

PENNSYLVANIA ENVIROTHON

2009

Teacher Resource Booklet



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2009 Teacher Resource Booklet

For the past 26 years, high schools in Pennsylvania have been recognizing the value of the Envirothon experience. Students and their teachers become empowered by their own motivation as the Envirothon engages them in an exciting, multi-faceted study of the environment. Students involved in the Envirothon often pursue further education in environmental fields. Many Envirothon participants pursuing college degrees in various natural resource studies have indicated that their education choice was partly due, or strengthened by, their Envirothon experience. Many Envirothon advisors credit the Envirothon with increasing student interest and involvement in environmental sciences. To many people involved, the Envirothon is more than just a competition.

We hope that whether this is your first Envirothon or you are a veteran, you and your team are excited to learn about the environment, our relationship with it, and how we can each work towards its protection and conservation.

This year features “Biodiversity in a Changing World” as the Current Environmental Issue. We have made an effort to link the other stations (Soils / Land Use, Aquatic Ecology, Forestry, and Wildlife) with the Current Issue in the Essential Topics and Learning Objectives to emphasize their interrelatedness.

This Teacher Resource Booklet is intended to help you and your teams become fluent in a broad range of environmental topics. It outlines the program guidelines of the Envirothon, including the Learning Objectives and Reference Lists. Included are:

1. *Envirothon Mission Statement and Objectives*
2. *Envirothon Sponsors, Partners, and Financial Contributors*
3. *General Information on the 2009 Pennsylvania and Canon Envirothon events*
4. *Brief History of the Envirothon*
5. *Overview of Station testing and a past station test used in 2007*
6. *Description of the Oral Component and the scenario used in 2008*
7. *Some Tips for Teaching Envirothon Material*
8. *Aquatic Ecology **
9. *Current Issues – Biodiversity in a Changing World**
10. *Forestry **
11. *Soil/Land Use **
12. *Wildlife **

** The following are specified for each station:*

- a) *Essential Topics*
- b) *Learning Objectives*
 - *Each is correlated with the PDE Environment & Ecology Standards*
- c) *Reference Materials List - If you are missing any of these materials, contact your County Conservation District.*
- d) *Learning Enhancements*

MISSION STATEMENT

The Envirothon is an environmental education program made available to Pennsylvania Conservation Districts in partnership with related state and federal agencies and other organizations. The Envirothon program is designed to test high school students' knowledge of Pennsylvania natural resources and environmental sciences. The program emphasizes the importance of environmental sensitivity while stressing a need to achieve a social, ecological, and economic balance. The Pennsylvania Envirothon provides future generations with the ability to be better equipped to address the complex natural resource concerns facing today's world as well as the challenges of tomorrow.

OBJECTIVES

Awareness: The Envirothon will help students cultivate an awareness of the total environment and acquire sensitivity towards its limited natural resources.

Knowledge: The Envirothon will help students develop a basic understanding of the earth's ecological systems and the life-sustaining implication these systems have on all living things.

Attitudes: The Envirothon will help students develop attitudes, which embrace environmental sensitivity and instill the dedication to participate in activities geared towards protecting the environment.

Application: The Envirothon will help students develop skills needed to identify, investigate, and contribute to the resolution of environmental issues and problems.

PARTNERS and SPONSORS

Pennsylvania Association of Conservation Districts
Pennsylvania State Conservation Commission
Pennsylvania's sixty-six Conservation Districts
Pennsylvania Department of Agriculture
Pennsylvania Department of Conservation and Natural Resources Bureau of Forestry
Pennsylvania Department of Conservation and Natural Resources Bureau of State Parks
Pennsylvania Department of Education Office of Environment and Ecology
Pennsylvania Department of Environmental Protection
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
U.S. Department of Agriculture, Natural Resources Conservation Service
Air Products & Chemicals, Inc.
Nestle Waters North America
PPL Corporation
Pennsylvania's Conservation Districts
Pennsylvania DCNR Bureau of Forestry Stewardship Program
Pennsylvania Fish and Boat Commission
Canon Envirothon
Pennsylvania Outdoor Writers Association
The AES Corporation
Bayer HealthCare Consumer Care
First Quality Enterprises
Conestoga Wood Specialties
The Hershey Company
Haines & Kibblehouse Inc.
International Erosion Control Assoc. Mid-Atlantic Chapter
Dwight Lewis Lumber
Lewis Lumber Products
Cargill

2009 PENNSYLVANIA ENVIROTHON

What: Pennsylvania State Envirothon – Twenty-Sixth Annual

Who: Teams of High School Students from all across Pennsylvania

When: Monday, May 18, and Tuesday, May 19, 2009

Where: University of Pittsburgh Johnstown

Why: To test the students' knowledge of Pennsylvania's natural resources while providing them with the ability to address the complex environmental concerns facing today's world as well as the challenges of tomorrow.

How: Teams rotate through five stations.

Station

Aquatic Ecology

Wildlife

Soil/Land Use

Forestry

*Biodiversity in a

Changing World

(* The fifth testing station is a Current Environmental Issue, which changes annually.)

Cooperating Agency

PA Fish & Boat Commission

PA Game Commission

USDA Natural Resources Conservation Service

PA DCNR Bureau of Forestry

PA DCNR Bureau of State Parks

Past Current Environmental Issues:

1984 - Acid Rain

1985 - Hazardous Waste

1986 - Solid Waste Management

1987 - Water Quality

1988 - Farmland Preservation

1989 - Recycling

1990 - Wetlands

1991 - Energy Sustainability

1992 - Groundwater

1993 - Pesticides

1994 - Acid Rain

1995 - Groundwater

1996 - Greenways

1997 - Pest Management

1998 - Watersheds

1999 - Wildfire Management

2000 - Wetland Management

2001 - Urban Nonpoint Source Pollution

2002 - Introduced Species

2003 - Farmland Preservation & Conservation

2004 - Natural Resource Management in the
Urban Environment

2005 – Managing Cultural Landscapes

2006 – Water Stewardship in a Changing Climate

2007 – Alternative/renewable Energy

2008 – Recreational Impacts on Natural Environments

2009 CANON ENVIROTHON

The winning team of the Pennsylvania Envirothon will advance to the Canon Envirothon being held August 2 – August 8, 2009, at the North Carolina University Asheville. Over forty-five states and nine Canadian provinces/territories are expected to participate in this 22nd North American event!

BRIEF HISTORY OF THE ENVIROTHON

The Envirothon program began here in Pennsylvania as the “Envir-Olympics” in 1979 with three counties holding competitions. In 1984, the first State competition was held with six counties participating. 1988 marked an important year in our history: the event had grown to include thirty-eight teams; the program was officially changed to “Envirothon”; and Pennsylvania planned, hosted, and won the first National Envirothon. Over 15,000 students now participate each year and the program has grown to include every conservation district in the state.

OVERVIEW OF THE STATION TESTING

To prepare teams for the Pennsylvania Envirothon, most counties model their test stations like/after the state competition.

Traditional state testing evaluates team performance in four universal areas (i.e., soils/land use, aquatic ecology, forestry, wildlife) and a different current environmental issue each year. At each station, written tests assess each team's knowledge of the specific resource at that site.

For example, the forestry station primarily relates to forest ecology, forest structure and composition, regional tree and plant species, and silvicultural and forestry practices; the aquatic ecology station primarily relates to aquatic ecosystems, species diversity, and aquatic resource management; the soils/land use station primarily relates to land formation, use of a soil survey, and land management practices; and the wildlife station primarily relates to wildlife ecology, conservation and management practices, regional wildlife species, and issues involving wildlife and society.

Station testing is designed to provide a challenging, hands-on opportunity for each team to demonstrate and apply their knowledge of environmental science and natural resource management.

As teams rotate through each of the five testing stations, they will experience a variety of testing formats. Most tests will include some type of identification, including wildlife tracks or mounts, bird calls, skins, fish, macroinvertebrates, trees, soil textures and soil horizons. The majority of the other questions will be in the format of matching and multiple choice, with a few fill-in-the-blank and short answer questions. At each station, teams receive a brief introduction to the specific site. The test is usually administered by a natural resource professional with expertise in that field. Students spend 25-35 minutes at each testing station with a five minute period for questions and review, and a five minute period for travel between stations.

Sample Station Test

The following are questions taken from the actual test used for the **2007 Current Issue** station. This test was based on the theme "*Alternative/renewable Energy.*" This is an example of the types of questions you may or may not experience at any given Envirothon competition.

