PENNSYLVANIA ENVIROTHON

2018
Teacher Resource Booklet

Pennsylvania Envirothon Inc.
Lorelle Steach, Executive Director
702 West Pitt Street, Suite 3
Bedford, PA 15522
PH: 814/310-3271
E-mail: lsteach@envirothonpa.org
Web site: www.envirothonpa.org

2018 Teacher Resource Booklet

For more than 34 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 natural resources. Students involved in the Envirothon often pursue further education in natural resource fields. Many Envirothon participants pursuing 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 natural resource and 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 participant, 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 "The Benefits of Grassland and Pastureland Management" 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.

This Teacher Resource Booklet is intended to help you and your teams become fluent in a broad range of natural resource 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 about the 2018 Pennsylvania and NCF Envirothon events
4. Brief History of the Envirothon
5. Overview of Station testing and a past current issue station test
6. Overview of state Oral Component and the 2017 scenario
7. Some Tips for Teaching Envirothon Material
8. Aquatic Ecology *
9. Current Issue – "The Benefits of Grassland and Pastureland Management" *
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 and Science and Technology Standards*

c) Reference Materials List - If you are missing any of these materials, contact your County Conservation District.

MISSION STATEMENT

The Pennsylvania Envirothon educates high school students in 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 learning objectives emphasize awareness, knowledge, and attitudes through outdoor hands-on applications while addressing 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

Partners

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
Pennsylvania Department of Environmental Protection
Pennsylvania Fish and Boat Commission
Pennsylvania Game Commission
U.S. Department of Agriculture, Natural Resources Conservation Service
National Conservation Foundation Envirothon

Corporate Sponsors

Shell Oil Company	Philadelphia Insurance Companies	The Hershey Company
Weis	EQT Foundation	Dwight Lewis Lumber
PPL Corporation	Chief Oil & Gas	Lewis Lumber Products
UGI Utilities	EQT Foundation	Cargill

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, which is now grown to an international competition. More than 15,000 students participate each year and the program has grown to include every county in the state.

2018 PENNSYLVANIA ENVIROTHON

What: Pennsylvania State Envirothon –35th Annual

Who: Teams of High School Students from all across Pennsylvania

When/Where: Tuesday, May 22, 2018 – Susquehanna University
Wednesday, May 23, 2018 – Camp Mount Luther

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	Cooperating Agency
Soil/Land Use	USDA Natural Resources Conservation Service
Aquatic Ecology	PA Fish & Boat Commission
Forestry	PA DCNR Bureau of Forestry
Wildlife	PA Game Commission
*Benefits of Grassland & Pastureland Management	PA Envirothon, USDA Natural Resources Conservation Service

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

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 – Biodiversity in a Changing World
2010 – Protection of Groundwater
2011 – Salt and Fresh Water Estuaries
2012 – NPS & Low Impact Development
2013 – Grazing and Pastureland Management
2014 – Sustainable Agriculture/Buy Locally
2015 – Urban and Community Forests
2016 – Invasive Species
2017 – Agricultural Soil and Water Conservation

2018 NCF-ENVIROTHON

The winning team of the Pennsylvania Envirothon will advance to the NCF-Envirothon being held July 22 – July 27, 2018 at Idaho State University, Pocatello, ID. Over forty-seven states, nine Canadian provinces/territories, and two Chinese provinces are expected to participate in this 30th international event!

OVERVIEW OF THE STATION TESTING

To prepare teams for the Pennsylvania Envirothon, most counties model their testing stations 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 resources at that site.

For example, the forestry station relates to forest ecology, forest structure and composition, regional tree and plant species, and silvicultural and forestry practices; the aquatic ecology station relates to aquatic ecosystems, species diversity, and aquatic resource management; the soils/land use station relates to land formation, use of a soil survey, and land management practices; and the wildlife station 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 its knowledge of environmental science and natural resource management.

As teams rotate through each of the five testing stations, they experience a variety of testing formats. Most tests 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 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 **2015 Current Issue** station. This county level test was based on the theme "Urban and Community Forests." These are examples of the types of questions you <u>might</u> experience at any given Envirothon competition.

