ecosystem.

- Analyze and evaluate changes in the environment that are the result of human activities.

Drinking Water Module: Money Down the Drain

Riparian Buffers Module: Buffered Stream/Healthy Stream, RCE, Riparian Buffers Metaphors!, Riparian Videos, RipCycles & Nutrient Travels, Wrangling Over Riparian Zones, Riparian Round Up, Riparian Runoff Rivalry

Topographic Map Module: Land Use in Watersheds

Water Pollution Module: Riverfront Property, Creek Geek Knowledgey

- Compare and contrast the environmental effects of different industrial strategies (e. g., energy generation, transportation, logging, mining, agriculture).

Riparian Buffers Module: RCE, RipCycles & Nutrient Travels, Wrangling Over Riparian Zones, Riparian Runoff Rivalry

Topographic Map Module: Land Use in Watersheds

Water Pollution Module: Riverfront Property, Creek Geek Knowledgey

4.8.10.D. Explain how the concept of supply and demand affects the environment.

- 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.

4.8.12. GRADE 12

4.8.12.A. Explain how technology has influenced the sustainability of natural resources over time.

- 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).

4.8.12.B. Analyze technology's role on natural resource sustainability.

- 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.

4.8.12.C. Analyze how pollution has changed in quality, variety and toxicity as the United States developed its industrial base.

- Analyze historical pollution trends and project them for the future.
- Compare and contrast historical and current pollution levels at a given location.

Drinking Water Module: Search for the Epidemic Source

4.8.12.D. Analyze the international implications of environmental occurrences.

- **Identify natural occurrences that have international impact (e. g., El Nino, volcano eruptions, earthquakes).**
- **Analyze environmental issues and their international implications.**

4.9. Environmental Laws and Regulations

4.9.7. GRADE 7

4.9.7.A. Explain the role of environmental laws and regulations.

- 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).

Riparian Buffers Module: Wrangling Over Riparian Zones Extension

Water Pollution Module: Parts Per Million, Creek Geek Knowledgey

Wetlands Module: Marsh Madness, Town Hall Meeting, Wetlands Creek Geek Knowledgey

- 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).

Riparian Buffers Module: Wrangling Over Riparian Zones Extension

Water Pollution Module: Parts Per Million, Creek Geek Knowledgey

Wetlands Module: Marsh Madness, Town Hall Meeting, Wetlands Creek Geek Knowledgey

4.9.10. GRADE 10

4.9.10.A. Explain why environmental laws and regulations are developed and enacted.

- Explain the positive and negative impacts associated with passing environmental laws and regulations.

Riparian Buffers Module: Wrangling Over Riparian Zones Extension

- Understand conflicting rights of property owners and environmental laws and regulations.

Riparian Buffers Module: Wrangling Over Riparian Zones Extension

Wetlands Module: Town Hall Meeting

- Analyze the roles that local, state and federal governments play in the development and enforcement of environmental laws.

Riparian Buffers Module: Wrangling Over Riparian Zones Extension

Water Pollution Module: Parts Per Million, Creek Geek Knowledgey

Wetlands Module: Marsh Madness, Town Hall Meeting

- Identify local and state environmental regulations and their impact on environmental health.

Riparian Buffers Module: Wrangling Over Riparian Zones Extension

Water Pollution Module: Parts Per Million, Creek Geek Knowledgey

- Explain the positive and negative impacts of the Endangered Species Act.

4.9.12. GRADE 12

4.9.12.A. Analyze environmental laws and regulations as they relate to environmental issues.

- 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.

Riparian Buffers Module: Wrangling Over Riparian Zones Extension

- Wetlands Module: Marsh Madness, Town Hall Meeting*
- **Research and describe the effects of an environmental law or regulation and how it has impacted the environment.**
 - Riparian Buffers Module: Wrangling Over Riparian Zones Extension]*
 - Water Pollution Module: Parts Per Million*