2007 Envirothon Current Issue Test

1. Noise has been a serious problem for the wind energy industry. Certain wind turbines were loud. To address this problem what two improvements were made?
 - A. Insulation & switch to plastic gears
 - B. Aerodynamics & lubricants of metal parts
 - C. Aerodynamics & insulation
 - D. Lubricants & insulation
2. Sound is measured in what two ways?
 - A. Sound power & sound pressure
 - B. Sound level & sound decibels
 - C. Sound pressure & sound level
 - D. Sound decibels & sound pressure
3. Cultural and archeological surveys are typically conducted as part of an environmental assessment. A wind turbine project that has the potential of impacting a site will be required to create offset measures. These measures known as _____ must be identified before a project goes forward.
 - A. Litigation
 - B. Mitigation
 - C. Subrogation
 - D. Provocation

4. Loss of habitat and vegetation can occur during the construction of wind turbines. Two of the largest impacts on loss of habitat are:
 - A. Human presence and equipment
 - B. Site topography and project layout
 - C. Tree removal and water impacts
 - D. Noise and motion

5. Currently, scientists are focusing on new technology and the use of hydrogen as an alternative energy source. This new technology is _____, which uses hydrogen to power it.
 - A. Ethanol
 - B. Biodiesel
 - C. E85 fuel
 - D. Fuel cells

6. Two thirds of the oil used in the United States is used for which?

A. Transportation	C. Home heating
B. Manufacturing	D. Energy production

7. Which is the only alternative fuel to have completed the health effects testing requirements of the Clean Air Act Amendments (1990)?

A. Ethanol	C. Methane
B. Biodiesel	D. None

8. Making biodiesel from soybeans reduces net emissions by what percentage?

A. 50%	C. 80%
B. 75%	D. 95%

9. What is the name of the chemical process that makes biodiesel?

A. Transesterification	C. Ethanification
B. Methylase transpiration	D. Azeotropic distillation

10. What are the by products of creating biodiesel?

A. Benzene and O ₂	C. Methyl esters and glycerine
B. Methane and CO ₂	D. Ethanol and water

11-16 MATCHING Environmental Advantages & Disadvantages to the alternative energy source.

Energy Source

Advantages

Disadvantages

11. Geothermal	A. clean, renewable, no waste products, Oldest energy source, uses gravitational pull	H. radioactive waste, not economically competitive, hazardous 1,000 years from now
12. Biomass	B. abundant, 50,000 times more energy in upper 6 miles of earth's crust than coal/oil	I. 96% produced from non-renewable source, energy 'carrier'-not a source, only as clean & sustainable as its source/process used to produce it.
13. Wind	C. easy to store, lightest & most abundant element in universe, could provide ALL of society's energy needs	J. Noise, viewshed interrupted, not always a constant source of energy.
14. Nuclear	D. renewable, no emissions, minimal impact on wildlife/habitat, no mining/drilling/waste	K. Too deep – technology not yet available to access it from the earth. Costly to access it.
15. Hydro	E. versatile, unlimited range of energy-related applications, practical & feasible alternative to petroleum for transportation. Feed-stock based.	L. high ecological/environmental impact as it drastically alters the environment, major impact on aquatic habitats.
16. Hydrogen	F. cheap, clean, emission-free, power found in the splitting of atoms.	M. env. impact varies greatly depending on farming practices & feedstock. Not economically competitive.

ORAL COMPONENT

What is the Oral Component?

The Oral Component (OC) offers Envirothon teams a chance to address real-life environmental problems as presented through a written scenario. The OC tests a team's ability to consider an environmental issue, discuss its likely ramifications and effects, develop possible solutions, and present their findings to a panel of judges and then answer the judges' questions during a 20-minute session. Participation in the OC is mandatory. The OC offers students a chance to hone their public speaking, problem solving and presentation skills, and it also helps the students prepare for the upcoming testing stations.

How does it Work and What will it Teach My Students?

The OC consists of a 5 – 10 minute oral presentation and a 10 minute question/answer period to a panel of five to seven judges. The scenario is posted on the Pennsylvania Envirothon website (www.envirothonpa.org) on Monday, May 11, 2009, one week prior to the event. Teams can utilize existing resources and research new information allowing them to better prepare for their oral presentation. Teachers/advisors are asked to NOT prepare the presentation of the team.

Before their scheduled presentation time, teams are allotted one hour to prepare any visuals that they wish to use during their presentation. The Pennsylvania Envirothon provides teams with the materials they are permitted to use. No other materials are allowed. Also, within this one hour timeframe, teams may practice their presentation before going in front of the judges. The team's overall knowledge of the required traditional Envirothon resource material serves as a sound base in preparing for the Oral Component. Actual study material may not be used during preparation time.

During a 20 minute session, the teams present their recommendations to a panel of judges chosen by the Pennsylvania Envirothon Board. A total of five to seven judges constitute a panel in each room. Each team is asked questions based on their recommendations and scored accordingly by the panel of judges. This is a great opportunity for students to work together and apply some of the things they have learned while studying for the Envirothon competition. Teams discuss their findings prior to presentation time and decide which of their recommendations is feasible in a real life situation. They are asked to defend and explain their recommended actions. Students are not judged on what is "right" or "wrong", they are judged on their ability to think on their feet and incorporate their existing knowledge of Soil/Land Use, Aquatic Ecology, Wildlife, Forestry and the year's current issue. The scenario is based on the Current Issue theme each year when applicable.

When is it Held?

The Oral Component is held the day prior to the station tests. Teams are scheduled for presentations according to their travel distance from the competition location. For example, for the 2009 event at the University of Pittsburgh Johnstown, teams closest to Johnstown, Cambria County, will present first, allowing additional travel time for teams coming from farther points.

How Can My Team Prepare?

To help your county team prepare for the Oral Component experience, peruse the "Learning Enhancement activities" provided in the literature in this booklet. Many of the activities allow students to role-play situations that affect various environmental areas. These role-playing extensions could be very valuable in preparing a team to think in terms of how all the traditional station areas interconnect. The following scenario was used for the 2008 oral component. This provides an example of the types of issues you may or may not experience at any given Envirothon competition.

2008 Oral Component Scenario

The Appalachian Trail Conservancy (ATC) is a volunteer-based, private nonprofit organization dedicated to the conservation of the 2,175-mile Appalachian National Scenic Trail, a 250,000-acre greenway extending from Maine to Georgia. Our mission is to ensure that future generations will enjoy the clean air and water, scenic vistas, wildlife and opportunities for simple recreation and renewal along the entire Trail corridor.

The idea of a "Trailway" was first embraced in 1937. The "Trailway" referred to an area dedicated to the interests of those on foot, originally a mile on either side. In some cases, that came to mean a "buffer"—a legally protected area around the path that kept the sights and sounds of civilization, logging, and development away from the solitary hiker. In other cases, it meant a great deal more. It evolved into a notion of a "greenway," a broad swath of protected land through which the Trail ran. Crucial to the idea of a greenway was that of the "viewshed," the countryside visible from the Trail's high points. In the years since the A.T. became a national scenic trail, the Conservancy has worked to influence the development of surrounding areas so that the views from the Trail remain scenic, even when those views are of areas well outside the boundaries of the public Trail lands themselves.

Within this "Trailway", no new parallel roads would be built or any other incompatible development allowed. Timber cutting would not be permitted within 200 feet of the Trail. Similar agreements, creating a zone one-quarter-mile in width, were signed with most states through which the Trail passes. Today, 99 percent of the Trail runs across public lands.

The ATC works with the National Park Service Appalachian Trail Park Office, 30 maintaining clubs and multiple other partners to engage the public in conserving this essential American resource.

At a Glance

The Appalachian Trail, completed in 1937:

- Is a unit of the National Park Service.
- Is the nation's longest marked footpath, at approximately 2,175 miles.
- Is the first national scenic trail, designated in 1968.
- Houses more than 2,000 occurrences of rare, threatened, endangered, and sensitive plant and animal species.
- Crosses six national parks.
- Traverses eight national forests.
- Touches 14 states.
- Crosses numerous state and local forests and parks.
- Is maintained by 30 trail clubs and multiple partnerships.

Impacts which threaten the A.T. and the hiking experience include:

Non-Recreational Activities

- Highway construction
- Housing developments
- Windmills & powerlines interrupting viewshed
- Invasive plants
- Declining air quality

Recreational Activities

- Trail maintenance/repair
- Camping in non-designated areas
- ATVs & snowmobiles**
- Bikers & horseback riders**
- Hiking
- Lesser Impacts (hunting, fishing, pets, cross-country skiing)

NOTE: ** No motorized vehicles, bicycles, or horses are allowed on the AT. The AT is strictly a walking/hiking trail for pedestrians only.

Fun facts about the Appalachian Trail:

- Lowest elevation: 124 feet.
- Highest elevation: 6,625 feet.
- More than 9,000 people have reported hiking the length of the Trail.
- It takes approximately 5 million footsteps to walk the entire length of the Trail.

PENNSYLVANIA SPECIFICS:

The Appalachian Trail follows ridges of mountains east of the Alleghenies to the Susquehanna River in a long section of Trail notorious for its foot-bruising, boot-destroying rocks. The Trail north of the Susquehanna is characterized by long, flat, rocky ridges broken by fairly strenuous climbs in and out of gaps. About ten miles south of the Susquehanna River, the Trail crosses the Great Valley of the Appalachians to the Blue Ridge. This southern portion of the Trail through Pennsylvania has many sections that are gentle, and grades are easy, making it one of the easiest sections of the Trail.

Pennsylvania can be oppressively hot in summer, and water may be scarce. The Trail crosses many roads, and some shelters are near roads, where scattered crime problems make extra safety awareness a good idea.