1. What is the difference between grey and green storm water systems?
    a. one produces grey water and one produces green water
    b. green uses special pipes while grey uses soils and plants
    c. grey uses curbs, drains, and pipes while green creates areas that mimic nature
    d. there is no difference

2. How does the use of permeable pavement benefit storm water management and urban trees?
    a. Water runs off the pavement into tree pits
    b. It allows for roots to grow through it
    c. It allows water to pass through it where it can percolate down to the soil and tree roots.
    d. It does not work well because it clogs up with sediment

3. Trees capture rainfall in their leafy canopies. This serves as a benefit to urban storm water management because it increases which portion of the water cycle?
    a. Transpiration
    b. Interception
    c. Infiltration
    d. Phytoremediation

4. Pruning is the selective removal of plant parts. However, different species of plants require proper pruning to be done in particular seasons. Which season should a non-flowering hardwood (ex: oaks, maples, birch) be pruned?
    a. Spring
    b. Summer
    c. Fall
    d. Winter
    e. Any time of the year
5. Upon inspection, you have noticed that the flowering pear tree has a cracked limb. It could potentially cause a hazard to pedestrians using the sidewalk. Which season should you wait to address this tree?
    a. Spring
    b. Summer
    c. Fall
    d. Winter
    e. As soon as possible

Use the words or phrases in the box to answer questions

Objectives	urban population	Strategies
Evaluation	Annual budget	Forested Bioswale
Comprehensive plans	Green roof	Vision statement

6. A _____ is a graded depression designed to detain storm water and promote infiltration.
7. A _____ is a mix of impervious base materials to prevent leakage and support soils, plants, irrigation, and drainage systems, making it and the building below structurally sound and safe.
8. This element of a community tree plan considers where you want to go with the plan, the desired future you wish to work toward.
9. This element of a community tree plan should include: effective administration, annual analysis and removal of hazardous trees, proper site analysis and preparation, proper tree planning, maintenance and others.

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 challenges 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?

It is mandatory for ALL teams to participate in the Oral Component.

The 2018 scenario will be posted on the Pennsylvania Envirothon website (www.envirothonpa.org) on Monday, May 14th, during the week prior to the event. Posting the scenario provides teams an opportunity to better prepare their oral presentation. Teams can utilize existing resources and research new information. Teams may also receive limited guidance (i.e., review score sheet, clarify scenario) from their advisors; advisors are encouraged to **NOT** prepare their team's presentation.

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 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. On the day of competition prior to their scheduled presentation time, teams are allotted one hour to prepare any visuals they wish to use during their presentation. A schedule is provided closer to the event. The Pennsylvania Envirothon provides teams with all materials, which are permitted for use. No other materials are allowed. This list is included in the Oral Competition Rules and Guidelines. Also within this one hour timeframe, teams may practice their presentation before going in front of the judges.

The presentation usually consists of how the team's proposed idea will positively and/or negatively impact the land, water, air, wildlife, forests, and people of the area. Although a few resource materials might be provided, the majority of the team's proposal is based on the resources they've been studying throughout the year.

When participating in the Oral Component, **teams are asked to NOT wear attire** (hats, shirts, shorts, etc.) **that may indicate or include their county name or school name.** Anonymity is important when the students are presenting before a panel of judges; this helps to keep a level playing field for all teams.

This is a great opportunity for students to work together and apply 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 testing. Team presentation times are randomly scheduled. *Teams are encouraged to call the Envirothon office if they cannot make their scheduled time.*

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 in situations that affect various environmental areas. These role-playing extensions can be very valuable in preparing a team to think in terms of how all the station areas interconnect. Also, the Pennsylvania Envirothon offers training videos that highlight the Oral Component. These videos can be found on the Pennsylvania Envirothon – Station Training – Oral Component web page two weeks prior to the competition. Teams will need a password in order to access the videos. The password is found in the team registration packet. In addition, your teams can view the top presentations from previous NCF-Envirothon competitions by visiting the NCF-Envirothon website's Media Center Video Gallery at: http://www.envirothon.org/video-gallery.html.

The following scenario was used for the 2017 oral component. This provides an example of the types of issues you might be asked to address at any given Envirothon competition.

2017 Oral Component Scenario

A young couple in their early thirties, one of whom is a veteran, wants to purchase their first farm. They have picked out an 80-acre farm in Everyton, Pennsylvania. The farm is in a state of disrepair due to poor management by the previous owner. They would like to get their start in farming by setting up a poultry flock and a small beef herd. They are considering their options for marketing specialty products from those commodities, and from crops or produce they could potentially grow in their fields.

The crop fields have some gully erosion, and the barnyard is directly adjacent to a stream. The barnyard was previously overcrowded and now contains only bare soil and excess manure. Runoff from the barnyard goes directly to the stream. The farmland is considered highly erodible and has very low organic matter, but the Phosphorus (P) levels in the fields around the barnyard are very high, over 200ppm. The new farmers want to install Best Management Practices (BMPs) to boost the productivity of the farm and improve water quality in the stream.

As an Envirothon Team, you should play the role of a group of conservation professionals from various state, federal, and county agencies, and private consulting firms. You are meeting with the young couple and several of their advisors (role-played by the judges) to offer recommendations for technical and financial assistance.

Your Presentation:

Create a 10-minute presentation for the young couple and their advisors highlighting potential opportunities for the future of their farm. Incorporate at least three (3) spoken, relevant, and reputable references as you present. During the 10-minute presentation, teams should address the following:

I. Task 1- Improve Soil – What BMPs could the couple utilize to repair the erosion issues, avoid future erosion problems, and improve soil health and soil quality? What crops or products would be most appropriate for the couple to grow considering both environmental sustainability and their ability to generate a sustainable income?

II. Task 2 - Improve Water Quality - What BMPs could the couple utilize to correct the current pollution issues coming from the barnyard, improve stream health, and reduce potential future pollution to the stream?

III. Task 3 – Identify Resources and Programs –What programs, both State and Federal, would you suggest to this couple to assist them with their farm improvement goals? What planning resources could the couple utilize to assist with land management goals?

IV. Economic and Community Impact – Describe ways the farm can become economically viable. The young couple has asked you to provide suggestions for raising and marketing some specialty farm products. How will the management choices the young couple makes for their farm affect the farm's economics? In what ways will the farm's new ownership and the new style of management impact the nearby community of Everyton, Pennsylvania?

SOME TIPS FOR TEACHING ENVIROTHON MATERIAL

1. **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.

2. **Ask your Conservation District about tree and log scales, diameter tapes, clinometers, aquatic specimens for identification, topographic maps, deer aging tools, soil pit profile posters, and other available educational resources and programs!** Many Conservation Districts have educational resources that you can borrow to assist with training your Envirothon teams. They also offer a variety of training workshops. Talk to your County Envirothon Coordinator about the possibilities of a school program or educational activity. This person(s) 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.

3. **Visit the PA Department of Education's website!** The Envirothon learning objectives can assist you in addressing the Environment and Ecology and the Science, Technology, Engineering, and Math 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.

4. **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 – Pennsylvania Envirothon
   - www.envirothon.org – NCF-Envirothon
   - Partner and sponsor page links can be found on the Pennsylvania Envirothon website
   - www.birds.cornell.edu or www.allaboutbirds.org/guide/search – Cornell University Lab of Ornithology

5. **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.

6. **Check out <u>Bay Journal</u>!** 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. You may read the Bay Journal online at www.bayjournal.com.

7. **Last, but certainly not least: HAVE FUN!** One key to a meaningful natural resource and environmental education experience is *fun*. Reading up on your local ecosystems, having an energetic discussion about a wildlife 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 they will learn information that will stick with them for years to come. Have a great time with the 2018 Envirothon!

REFERENCE MATERIAL AVAILABLE ONLINE

www.envirothonpa.org

For each station, the majority of the references listed are available on the Pennsylvania Envirothon website under the tab - **<u>Station Training</u>**.

Please visit the site at *http://www.envirothonpa.org*.

Some publications are not available in electronic format or via the internet. These publications are available in hard copy by contacting your County's Envirothon Coordinator.

2018 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 and Assessment Anchors 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 Ecology – 4.1.12.F*
            **4.2 Watersheds and Wetlands – 4.2.10.A, B, C, D, 4.2.12.B, C, D*
        2. Explain how water flow, water temperature, water turbidity, and surface tension influence a particular aquatic organism.
            **4.2 Watersheds and Wetlands - 4.2.10.A, B, C, 4.2.12.C, D*
        3. Explain how surrounding land influences water flow, channel shape, and habitat types in a stream.
            **4.2 Watersheds and Wetlands - 4.2.10.A, B, 4.2.12.A*
        4. Identify three specific parts of the water cycle and describe their influence on the aquatic ecosystem.
            **4.2 Watersheds and Wetlands - 4.2.10.A, B*
        5. Identify Pennsylvania's six watersheds and their related river systems and locate them on a map.
            **4.2 Watersheds and Wetlands - 4.2.10.A*
        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.
            **4.2 Watersheds and Wetlands - 4.2.10.A, C*
    b. Biotic
        1. Identify (to include calls) common and significant aquatic animals from a give identification list.
            **4.2 Watersheds and Wetlands - 4.2.10.C*
        2. Describe the life cycle of three or more specific aquatic animals.
            **4.2 Watersheds and Wetlands – 4.2.10.C*
        3. List three adaptations of a specific aquatic animal and explain the advantage of each.
            **4.1 Ecology – 4.1.10.D*
            **4.2 Watersheds and Wetlands - 4.2.10.A, C*
        4. Describe the habitat needs of three or more specific aquatic animals.
            **4.2 Watersheds and Wetlands - 4.2.10.C*