ATC has a field office along the Trail in Boiling Springs.

Pennsylvania at a Glance

A.T. mileage	229 miles
Difficulty rating	2-4 (Scale is 1-10: 1=flat/easy; 10=difficult -requires use of hands, footing precarious)
Elevation	320—2,080 feet

Scenario Outline / Objective:

The variety of recreational uses on and near the Appalachian Trail negatively impacts habitats, wildlife, forests, water quality, land use, and user experience. Your team is a group of environmental consultants, hired by the Appalachian Trail Conservancy, Pennsylvania Chapter, to develop and deliver up to a 12 minute presentation on your management plan. Your plan should address 2 critical recreational activities which negatively impact the AT in Pennsylvania and WHY you selected them. It should also include 2 solutions to minimize those critical recreational impacts on the Appalachian Trail and define strategies of how to implement those solutions.

Your plan and presentation must:

- Identify 2 **Critical Recreational Activities** that have an environmental and social impact on the Appalachian Trail and trail users. Discuss why you chose them and what makes them critical.
- Discuss how these activities impact the soil, water quality, forests, wildlife, habitats, and quality of experiences for those using the trail. Impacts may include environmental, social, health, or economic.

Propose a solution/recommendation for each of the CRAs which will minimize these impacts or provide protection of the trail. Explain how these solutions and/or recommendations can be implemented. Who would be impacted? Who will enforce them? How will these solutions improve conditions relevant to wildlife, forests, soils, habitats, water quality, trail communities, and other users?

SOME TIPS FOR TEACHING ENVIROTHON MATERIAL

1. Try a few of the learning enhancements with this year's reference materials! We have tried to identify learning enhancements that would assist you in teaching Envirothon material. They can be a lot of fun and can help improve student understanding of key concepts for each station. If you do not have a copy and would like one, contact your County Conservation District.

2. Arrange a visit to a local park or nature center! Just one day or afternoon "in the field" can do wonders for bringing all of your team's studying to life. Many environmental educators in parks and nature centers can lead hikes based around themes or concepts that *you* want covered with your students. Hands-on investigations, tree identification walks, stream investigations: all of these may be possible at sites near your school.

3. Ask your Conservation District about tree and log scales, diameter tapes, topographic maps, and other available educational resources and programs! Many Conservation Districts have educational resources that you can check out for use with the Envirothon and they offer a variety of training workshops. Talk to your County Envirothon Coordinator about the possibilities of a school program or other educational activity. This person (or persons) is your contact for a wide array of helpful services. Write or give them a call! A listing of contacts and phone numbers can be found on the Envirothon website.

4. Visit the PA Department of Education's website! The Envirothon learning objectives can assist you in addressing the adopted Environment and Ecology standards. If you would like to see how the Envirothon learning objectives correlate to these standards, visit the PA Department of Education's website at www.pde.state.pa.us.

5. Utilize the World Wide Web! The Envirothon WebPages have been recently updated and, in addition to all of the information there, it also has links to all of our sponsors and partnering agencies. For updates, current events, and resources, this is a great way to go!

A few links of interest:

- www.envirothonpa.org - PA Envirothon homepage
- All of our partners' and sponsors' page links can be found on the Envirothon homepage.
- www.envirothon.org - Canon Envirothon homepage
- www.eNature.com - Bird calls, resources, activities, information, updates, etc.

6. Follow environmental issues in your local newspapers! This is a great way for your students to connect all of the environmental concepts the Envirothon covers with "real life." In every spot in Pennsylvania on every day, something is happening which affects the health of our forest ecosystems and watersheds, the quality of living for local residents, and the use of our resources. There are success stories as well as hard lessons in economics, politics, and sociology. Following a current local event in the classroom is an effective way of engaging students in informed discussions and action.

7. Check out Keystone WILD! Notes This is wonderful Pennsylvania-centered conservation-education publication. Each issue reviews special articles that can be used in the classroom as foundations for a lesson.

For further information, contact: Wild Resource Conservation Program
P.O. Box 8764
Harrisburg, PA 17105-8764

8. Check out Bay Journal! This is a broad-reaching and informative monthly publication put out by the Alliance for the Chesapeake Bay that focuses on issues and updates on our downstream estuary. It would be a great addition to teacher reference materials for use in student research assignments, in-class discussions of current events, or a year-long monitoring of this critical ecosystem's health. Topics covered include: water quality, pollution violations, the Clean Water Act, conservation efforts, oyster and crab population levels, and threats of industrial development projects. This is free! You may read the Bay Journal online at www.bayjournal.com or for further information, contact:

Alliance for Chesapeake Bay
6600 York Road, Suite 100
Baltimore, MD 21212

9. Last, but certainly not least: have fun! One key to a meaningful environmental education experience is *fun*. Reading up on your local ecosystems, having an energetic discussion about a forestry issue, investigating a stream for water quality, measuring trees like professional foresters, even getting your hands "dirty" in an exposed soil profile, all of these can be fun and exciting adventures in learning. If it's fun, you will not only get the students excited for more, but what they end up learning will probably stand a better chance of sticking with them. Have a great time with the 2009 Envirothon!



REFERENCE MATERIAL AVAILABLE ON COMPACT DISKS



It is the goal of the Pennsylvania Envirothon program to go "almost" paperless. For each station, we are providing you with a compact disk that contains most of the required reference material. Some publications are not available in electronic format or via the internet. These publications are still available in hard copy by contacting your County's Envirothon Coordinator.

If you experience difficulty in opening a file...

Many of the references are Portable Document Format (pdf) files. When opening a pdf file you may receive an information bar indicating the following message: To help protect your security, Internet Explorer has restricted this file from showing active content that could access your computer. Click here for options...

Options include: Allow Blocked Content...
What's the Risk?

Click "Allow Blocked Content" and Click "yes" to the Security Warning. The file should open.

AQUATIC ECOLOGY

Essential Topics

I. Aquatic Ecology

- a. Abiotic
 1. Influence of water's chemical properties on aquatic organisms
 2. Influence of water's physical properties on aquatic organisms
 3. Influence of the surrounding land on a stream
 4. Influence of the water cycle on the aquatic ecosystem
 5. Identification of watersheds and river systems in Pennsylvania
 6. Identification and comparison of stream order within a watershed
- b. Biotic
 1. Identification of aquatic organisms
 2. Life cycles of aquatic organisms
 3. Adaptations of aquatic organisms
 4. Habitat needs of aquatic organisms
- c. Community
 1. Identification of aquatic and wetland environments
 2. Functions and values of wetlands
 3. Physical, chemical, and biological changes in the stream continuum
 4. Functional feeding groups of aquatic organisms and their niche in the stream continuum
 5. Energy flow in aquatic food chains

II. Aquatic Resource Issues

- a. Human effects on the aquatic ecosystem
- b. Impact of water pollution on aquatic communities
- c. Threatened and endangered species and their impact on biodiversity
- d. Introduced and invasive species and their effects on the aquatic ecosystem

III. Aquatic Resource Management and Protection

- a. Commission roles in management, conservation, and protection of aquatic resources
- b. Regulations and how they protect aquatic animals and aquatic habitats
- c. Water quality assessment
- d. Water quality improvement
- e. Aquatic habitat enhancement
- f. Restoration of aquatic organisms
- g. Aquatic resource protection at home and school

Learning Objectives

**Correlated with the Academic Standards for Environment and Ecology*

After completing study on this issue, students will:

1. Aquatic Ecosystems
 - a. Abiotic
 1. Determine pH, alkalinity, and dissolved oxygen percent saturation of a water sample with given information and explain how each property influences a particular aquatic organism.

**4.1 Watersheds and Wetlands – 4.1.7.C, 4.1.12.C*

**4.6 Ecosystems and their Interactions - 4.6.7.A, 4.6.10.A*

2. Explain how water flow, water temperature, water turbidity, and surface tension influence a particular aquatic organism.
**4.1 Watersheds and Wetlands - 4.1.7.C, 4.1.10.B, 4.1.12.C*
 3. Explain how surrounding land influences water flow, channel shape, and habitat types in a stream.
**4.1 Watersheds and Wetlands - 4.1.10.B*
 4. Identify three specific parts of the water cycle and describe their influence on the aquatic ecosystem.
**4.1 Watersheds and Wetlands - 4.1.7.A*
 5. Identify Pennsylvania's six watersheds and their related river systems and locate them on a map.
**4.1 Watersheds and Wetlands - 4.1.7.B*
 6. Identify the stream order of three or more given watercourses in a particular watershed and compare or contrast the habitats and aquatic animals that are found in each of those ordered watercourses.
**4.1 Watersheds and Wetlands - 4.1.12.A*
- b. Biotic
1. Identify (to include calls) common and significant aquatic animals from a give identification list.
**4.1 Watersheds and Wetlands - 4.1.7.C, 4.1.7.D, 4.1.10.C*
 2. Describe the life cycle of three or more specific aquatic organisms.
**4.1 Watersheds and Wetlands - 4.1.7.C*
 3. List three adaptations of a specific aquatic animal and explain the advantage of each.
**4.1 Watersheds and Wetlands - 4.1.7.C, 4.1.10.C*
**4.6 Ecosystems and their Interactions – 4.6.7.A*
**4.7 Threatened, Endangered and Extinct Species - 4.7.10.A, 4.7.10.B*
 4. Describe the habitat needs of three or more specific aquatic animals.
**4.1 Watersheds and Wetlands - 4.1.10.C*
- c. Community
1. Identify six specific aquatic or wetland environments given their physical, chemical and biological characteristics.
**4.1 Watersheds and Wetlands - 4.1.7.D, 4.1.12.B*
 2. List three functions or values of wetlands.
**4.1 Watersheds and Wetlands - 4.1.7.D, 4.1.7.E, 4.1.10.D, 4.1.12.D*
 3. Compare and contrast physical, chemical, and biological differences found in a stream continuum from headwater to mouth.
**4.1 Watersheds and Wetlands - 4.1.10.A, 4.1.10.C, 4.1.12.A*
 4. Identify the functional feeding group of four or more aquatic macroinvertebrates and describe their niche in the stream continuum.
**4.1 Watersheds and Wetlands - 4.1.10.C*
 5. Compare and contrast the flow of energy in two different aquatic food chains.
**4.6 Ecosystems and their Interactions - 4.6.7.A, 4.6.10.A*