c. Community
    1. Identify six specific aquatic or wetland environments given their physical, chemical and biological characteristics.
        **4.2 Watersheds and Wetlands – 4.2.10.B, D*
    2. List three functions or values of wetlands.
        **4.2 Watersheds and Wetlands - 4.2.7.B*
    3. Compare and contrast physical, chemical, and biological differences found in a stream continuum from headwater to mouth.
        **4.2 Watersheds and Wetlands - 4.2.10.A, C, D, 4.2.12.D*
    4. Identify the functional feeding group of four or more aquatic macroinvertebrates and describe their niche in the stream continuum.
        **4.2 Watersheds and Wetlands - 4.2.10.C*
    5. Compare and contrast the flow of energy in two different aquatic food chains.
        **4.1 Ecology - 4.1.7.A, 4.1.10.A*

2. Aquatic Resource Issues
    a. Explain the effects of three different human activities on the aquatic ecosystem.
        **4.2 Watersheds and Wetlands - 4.2.10.A, B, D, 4.2.12.A, C*
        **4.5 Humans and the Environment- 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.
        **4.2 Watersheds and Wetlands - 4.2.10.A*
        **4.5 Humans and the Environment- 4.5.10.A, C*
    c. Identify at least six threatened or endangered species, give reasons for their status, and explain how their extirpation or extinction could impact biodiversity.
        **4.1 Ecology – 4.1.10.A, D, E, 4.1.12,D, E, F*
    d. Identify at least six different invasive species and discuss their habitat, spread, distribution and environmental impacts.
        **4.2 Watersheds and Wetlands – 4.2.10.C*

3. Aquatic Resource Management and Protection
    a. Explain three or more ways that the Commission manages, conserves, and protects aquatic resources.
        **4.2 Watersheds and Wetlands – 4.2.12.A, B, C*
        **4.5 Humans and the Environment - 4.5.12.C*
    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.
        **4.1 Ecology – 4.1.12.A, E*

c. Explain one or more methods to assess the water quality of a stream.
   **4.2 Watersheds and Wetlands – 4.2.10.A, C, D*

d. List and describe three or more ways to improve the water quality of a stream.
   **4.2 Watersheds and Wetlands – 4.2.10.C*

e. List and describe three or more ways to enhance aquatic habitats.
   **4.2 Watersheds and Wetlands – 4.2.10.D, 4.2.12. D*

f. Identify three or more migratory fish that the Commission is restoring and name the watershed in which each can be found.
   **4.1 Ecology – 4.1.12.E*

g. Discuss at least three ways that you can protect aquatic resources at home or school.
   **4.1 Ecology – 4.1.10. D, E, 4.1.12.D, E*
   **4.5 Humans and Environment*

Reference Materials List - 2018

The references are found on the PA Envirothon web site at *www.envirothonpa.org* under *Station Training*. The references are also available on the Commission's Learning Center page: www.fishandboat.com.

1. *Books*:
   Pennsylvania Fishes (ISBN 1-930369-01-8)
   Pennsylvania Amphibians and Reptiles (ISBN 1-930369-00X) (Hard copy only, new teams should contact county Envirothon coordinator to obtain a copy.)

2. *Fact Sheets*
   A River Flows Through It
   Basics of Water Pollution
   Caddis Flies
   Clams and Mussels
   Crazy Crayfish
   Dobsonfly
   Dragons & Damsels
   ENA & ELPA
   Macroinvertebrate Feeding Frenzy
   Mayflies
   Phytoplankton
   Pond/Stream Study Guide/Key to Macroinvertebrates
   Snails
   Stoneflies
   Stream Reader
   Water Walkers
   Zooplankton

3. *PLAY Issues and Select PLAY Pages*
   Focus on Habitat: Largemouth Bass
   Focus on Habitat: Wild Brook Trout
   Freaky Fish of PA
   Good Fishing Needs Good Habitat
   PA's Most Mighty Migratory Fish
   PA's FSI: Fish Scene Investigation
   Six Legs Underwater
   Six Ways to the Sea
   Watersheds and Stream Order

4. *Articles*
   A Fish and Livestock Tale
   Ghosts of the Ohio River
   PA's Threatened and Endangered Fishes
   PA's Wild Trout Streams
   State Wildlife Action Plan
   State Wildlife Action Plan: Identifying Threats to PA's At Risk Aquatic Species
   State Wildlife Action Plan: Identifying Conservation Actions to Protect PA's At-Risk Species
   State Wildlife Action Plan; A Lifeline for the Commonwealth's Imperiled Species
   Timbering and Trout
   The Water Cycle, A Quick Summary (USGS)
   Wetlands: The Vital Link

5. Select pages from the *2018 Pennsylvania Fishing Summary* (available after December 2017):
   General Regulations, Tackle and Bait
   Unlawful Acts
   All Fish Species - Inland Waters
   Largemouth, Smallmouth, Spotted Bass
   Pymatuning & Conowingo Reservoirs
   Delaware River Fishing
   Lake Erie Fishing
   Muskellunge, Pike, Pickerel & Panfish
   Reptiles, Amphibians, Endangered Species
   Aquatic Invasive Species
   Trout Fishing Regulations
   Special Regulation Areas
6. *Frog and Toad Calls of Pennsylvania* CD
   New teams should contact county Envirothon coordinator to obtain a copy.
7. *Herp Sweet Home*
8. *Threatened & Endangered Species*
   Current List of PA's Endangered, Threatened and Candidate Species
   Endangered Species and the PFBC
   Poster of PA's Threatened & Endangered Species (both sides) *

Invertebrates	**Fish**	**Amphibians & Reptiles**
Clubshell Mussel	Atlantic Sturgeon	Eastern Spadefoot Toad
Dwarf Wedgemussel	Burbot	Northern Cricket Frog
Eastern Pearlshell Mussel	Hickory shad	Green Salamander
	Longear Sunfish	Eastern Redbelly Turtle
	Spotted Gar	Eastern Massasauga Rattlesnake

*Participants are responsible for identification of each of the given animals in addition to knowing the information under *Objective 2c*.

9. *PA's Field Guide to AIS* (PA Sea Grant)
   Introduction
   Prevention
   Species Pages*

Plants	Invertebrates	Fish	Algae	Reptiles
Eurasian watermilfoil	Asian Clam	Common Carp	Didymo	Red-eared Slider
Hydrilla	New Zealand Mudsnail	Flathead Catfish		
Water Chestnut	Rusty Crayfish	Northern Snakehead		
Common Reed	Spiny water Flea	Round Goby		
Purple Loosestrife	Zebra Mussel	Sea Lamprey		

*Participants are responsible for identification of each of the given plants and animals in addition to knowing the information under *Objective 2d*.

Identification Study List (from PA Fishes and PA Amphibians & Reptiles books)

Fish	Amphibians	Reptiles	Invertebrates
American Eel	Eastern Gray Treefrog*	Common Snapping Turtle	Amphipod/Scud
American Shad	Eastern American Toad	Eastern Box Turtle	Backswimmer
Black nose dace	Fowler's Toad*	Midland Painted Turtle	Blackfly larva
Bluegill	Northern Green Frog*	Spiny Softshell Turtle	Caddisfly*
Bowfin	Northern Leopard Frog*	Spotted Turtle	Crayfish
Brown Bullhead	Northern Spring Peeper*	Wood Turtle	Cranefly/Tipulid*
Brown Trout	Pickerel Frog*	Northern Coal Skink	Damselfly*
Brook Trout	Wood Frog*	Northern Fence Lizard	Dobsonfly/Fishfly*
Chain Pickerel	Eastern Hellbender	Eastern Garter Snake	Dragonfly*
Channel Catfish	Four-toed Salamander	Eastern (Black) Rat Snake	Freshwater snail
Crappie (genus)	Jefferson Salamander	Eastern Hognose Snake	Giant Water Bug
Creek Chub	Longtail Salamander	Eastern Milk Snake	Isopod/Aquatic Sowbug
Johnny Darter	Marbled Salamander	Queen Snake	Mayfly*
Largemouth Bass	Mudpuppy	Northern Copperhead	Predaceous Diving Beetle
Muskellunge	Northern Dusky Salamander	Northern Redbelly Snake	Stonefly*
Northern Pike	Northern Spring Salamander	Northern Ringneck Snake	Water Scorpion
Paddlefish	Northern Red Salamander	Northern Water Snake	Water Strider
Rainbow Trout	Red-Spotted Newt/Red Eft	Ribbon Snake	Whirligig Beetle
Rock Bass	Slimy Salamander	Rough Green Snake	Water Boatman
Slimy Sculpin	Spotted Salamander	Timber Rattlesnake	Water Penny
Smallmouth Bass			
Striped Bass			
Yellow Perch			
White Sucker	*Must know calls		*Must know life stages