2. Aquatic Resource Issues

- a. Explain the effects of three different human activities on the aquatic ecosystem.
 - *4.1 Watersheds and Wetlands - 4.1.10.E*
 - *4.3 Environmental Health - 4.3.7.B, 4.3.10.B*
- b. List three types of water pollution, their sources and explain how they impact an aquatic community.
 - *4.1 Watersheds and Wetlands - 4.1.10.E*
 - *4.3 Environmental Health - 4.3.7.A, 4.3.7.B*
- c. Identify at least three threatened or endangered species, give reasons for their status, and explain how their extirpation or extinction could impact biodiversity.
 - *4.7 Threatened, Endangered and Extinct Species - 4.7.7.C, 4.7.10.A, 4.7.12.A, 4.7.12.B*
- d. List at least three invasive or introduced plant and animal species and discuss their affects on the aquatic ecosystem.
 - *4.7 Threatened, Endangered and Extinct Species - 4.7.10.A*

3. Aquatic Resource Management and Protection

- a. Explain three or more ways that the Commission manages, conserves, and protects aquatic resources.
 - *4.8 Humans and the Environment - 4.8.7.D*
 - *4.9 Environmental Laws and Regulations - 4.9.7.A*
- b. Identify or list at least three specific fishing regulations from the current PA Fishing Summary and explain how each protects aquatic animals or aquatic habitats.
 - *4.9 Environmental Laws and Regulations – 4.9.7.A, 4.9.10.A*
- c. Explain one or more methods to assess the water quality of a stream.
 - *4.1 Watersheds and Wetlands – 4.1.12.C*
- d. List and describe three or more ways to improve the water quality of a stream.
 - *4.8 Humans and the Environment - 4.8.7.D*
- e. List and describe three or more ways to enhance aquatic habitats.
 - *4.8 Humans and the Environment - 4.8.7.D*
- f. Identify three or more migratory fish that the Commission is restoring and name the watershed in which each can be found.
 - *4.7 Threatened, Endangered and Extinct Species - 4.7.7.C*
- g. Discuss at least three ways that you can protect aquatic resources at home or school.
 - *4.3 Environmental Health - 4.3.7.A*
 - *4.8 Humans and the Environment - 4.8.7.C, 4.8.7.D*

Reference Materials List

The following resources are available on the Aquatics Reference Materials CD, except where indicated. References marked with an asterisk were distributed as paper copy in previous years via the PA Envirothon. Two new PLAY issues will be distributed for 2009 and can be found on the 2009 Current Issue CD in the Aquatic Ecology file. The references are also available on the Learning Center page of the Commission's website at www.fish.state.pa.us. New resources are underlined.

1. Books:

- Pennsylvania Fishes (ISBN 1-930369-01-8)
- Pennsylvania Amphibians and Reptiles (ISBN 1-930369-00X)*

*The PA Amphibians and Reptiles book is not available on the Aquatics CD. New teams should contact their County's Envirothon Coordinator to obtain their copy of this book.

2. Fact Sheets

- | | |
|-----------------------------------|---|
| A River Flows Through It | Macroinvertebrate Feeding Frenzy |
| Basics of Water Pollution | Mayflies |
| Caddis Flies | Phytoplankton |
| Clams and Mussels | Pond/Stream Study Guide/Key to Macroinvertebrates |
| Crazy Crayfish | Snails |
| Dobsonfly | Stoneflies |
| Dragons & Damsels | Stream Reader |
| ENA & ELPA | Water Walkers |
| Great Fishing Needs Great Habitat | Zooplankton |

3. Select Pages from PLAY (on the Aquatic Ecology CD)

- | | |
|-------------------------------|---|
| ANS - From Here to There | Focus on Habitat: Largemouth Bass |
| ANS - PA's Least Wanted | Focus on Habitat: Wild Brook Trout (Part 1 & 2) |
| ANS - PA's Ten Least Wanted | Six Ways to the Sea |
| ANS - Protecting Pennsylvania | Water Cycle |
| Aquatic Leaf Eaters | |

PLAY Issues (distributed in 2008, except for two new issues for 2009)

- All about Trout
- Flex Your Mussel Knowledge
- PA's Most Mighty Migratory Fish
- Sci-fi in the Real World (new for 2009)
- Six Legs Underwater
- Smallmouth Bass
- The Road to Extinction (new for 2009)
- Watersheds and Stream Order

4. Articles

- A Fish and Livestock Tale
- Fish Habitat and Flow: What's the Connection
- Migratory Fish Restoration
- On the Road to Extinction
- PA's Threatened and Endangered Fishes
- Timbering and Trout
- Wetlands: The Vital Link

5. Select pages from the *2009 Pennsylvania Summary of Fishing Laws and Regulations*
The Summary book will be available on the Fish page of the Commission’s website in January 2009. Teams should review the following regulations or information (ordered as they appear in Summary):
 - Commonwealth Inland Waters
 - Big Bass Program
 - Stop Aquatic Nuisance Species
 - Trout Fishing Regulations
 - Catch and Release Fishing – How to Release Fish
 - Panfish Enhancement Special Regulations
 - Reptiles, Amphibians, Endangered Species – Seasons and Limits
 - General Regulations, Tackle and Bait
 - Unlawful Acts – It is Unlawful

6. *Frog and Toad Calls of Pennsylvania* CD
New teams should contact their County’s Envirothon Coordinator to obtain a copy of this separate CD.

Learning Enhancements

Completing these activities will enhance learning and help students begin to meet some of the Aquatic Ecology objectives.

1. Froggy Swamp (included on the Envirothon Aquatic Ecology CD)
2. Herp Sweet Home (included on the Envirothon Aquatic Ecology CD)
3. Can Mussels Move (PLAY – Flex Your Mussel Knowledge)
4. Match the hatch (PLAY – Six legs Underwater)
5. Smallmouth Bass Skills (PLAY – Smallmouth Bass)

Identification Study List

The animals from this list are common species or have other significance in the aquatic ecosystem (migratory, endangered, invasive, water quality indicator, etc).

Fish	Amphibians	Reptiles	Invertebrates
American eel	Bullfrog*	Bog turtle	Amphipod/scud
American shad	Eastern American toad*	Common snapping turtle	Backswimmer
Atlantic sturgeon	Eastern gray treefrog*	Eastern box turtle	Blackfly larva
Blacknose dace	Pickereel frog*	Map turtle	Caddisfly*
Bluegill	Northern green frog*	Midland painted turtle	Crayfish
Brown bullhead	Northern leopard frog*	Red eared slider	Cranefly*
Brook trout	Northern spring peeper*	Spotted turtle	Damselfly*
Brown trout	Wood frog*	Wood turtle	Dobsonfly/fishfly*
Chain pickerel	Four-toed salamander	Northern coal skink	Dragonfly*
Channel catfish	Eastern hellbender	Northern fence lizard	Freshwater mussel
Common carp	Jefferson salamander	Black rat snake	Freshwater snail
Flathead catfish	Longtail salamander	Eastern garter snake	Giant water bug
Greenside darter	Marbled salamander	Eastern hognose snake	Isopod/aquatic sowbug
Largemouth bass	Mudpuppy	Eastern massasauga	Mayfly*
Mottled sculpin	Northern dusky salamander	Eastern milk snake	Predaceous diving beetle
Muskellunge	Northern spring salamander	Eastern smooth green snake	Stonefly*
Northern pike	Northern two lined salamander	Northern brown snake	Water scorpion
Paddlefish	Northern red salamander	Northern copperhead	Water strider
Rock bass	Redback salamander	Northern ringneck snake	Whirligig beetle
Sea lamprey	Red-spotted newt	Northern water snake	Water boatman
Smallmouth bass	Slimy salamander	Ribbon snake	Water penny
Striped bass			
Walleye			
White sucker			
Yellow perch			
	*Must know calls		*Know larval/adult stage