PA Fish & Boat Commission, Bureau of Outreach Education and Marketing

Northwest Region	11528 State Highway 98, Meadville, PA 16335	814-336-2426
Southwest Region	236 Lake Road, Somerset, PA 15501	814-443-9841
Northcentral	595 East Rolling Ridge Drive, Bellefonte, PA 16823	814-359-5127
Southcentral Region	1704 Pine Road, Newville, PA 17241	717-486-7352
Southeast Region	101 Swamp Road, Newtown, PA 18940	215-968-3631
Northeast Region	5566 Main Road, Sweet Valley, PA 18656	570-477-2206

2018 CURRENT ISSUE

Benefits of Grassland and Pastureland Management

Privately-owned grazing land is an important landscape feature in Pennsylvania. Many people identify pastoral settings with animals grazing on them as good farming practices that are also good for the animals. Grazing and browsing animals are used to manage grasses, forbs, residues, and shrubs on pastures and other grasslands, crop fields, and forests. Well-managed pastures and hay fields provide valuable products, conservation of natural resources and valuable wildlife habitat, making them assets not only to private land users but also to the greater agricultural and rural community.

In Pennsylvania, the overall number of farms decreased by 6.5% between 2007 (63,163) and 2012 (59,309). The total number of farm acres in the state is 7,704,444. Of that total, *permanent pasture* constitutes 814,210 acres, and *pastured cropland* constitutes 118,049 acres. The number of farms in Pennsylvania with cropland used solely for grazing or pasture in 2012 was 4,962. The average dollar value per acre of pasture is $2,600.00 (Source for all information above- 2012 Ag Census, NASS).

Major benefits realized from grazing and pasture lands include 1) provision of feed and forage for livestock production, 2) reduction in soil erosion, 3) seasonal protection for nesting birds and wildlife habitat, 4) better water quality, 5) improved soil nutrient content and soil health, and 6) providing food and recreation. While grazing and pasture lands may have their own natural resource *concerns*, conversion of short rotation cropland and hayland to a grazing system may present excellent *opportunities* for livestock producers to distribute nutrients away from concentrated areas and reduce fuel inputs needed to produce feed. Converting short rotation cropland to perennial grasses for producing cellulosic biomass also presents new opportunities for conserving natural resources.

In terms of planning, landowners incorporating pastures and grazing into their livestock operation have access to technical and financial assistance through USDA programs, but there is a need for increased management on the part of the producer which seems to be a prohibiting factor for overall success. While there is a reduced need for fuel and feed inputs, the producer needs to be able to rotate the livestock between pasture to ensure healthy plant growth. Grazing management is the key to healthy, productive pastures and healthy, productive pastures are the key to healthy, productive animals. Working with technical partners such as USDA/NRCS, conservation districts, and Penn State Extension, landowners can get the help they need to get started. There are also professional grazing groups such as Pennsylvania Grazing Lands Coalition and Grazing Lands Conservation Initiative or local producer groups that can advise and address the training and education need for producers.

Envirothon teams will learn how Best Management Practices are used to protect grazing and pasture lands, improve grazing management schemes, promote pest management, and improve habitat for nesting birds and other wildlife. Information provided will demonstrate the importance of finding the optimum balance between natural resource protection and agricultural use on grazing and pasture lands.