PA Fish & Boat Commission Regional Aquatic Resources Program Specialists

Northwest Region	11528 State Highway 98, Meadville PA 16335	814-336-2426
Southwest Region	236 Lake Road, Somerset, PA 15501-1644	814-443-9841
Northcentral Region	450 Robinson Lane, Bellefonte, PA 16823	814-359-5193
Southcentral Region	PO Box 67000, Harrisburg PA 17106-7000	717-705-7850
Southeast Region	PO Box 8, Elm, PA 17521-0008	717-626-9081
Northeast Region	PO Box 88, Sweet Valley, PA 18656	570-477-2206

CURRENT ISSUE TOPIC

Biodiversity in a Changing World

The rich tapestry of life on our planet is the outcome of over 3.5 billion years of evolutionary history. It has been shaped by forces such as: changes in the planet's crust, ice ages, fire, and interaction among species. Now, it is increasingly being altered by humans through our habitat changes to benefit us. The impacts of human activities reach into every corner of the natural world. For instance, between one third and one half of the Earth's land surface has been substantially transformed by agriculture, urbanization, and commercial activities of various kinds; about one quarter of all bird species have been driven to extinction; and more than one half of all accessible surface water, as well as an enormous quantity of groundwater, is diverted for human uses. It is estimated that 25% of all species could go extinct in the next ten years.

These uses have brought unquestionable benefits to human welfare. But the upshot of this growing human domination of the planet is that no ecosystem on Earth is free from pervasive human influence.

The term 'biodiversity' is indeed commonly used to describe the number, variety and variability of living organisms. It has become a widespread practice to define biodiversity in terms of genes, species and ecosystems, corresponding to three fundamental levels of biological organization.

It is evident that a certain level of biological diversity is necessary to provide the material basis of human life: at one level to maintain the biosphere as a functioning system and, at another, to provide the basic materials for agriculture and other needs.

Over geological time, all species have a finite span of existence. Species extinction is therefore a natural process, which occurs without the intervention of man. However, it is beyond question that extinctions caused directly or indirectly by man are occurring at a rate, which far exceeds any reasonable estimates of background extinction rates. Management of our ecosystems intended to maintain one facet of biodiversity will not necessarily maintain another facet which may be just as important.

Perhaps because the living world is most widely considered in terms of species, biodiversity is very commonly used as a synonym of species diversity, in particular of 'species richness', which is the number of species in a site or habitat. Marine habitats frequently have more different phyla but fewer species than terrestrial habitats. Species diversity in natural habitats is high in warm areas and decreases with increasing latitude and altitude. On land, diversity is also usually higher in areas of high rainfall and lower in drier areas. The richest areas are undoubtedly tropical moist forests. In aquatic areas most life is found near the shoreline.

- Biodiversity changes as man manipulates his environment - is this good or bad?
- Biodiversity changes are a natural process - how does acceleration of our environmental changes affect it?
- Biodiversity has changed or changes as a result of our activities
 - A. Habitat Loss (i.e. agricultural, urban sprawl, population growth, etc.)
 - B. Natural Disasters
 - C. Alterations in Ecosystems (i.e. deforestation, dams, fragmentation, etc.)
 - D. Invasive and Non-Native Species
 - E. Over-exploitation
 - F. Pollution / Pesticides
 - G. Global Climate Change

Learning Objectives

Students will be able to:

1. Define Biodiversity
 - A. Species Biodiversity
 - B. Ecosystem Biodiversity
 - C. Genetic Biodiversity
 - D. Cultural Biodiversity

**4.3 Environmental Health – 4.3.10. C*

2. Explain the benefits of biodiversity and why they are important.
 - A. Economic
 - B. Environmental
 - C. Medical
 - D. Recreational / Social

**4.8 Humans and the Environment – 4.8.10. A, B, C, D and 4.8.12. C, B*

3. Identify and explain how a changing world impacts soils/land use, aquatic ecology, forestry, and wildlife and the effects these changes have on biodiversity.
 - A. Habitat Loss (i.e. agricultural, urban sprawl, population growth, etc.)
 - B. Natural Disasters
 - C. Alterations in Ecosystems (i.e. deforestation, dams, fragmentation, etc.)
 - D. Invasive and Non-Native Species
 - E. Over-exploitation
 - F. Pollution / Pesticides
 - G. Global Climate Change

**4.3 Environmental Health – 4.3.10. C*
**4.6 Ecosystems and their Interactions – 4.6.10. A and 4.6.12.B, C*
**4.8 Humans and the Environment – 4.8.10. A, B, C, D and 4.8.12. C, B*

4. Provide solutions to minimize and /or solve biodiversity loss.

**4.3 Environmental Health – 4.3.12. C*

Resources

The following resources are available on the 2009 Current Issue Reference CD in the “Current Issue” file.

1. Biodiversity in a Changing World – Resource compiled and provided by the PA Envirothon Program (Resources cited at the end of document)

2. Biodiversity Our Living World: Your Life Depends On It!

Learning Enhancement Activity

1. Biodiversity: Earth’s Most Valuable Resource

FORESTRY

Learning Objectives

The basic resources for each objective are found on the Forestry Reference Materials CD provided through your County Conservation District. Additional resources are suggested under a following heading.

**Correlations with the Academic Standards for Environment and Ecology*

After completing study on this issue, students will:

I. Knowledge of Trees. Forestry Reference Materials CD Section I.

- a. Identify common species without a key and specific or unusual species of trees or shrubs using a botanical key. (Use of a botanical key is an important skill in many environmental professions. Practice with the Summer Key to Pennsylvania Trees provided.)
Pay special attention to shade tolerance and soil moisture requirements of each tree species studied. Understand their timber and wildlife values.

**4.2 Renewable and Nonrenewable Resources – 4.2.4.A - D, 4.2.7.A - D, and 4.2.10.A and B*

- b. Explain typical tree growth and life cycle. Be able to describe the parts and tissues of a tree and their arrangements and functions. Recognize defects that effect a tree's health, quality and resource potential.

**4.7 Threatened, Endangered, and Extinct Species – 4.7.10.B*

- c. Explain the cause and effect relationships between environmental factors, (light, soil and moisture) and tree growth. Be able to interpret these effects in the growth rings of a sample of wood (either a "tree cookie" or core taken with an increment borer).

**4.6 Ecosystems and their Interactions – 4.6.7.A – C, and 10.A*

II. Knowledge of Forest Ecology. Forestry Reference Materials CD Section II.

- a. Explain general forest typing based on the dominant tree species. Describe major forests types found in Pennsylvania. Analyze and type a specific forest site.

**4.6 Ecosystems and their Interactions – 4.6.10.A*

**4.7 Threatened, Endangered and Extinct Species – 4.7.7.A - C*

- b. Explain typical forest structure (canopy, under story and ground layers) and crown classes.
- c. Explain typical forest succession from open areas to closed canopy and back again. Analyze the successional stage of a specific forest site.

**4.6 Ecosystems and their Interactions – 4.6.7.C and 10 C*

- d. Explain how wildlife habitat relates to the forest plant community (i.e. tree species present, age structure, snags and dead-and-down trees, availability of food and riparian zones).

**4.6 Ecosystems and their Interactions – 4.6.10.A*

- e. Explain what effects a specific species increase or decrease might have on the forest ecosystem.

**4.3 Environmental Health – 4.3.10.C*

- f. Evaluate species diversity and its importance. Explain biological diversity as an indicator of a healthy environment as well as analyze the effects of species extinction on the health of an ecosystem.

**4.3 Environmental Health – 4.3.10.C*

III. Knowledge of Forest Benefits and Resources. Forestry Reference Materials CD Section III.

- a. Be able to summarize the general history of Pennsylvania's forests from the arrival of the first humans 10,000 years ago to the present.
 - *4.4 *Ecosystems and their Interactions – 4.4.10.A*
 - *4.8 *Humans and the Environment – 4.8.10.C*
- b. Describe values and benefits of forests for recreation, wildlife and watershed quality.
- c. Demonstrate the use of common forestry equipment (Biltmore stick, diameter tape and clinometers), to measure tree diameter and height. Be able to calculate wood volume.
- d. List products and uses of the following commercial species grown in Pennsylvania: Red & White oaks, Black cherry, White ash, hickories
 - *4.4 *Ecosystems and their Interactions – 4.4.10.A*
- e. Describe the benefits of maintaining trees in urban and suburban communities and factors effecting their health and survival.
 - *4.3 *Environmental Health – 4.3.12.A*

IV. Forest Resource Management and Protection. Forestry Reference Materials CD Section IV.

- a. Study *The State of the Forest: A Snapshot of Pennsylvania's Updated Forest Inventory 2004*. This is the most current data available describing Pennsylvania's forest resources. Particularly note the patterns of forestland ownership, area of forests, distribution of age and size classes and of tree species, wood volume statistics and regeneration issues.
- b. Explain the uses of these silviculture techniques in even-aged and uneven-aged forest management: thinning, clear-cutting, seed-tree method, shelter wood method, and selection method. Describe the practices of "high grading" and "diameter limit" cutting.
 - *4.2 *Renewable and Nonrenewable Resources – 4.2.10.C*
 - *4.4 *Ecosystems and their Interactions – 4.4.12.A*
 - *4.8 *Ecosystems and their Interactions – 4.8.10.C*
- c. Identify and describe the life cycle and impacts of common forest pests and invasive plants. Research integrated pest management strategies for selected pests.
 - *4.5 *Integrated Pest Management – 4.5.10.A and 12.A*
- d. Predict how human or natural action can produce change to which an organism cannot adapt (Gypsy Moth, Chestnut blight, invasive species, etc.)
 - *4.6 *Ecosystems and their Interactions – 4.6.10.B*
 - *4.8 *Humans and the Environment – 4.8.10.C*
- e. Explain the role of fire in forest ecosystems. Describe the basic principles of wildfire prevention and control.
 - *4.6 *Ecosystems and their Interactions – 4.6.12.C*
- f. Explain the potential for pollution from timber harvesting and the practices used to minimize erosion and sedimentation.
 - *4.3 *Environmental Health – 4.3.10.B*
 - *4.8 *Humans and the Environment – 4.8.10.C*
- g. Summarize State and local regulations and programs pertaining to timber management including PA Code Chapter 102 Erosion & Sedimentation Control regulations, waterways management regulations–PA Code Chapter 105, Pennsylvania's *Right to Practice Forestry Act* and the Forest Stewardship Program.
 - *4.9 *Environmental Law and Regulations – 4.9.12 A*

Reference Materials List

Forestry Reference Materials Compact Disk – Review the topics and objectives listed below on the *Forestry Reference Materials* compact disk provided by your County Conservation District. Most of these materials are from publications produced by the Pennsylvania State University or from the USDA Forest Service.

Although the CD contains a large amount of material, many topics are covered more than once in different ways. So, it is not as overwhelming as it might appear at first glance.

Forestry CD Index

I. *Knowledge of Trees*

Common Trees of Pennsylvania (substitute new edition from your files)

Penn State CD: Tree Identification Power Point; Summer Key; Slide Index (from CD provided)

Tree Rings (an example of interpreting patterns in the growth rings of trees)

Tree Layers (an illustration of the tissue layers that make up a tree trunk)

II. *Knowledge of Forest Ecology*

Forest Types of Pennsylvania

Penn's Woods: Our Heritage from the Past, Our Legacy for the Future

Forest Succession and Wildlife

Habitat Adaptations of Some Common Trees of Pennsylvania

Vertical Forest Stratification

Pennsylvania Woodlands: #6 Woodland Wildlife Management

Understanding biological wealth in our forests

III. *Knowledge of Forest Benefits and Resources*

People of Penn's Woods

Tree Inventory & Utilization

Forest Measurement Tools

Measuring Tree Height using a Clinometer

Urban & Community Forestry

Benefits of Urban Trees

From the Woods Series:

Hardwood Lumber Incredible Wood

Hardwood Veneer Maple Syrup

Ten Important Hardwoods Watersheds

American Chestnut

IV. *Forest Resource Management and Protection*

The State of the Forest

Forest Stewardship Bulletin #15 Regenerating Hardwood Forests: Managing Competing Plants, Deer, and Light

Basic Forest Management

Pennsylvania Woodlands: #8 Principles of silviculture

From the Woods Series

White-tailed Deer

Sustainable Forestry

Insect Threats

Hemlock Woolly Adelgid in PA

Gypsy Moth Control

Emerald Ash Borer

Asian Longhorn Beetle

What is an Invasive Plant?

Purple-loosestrife; Mile-a-minute; Bush honeysuckle; Japanese honeysuckle; Japanese barberry; Japanese-knotweed; Multiflora-rose; Tree-of-heaven; Autumn-olive; Garlic mustard

Watershed Management

Wildfires in Pennsylvania

Government Programs and Regulations Pertaining to Forestry

Non-government Sources of Forestry Assistance

Pennsylvania Woodlands: #4 Forest Terminology

2009 Current Issue “*Biodiversity in a Changing World*” and the overlap with Forestry.

Section II of the Forestry Reference Materials contains most of the resources addressing biodiversity issues. Explanations of genetic, species and ecosystem biodiversity are included in *Understanding biological wealth in our forests*.

Review the threats to forest resources discussed in the sections of *Pennsylvania's Wildlife and Wild Places: Our Outdoor Heritage in Peril* provided. This resource can be found on the 2009 Current Issue CD in the “Forestry” file.

Review updated information with these on-line resources.

Information on Pennsylvania native wild plants, invasive exotic plant problems and ginseng can be found at www.dcnr.state.pa.us/forestry/wildplant/index.aspx.

Check recent developments in the fight against invasive plant species on the internet at www.invasivespeciesinfo.gov/ under “Species Profiles”.

Get updated information about emerald ash borer, gypsy moth and other insect pests on the DCNR-Bureau of Forestry-Forest Pest Management website www.dcnr.state.pa.us/forestry/fpm_invasives.aspx and the US Forest Service web site at <http://www.emeraldashborer.info/>

The Penn State College of Agricultural Sciences – School of Forest Resources provides a Sustainable Forestry Teacher Resource Center. It provides lesson plans in sustainable forestry, natural resources, water, and wildlife. The lesson plans are designed by teachers for actual use in the classroom and meet Pennsylvania's environmental and ecology education standards. Each lesson plan indicates subject matter, grade level, and regional applicability. The lesson plans can be adapted to fit your location. These resources are found at <http://sftrc.cas.psu.edu/>.

Additional sources: The following books contain helpful information, illustrations and background materials. They are available in libraries and bookstores.

Peterson Field Guide Series, Published by Houghton Mifflin Company

A Field Guide to Eastern Forests, by John C. Kricher and Gordon Morrison.

Good coverage of several complex topics:

Section 2. Forest Field Marks

Stratification; Predicting a Forest's Future; The Forest Food Chain and Ecological Pyramid

Section 4 Disturbance and Pioneer Plants

Ecological Succession: The Process of Vegetation Development Over Time

Section 8. Autumn and Winter

Tree Trunks and Growth Rings

For help with tree identification try these titles also from the Peterson Field Guides series:

A Field Guide to Trees and Shrubs by George A. Petrides

A Field Guide to Eastern Trees by George A. Petrides/Janet Wehr

Bureau of Forestry Service Foresters can help teacher/advisors prepare for local Envirothon events. See the Bureau's web site for the service forester assigned to your county at www.dcnr.state.pa.us/forestry/serviceforesters_select.aspx.

SOIL / LAND USE

Essential Topics

New topics/objectives are underlined.

I. Basic Soils Knowledge

- a. Formation
- b. Drainage
- c. Soil horizons
- d. Hands-on investigations
- e. Soil quality
- f. Soil biology and diversity

II. Understanding Maps, Surveys and Landforms

- a. Soil survey maps and data tables
- b. Topographic maps
- c. Land forms and geologic terms

III. Land Use

- a. Agriculture and conservation practices
- b. Current environmental concerns and land use issues
- c. Soils and history
- d. Pollution remediation
- e. Identification and benefits of wetlands
- f. Carbon sequestration

IV. Decision-Making and Protection of Soils

- a. Scenarios
- b. Actions at home and at school

Learning Objectives

**Correlated with the Academic Standards for Environment and Ecology*

After completing study on this issue, students will:

1. Describe the relationship between soil formation and the movement of water both within the soil and across the landscape.
**4.1 Watersheds and Wetlands – 4.1.10.A, B, C*
2. Describe how soil characteristics are affected by water, and how to control water movement to prevent erosion and pollution. Understand how topography, stream movement, and drainage are related.
**4.1 Watersheds and Wetlands – 4.1.10.B*
3. Explain the importance of wetlands and how to recognize potential wetland areas and hydric soils.
**4.1 Watersheds and Wetlands – 4.1.10.D, E*
4. Explain the importance of soils as a natural resource which must be managed properly in order to sustain a healthy society. Understand that soils are in some ways nonrenewable, and what effects gross mismanagement of soils has had historically.
**4.2 Renewable and Nonrenewable Resources – 4.1.10.A, B, C*
5. Describe the effects of human activity on soils and how soils can be used to clean up pollutants or can become a major pollutant.
**4.2 Renewable and Nonrenewable Resources – 4.1.10.C, D*

6. Describe basic soil chemical and physical properties and how they interact with other variables to determine soil fertility or the ability of a soil to remediate pollution and improve environmental health.
**4.3.Environmental Health – 4.3.10.A, B*
7. Explain how soil is alive, and how biological diversity is important for soil health and hence human, plant, and environmental health.
**4.3 Environmental Health – 4.3.10.C*
**4.7 Threatened, Endangered and Extinct Species – 4.7.10.A*
8. Explain the soil food web and the different roles and survival strategies that various soil microbial organisms develop within the soil environment.
**4.7 Threatened, Endangered and Extinct Species – 4.7.10.B, C*
9. Understand and be able to describe the importance of soils to agriculture and soil quality properties. Describe current research findings on best management practices to maximize agricultural production, maintain and build soil health, and prevent soil loss and pollution.
**4.4 Agriculture and Society – 4.4.10.A, B, C, D*
10. Use the soil survey to evaluate the best crops to grow in a given area and what limitations certain soils have to agricultural productivity. Also identify areas of prime farmland that should be preserved.
**4.4 Agriculture and Society – 4.4.10.C*
11. Describe the hydrologic, carbon, and nutrient cycles and how soil management relates to those processes.
**4.6 Ecosystems and their Interactions – 4.6.10.A, B*
12. Explain how societal needs, economic forces, and natural forces affect soil resources and how we can ensure long term sustainability of soil health.
**4.8 Humans and the Environment – 4.8.10.A, B, C, D*
13. Explain historical events that led to the creation of the soil conservation service.
**4.9 Environmental Laws and Regulations – 4.9.10.A*
14. Explain in detail the role that geology plays in soil formation, the kinds of soils that are formed, and their basic characteristics including texture, pH, color, and structure.
**3.5 Earth Sciences – 3.5.10.A*
15. Describe the basic geological features and rocks of the state of Pennsylvania and how they were formed.
**3.5 Earth Sciences – 3.5.10.A*
16. Understand and interpret geographical and geological information from topographic maps. Be able to make some basic assumptions about appropriate land use from topographic and geologic maps and information.
**3.5 Earth Sciences – 3.5.10.A*
17. Use a soil survey or web-soil survey data to evaluate land use in Pennsylvania. Show how information in soil surveys can help the land user predict or avoid problems like sinkholes, or regions prone to landslides, flooding, drought, or soil instability.
**3.5 Earth Sciences –3.5.10.B*
18. Compare different kinds of land uses and conservation practices on erosion and sedimentation.
**3.5 Earth Sciences – 3.5.10 B*

19. Explain how climate is a major soil forming factor through its affect on vegetation, organisms, water, and weathering.

**3.5 Earth Sciences – 3.5.10.C*

20. Explain how soils and soil management are integral to maintaining clean water and a healthy aquatic environment.

**3.5 Earth Sciences – 3.5.10.D*

Reference Materials List

The following references can be found on the Envirothon Soil / Land Use CD. New references are underlined.

1. An Introduction to Soils of Pennsylvania
2. Soil Survey (York County)
3. Soil Quality Information Sheets (found on the following website://soils.usda.gov/sqi/)

Soil Quality Introduction	Indicators for Soil Quality Evaluation
Erosion	Organic Matter
Sediment Deposition	Soil Crusts
Compaction	Aggregate Stability
Soil Biodiversity	Infiltration
Available Water Capacity	Soil pH
Pesticides	
4. Sustaining Our Soils and Society
5. Topographic Map Symbols
6. Soil Biology Primer (use only chapter 1: “The Soil Food Web”, pp. 4 - 9 and chapter 2: The Food Web & Soil Health pp. 10 - 17)
7. From the Surface Down
8. A Conservation Catalog
9. Soil References for Landforms and Geologic Terms
“Soil Structure and Soil Texture Triangle”
10. Soil’s Not Trivial
11. Cornell Soil pH kits – pH kits may be purchased from the Cornell University by visiting the following website: http://www.css.cornell.edu/soiltest/soil_testing/products.asp
12. Do You Dig Wetland Soils?
13. The Color of Soil
14. Soil Carbon Sequestration Fundamentals: Ohio State University Fact Sheet – Found on the 2009 Current Issue CD in the “Soil & Land Use” file.
15. General Soil Map of Pennsylvania - Found on the 2009 Current Issue CD in the “Soil & Land Use” file.

Learning Enhancement

The Smithsonian has a brand new soils exhibit. If you would like to learn more about it, you can visit their website at: <http://forces.si.edu/soils/> (This is not a required resource.)

WILDLIFE STATION

Essential Topics

New topics/objectives are underlined.

- I. Knowledge of Birds and Mammals
 - a. Bird and mammal identification
 - b. Natural history of birds and mammals
 - c. Habitat/ecosystem types and associated wildlife
- II. Understanding Wildlife Ecology
 - a. Survival requirements of wildlife and how they are met
 - b. Ecosystem dynamics:
 - Predator-prey relationships
 - Energy flow-food chain, food web, food pyramid
 - Succession
 - c. Adaptations
 - d. Population dynamics
- III. Conservation and Management of Wildlife
 - a. Pennsylvania Game Commission
 - b. Hunting and Trapping regulations
 - d. Pennsylvania Game and Wildlife code
 - e. Wildlife Management
 - f. Improving/managing habitat for wildlife
- IV. Issues Involving Wildlife and Society
 - a. Biodiversity
 - Levels of biodiversity
 - Importance of biodiversity ecologically and in our every day life
 - Loss of biodiversity causes and implications
 - b. Endangered and threatened species
 - What makes a species more prone to becoming endangered than other species?
 - Responsibility for upholding endangered species act
 - Terminology: for example: reintroduction, endangered, threatened, extirpated, and extinct
 - Endangered and threatened birds and mammals of PA
 - c. Habitat loss and fragmentation
 - d. Managing/planning for people and wildlife
 - e. Non-native species; invasive species; introduced species
 - f. Reintroduction of native species
 - g. Current Issue – Biodiversity

Learning Objectives

**Correlated with the Academic Standards for Environment and Ecology*

Envirothon Students will be able to:

1. Knowledge of Wild Birds and Mammals
 - a. Answer questions concerning the natural history of wild bird and mammal species and identify birds and mammals if given natural history information.
 - b. Identify and be able to group animals that would be associated with specific ecosystems.
 - c. Evaluate a specific habitat and select or list species most likely to live there.
 - d. Describe various roles of birds and mammals in their ecosystems and be able to cite examples.

- e. Identify wildlife species from mounted specimens, pictures or silhouettes.
(Species for items a - e are selected from the Wildlife Notes found on List B in the Appendix.)
- f. Identify wildlife species based on signs including: fur, hair, wings, feathers, gnawings, rubbings, pellets, tracks*, skulls♦ and scat. (tracks for *animals only and skulls for ♦ animals) - Wildlife species are selected from list C in the Appendix.
- g. Identify birdcalls of bird species found on list A in the Appendix.
- h. Describe ways habitat can be managed/improved for specific birds and mammals.

**4.6. Ecosystems and their Interactions – 4.6.7.A, C, 10.A, and 12.C*

**4.7 Threatened, Endangered and Extinct Species – 4.7.7.A, C, 10.A and C*

2. Understanding Wildlife Ecology

- a. Identify basic needs required by wildlife.
- b. Identify, describe, and explain specific anatomical, physiological and/or behavioral adaptations of wildlife to the environment and how they help the animal survive. (i.e. migration, hibernation, defense posturing, strong beak, webbed feet, - includes skull and teeth and all descriptions, explanations, and terminology in reference to skull hand-out)
- c. Describe predator-prey relationships, discuss physical adaptations of predator vs. prey species, and be able to cite examples.
- d. Describe and be able to model food chains, food webs, trophic levels - be able to cite examples.

**4.6 Ecosystems and their Interactions – 4.6.7.A and 10.A*

**4.7 Threatened, Endangered and Extinct Species – 4.7.7.A, B, 10.A and B*

- e. Describe factors that limit or enhance population growth.
- f. Define and explain terms associated with wildlife biology and wildlife populations.
(i.e. natality, mortality, precocial, altricial, crepuscular, nocturnal, delayed implantation, carnivore, niche, herbivore, insectivore, omnivore, producer, primary consumer, secondary consumer, etc.).
- g. Define and explain basic ecological concepts and terminology (i.e. limiting factor, biological carrying capacity, cultural carrying capacity, territory, home range, population, community, succession, forest fragmentation, etc.).

**4.6 Ecosystems and their Interactions – 4.6.7.A, C, 10.A and C*

**4.7 Threatened, Endangered and Extinct Species – 4.7.7.C and 10.C*

3. Conservation and Management of Wildlife

- a. Describe the role of the Game Commission as the agency responsible for the protection, conservation, and management of wild birds and mammals of Pennsylvania.
- b. Identify the Game Commission as the agency responsible for hunting and trapping regulations and upholding the Game and Wildlife code in the state of Pennsylvania.
- c. Answer questions concerning hunting and trapping regulations - related to pages indicated in the Reference section of the Appendix.
- d. Classify birds and mammals as to Game and Wildlife Code classifications.
- e. Identify and describe methods that can be used to evaluate a habitat.
- g. Identify and describe methods that can be used to determine the abundance and distribution of wildlife.
- h. Identify and describe methods that can be used to determine the specific needs of a species.
- i. Describe methods used to manage and conserve wildlife and wildlife habitat.
- j. Describe ways each person can help in the protection, conservation management and enhancement of wild bird and mammal populations.

**4.6 Ecosystems and their Interactions – 4.6.7.A, 10.A, C, and 12.C*

**4.8 Humans and the Environment – 4.8.7.D, 10.C and D*

**4.9 Environmental Laws and Regulations – 4.9.7.A and 10.A*

4. Issues Involving Wildlife and Society

- a. Define biodiversity and provide examples of how biodiversity is important to people and wildlife.
- b. Describe levels of biodiversity (genetic, species, and ecosystem or community) and explain why diversity within each level is important for healthy environment.
- c. Describe implications of biodiversity loss at each of the 3 levels of biodiversity.
- d. Identify and explain the major causes of loss of biodiversity in our state and worldwide.
- e. Explain the relationship of deer and deer management with biodiversity in our state.

**4.3 Environmental Health – 4.3.7.C and 10.C*

**4.7 Threatened, Endangered and Extinct Species – 4.7.7.A, C, 10.A, and 12.A and C*

- f. Identify and explain the terms used in endangered and threatened species, for example: extinct, extirpated, endangered, threatened, candidate species, and reintroduction.
- g. Identify wild birds and mammals that are listed as endangered, extirpated, threatened or candidate species. Know natural history and habitat requirements. Describe the main causes that have led to the depleted populations and describe measures being taken to help their recovery.
- h. Identify and explain factors that have led to species becoming endangered and threatened.
- i. Identify and explain factors which can make a species more likely to become endangered and threatened.
- j. Identify and explain methods and management practices that are used to save an endangered or threatened species.
- k. Describe major causes of habitat loss in Pennsylvania and how habitat loss affects wildlife.
- l. Explain the role of the Endangered Species Act in helping to conserve endangered and threatened species.
- m. Know the organizations and agencies responsible for listing species on global, federal and state level.
- n. Describe specific impacts of people on biodiversity – both negative and positive, for example:

Negative impacts include but are not limited to:

- Fragmentation of habitat due to roads and trails, buildings, etc.
- Disturbance of wildlife in nesting seasons due to human activity and noise.
- Destruction of habitat due to vehicle.
- Death and/or injury of species by vehicle collision.
- Trash interfering with wildlife health through food intake or causing injury to wildlife.
- Pesticides or other changes to environment to make areas more comfortable.

Positive impacts include but are not limited to:

- Enhancement of wildlife habitat in order to attract wildlife for viewing.
- Increase knowledge of wildlife through visiting wildlife and natural areas.
- Increase appreciation of wildlife and the importance of the natural world – leads to conservation.
- Funding for wildlife management.

**4.7 Threatened Endangered and Extinct Species – 4.7.7.B, C, 10.B and C, 12.B and C*

**4.9 Environmental Laws and Regulations – 4.9.10.A*

Reference Materials List

Prepare for the wildlife portion of the PA Envirothon by reviewing the Wildlife Reference Materials compact disk provided by your County Conservation District. New items are underlined.

1. Wildlife Note Series - see List B in the Appendix for Wildlife Notes needed. Refer to CD and PGC webpage.
2. *Helping Wildlife: Working with Nature* booklet – This booklet can be obtained by contacting your County’s Envirothon Coordinator.
3. Envirothon Animal Tracks – Refer to CD – see List C in the Appendix for Identification of Wildlife sign indicated by an asterisk *.
4. Envirothon Skull Reference Resource: compiled by the PA Game Commission – see List C in the Appendix for Identification of Wildlife sign indicated by a diamond ♦. Refer to CD or a paper copy can be obtained from your County’s Envirothon Coordinator.
5. Endangered and Threatened Species – Refer to CD and PGC webpage, **www.pgc.state.pa.us**
Click on Wildlife (left column) → Endangered / Threatened species from middle reference material and the species material → Birds and Mammals
Do not forget the information on the CD as well!
6. 2008-2009 Pennsylvania Digest of Hunting and Trapping regulations - **the following 7 sections only: General Hunting Regulations, State Game Land Regulations, Wildlife Classifications** (on p. 59 of book or click on harvest Report and Dog Hunting page to find Wildlife Classification on web), **Youth Hunting Opportunities, ATV Use, CWD, and Fluorescent Orange Requirements.** This can be found on the PGC web site at **www.pgc.state.pa.us** go to **Quick Clicks** (right column) and click on 2008-2009 Hunting and Trapping Digest.
7. 2008-2009 Hunting Annual - This can be found in the Hunting and Trapping digest (towards middle) or on the PGC web site at **www.pgc.state.pa.us** click on **Quick Clicks** (right column) 2008-2009 Hunting and Trapping Digest, scroll down and look for picture towards the left (woods scene with adult and child in camo) click picture for the 2008-2009 Hunting Annual.
8. Pennsylvania Envirothon Bird Song CD
9. PGC Skull Envirothon resource – Refer to CD - To view drawings of skulls, go to the Smithsonian Institute Zoology, North American Mammals website **www.mnh.si.edu/mna** and search by species name.
10. Biodiversity: PA Species, Ecosystems and Biodiversity – Refer to CD

LIST A: Identification of BIRD Calls, Songs, and Sounds (Based on PA Envirothon Bird Song CD)

Mourning Dove	Ring-Necked Pheasant	Wild Turkey
Robin	Wood Thrush	Mallard
Northern Flicker	House Wren	Meadowlark
Blue jay	Great-Horned Owl	Barn Owl
Canada goose	Barred Owl	Kestrel
Red-Tailed Hawk	Screech Owl	Common Nighthawk
Wood Duck	American Woodcock	Grouse
American Crow	Pileated Woodpecker	Eastern Towhee
Cardinal	Red-Winged Blackbird	Osprey
House Sparrow	Great Blue Heron	Bald Eagle
Black-Capped Chickadee		

LIST B: Identification, Natural History, Wildlife Biology, and Habitat Evaluation based on the following Wildlife Notes. New notes are underlined.

Bats	Finches and House Sparrow	Raccoon
Beaver	Fisher	Ruffed Grouse
Black Bear	Foxes (Red and Gray)	Shrews
Blackbirds, Orioles, Cowbird and Starling	<u>Flycatchers</u>	Sparrows and Towhee
<u>Bluejay</u>	Gray Catbird, Northern Mockingbird and Brown Thrasher	<u>Snow Goose</u>
Bobcat	Hawks (Raptors)	Squirrels
Canada Goose	Heron Family	Thrushes
Chickadees, Nuthatches, Titmouse and Brown Creeper	Mallard	Tundra Swan
Chimney Swifts, Purple Martin, and Swallows	Mice and Voles	Vultures
Common Nighthawk and Whip-poor-wills	Minks and Muskrats	Weasels
<u>Chipmunk</u>	Opossum	White-Tailed Deer
Cottontail Rabbit	Otter (River)	Wild Turkey
Crows and Ravens	Owls	Wrens
Diving Ducks	Porcupine	Woodchuck
Eagles and Osprey	Puddle Ducks	Woodcock
Eastern Coyote		Woodpeckers
Elk		

Wildlife Notes may be found on the PGC web site, www.pgc.state.pa.us, click on Wildlife (left column) and then Wildlife Notes (right column).

LIST C: Identification of WILDLIFE SIGN

SIGNS CAN INCLUDE: fur, hair, feathers, gnawings, rubbings, pellets, nests, scat, skulls[♦], and tracks* (only *animals for tracks and only [♦] animals for skulls.) New species are *italicized*.

Baltimore Oriole	House Sparrow	Red Fox*
Black Bear* [♦]	Fisher	River Otter*
Beaver* [♦]	Gray Fox*	Robin (See Thrushes)
Black-Capped Chickadee	Green-winged Teal	Ruffed Grouse
Bobcat* [♦]	Mallard	Gray Squirrel
Blue winged Teal	Mink*	Red Squirrel
Black Duck (see puddle ducks)	Muskrat	Striped Skunk*
Canada Goose	Opossum*	White-Tailed Deer* [♦]
Cottontail Rabbit [♦]	Owl	Wild Turkey
Coyote* [♦]	<u>Pileated Woodpecker</u>	Wood Duck
Crow	Pheasant, Ring-Necked	Woodchuck
Bluebird (See Thrushes)	Porcupine*	Woodcock
Elk*	Raccoon* [♦]	<u>Yellow-bellied sapsucker</u> (see Woodpeckers)

Pennsylvania Game Commission

Website: www.pgc.state.pa.us

Northwest Region, PO Box 31, Franklin, PA 16323	Phone: (814) 432-3188 or (814) 432-3189
Southwest Region, 4820 Route 711, Bolivar, PA 15923	Phone: (724) 238-9523 or (724) 238-9524
Northcentral Region, 1566 South Route 44 Highway, PO Box 5038, Jersey Shore, PA 17740	Phone: (570) 398-4744 or (570) 398-4745
Southcentral Region, 8627 William Penn Highway, Huntingdon, PA 16652	Phone: (814) 643-1831 or (814) 643-1835
Northeast Region, PO Box 220, Dallas, PA 18612	Phone: (570) 675-1143 or (570) 675-1144
Southeast Region, 448 Snyder Road, Reading, PA 19605	Phone: (610) 926-3136 or (610) 926-3137
Central Office PA Game Commission Headquarters, 2001 Elmerton Avenue, Harrisburg, PA 17110	Phone: (717) 787-6286