Key Topics:

1. Grazing is a popular farming practice. How can this tool be used to help manage the ecosystem?
2. What can management strategies help reduce the spread and impact of noxious weeds?
3. How can grassland and pastureland management be used to maintain a balanced plant community to support livestock, nesting birds, as well as other wildlife and land uses?
4. How can grassland and pastureland managers balance livestock production (grazing) with the maintenance of water quality?

Learning Objectives:

Information and examples provided will help Envirothon Teams understand the following:

1. Characteristics of pastureland and grassland in Pennsylvania and management options.
2. Ways to protect water quality within pastureland and grasslands.
3. How grazing, prescribed burning, and other management tools can be effective to control noxious weeds and improve wildlife habitat.
4. Current BMPs for pastures and grasslands and how they support livestock production, pest management, wildlife, and pollinator habitat maintenance.
5. How different ecosystems, including forests, wetlands, riparian areas, etc. within or near pastures and grasslands interact.
6. How the use of the land by humans, domestic livestock, and wildlife affects the plant community.

Resources

1. Mowing and Wildlife: Managing Open Space for Wildlife Species
2. Well-managed grazing systems: A forgotten hero for conservation
3. Grassland Bird Wildlife Habitat (NRCS)
4. Native Warm-Season Grasses and Wildlife (NRCS)
5. Warm-Season Grasses and Wildlife (Penn State Extension)
6. Prescribed Burning (NRCS) (pdf)
7. Prescribed Burning – NRCS Conservation Practice Standard (pdf)
8. USDA Grazing Management (pdf)
9. Prescribed Grazing – NRCS Conservation Practice Standard (pdf)
10. USDA Herbaceous Weed Control (pdf)

11. USDA Grazing Economics (pdf)
12. Introduction to Livestock – PA Grazing Lands Coalition
13. Pasture, Rangeland, and Grazing Management (ATTRA) (2013)
14. Working Trees - Mitigating Heat Stress in Cattle (US AgroForestry Notes)
15. What is Silvopasture – A Northeast SARE grant (pdf)
16. Idaho Agricultural Best Management Practices - Chap 4 – Grazing (Idaho resource)
17. Plant Identification – excerpts taken from Pasture Plants of the Northeastern United States, Sarah Goslee, USDA-ARS Pasture Systems and Watershed Management (pdf)
    a. Warm Season Grasses - Switchgrass
    b. Cool season grass – Orchardgrass
    c. White Clover
    d. Grazing alfalfa
    e. Dandelion
    f. Plantain
18. PA Conservation Catalog (pdf)
19. Pollinators in Natural Areas – A Primer on Habitat Management (pdf)

**You may also see questions relating to agricultural soil and water conservation stewardship in the soil and land use, forestry, aquatic ecology, and wildlife stations' reference materials.

FORESTRY

Learning Objectives - 2018

The basic resources for each objective are found on the PA Envirothon web site at *www.envirothonpa.org* under *Station Training*.

**Correlations with the Academic Standards for Environment and Ecology and Science and Technology are provided.*

1. **Trees**
   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 Key to Some Common Trees of Pennsylvania provided.)
   Pay special attention to shade tolerance and soil moisture requirements of each tree species studied. Understand their timber and wildlife values.
   **4.3 Natural Resources – 4.3.10.A*

   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.
   **4.3 Natural Resources*
   **3.1 Biological Sciences – 3.1.10.A3*

   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).
   **4.3 Natural Resources*
   **3.1 Biological Sciences – 3.1.10.A3*

2. **Forest Ecology**
   a. Explain general forest typing based on the dominant tree species. Describe the most abundant forest types found in Pennsylvania. Analyze and type a specific forest site.
   **4.3 Natural Resources – 4.3.10.A, C*

   b. Explain typical forest structure (canopy, understory 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.
   **4.1.Ecology – 4.1.10.E*
   **4.3 Natural Resources – 4.3.10.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).
   **4.1 Ecology – 4.1.10.C, D*

   e. Explain what effects a specific species increase or decrease might have on the forest ecosystem.
   **4.1 Ecology – 4.1.10.E, 4.1.12.E*
   **3.1 Biological Sciences – 3.1.10.A3*

   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.
   **4.1 Ecology – 4.1.10.A, 4.1.12.A*

3. **Forest Resource Management and Protection**

   a. Study *Pennsylvania Forests 2009.* This is a summary of 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. Describe the distribution of forest land ownership in Pennsylvania as cited in the "Forest Features" section of this report.

   b. Describe values and benefits of forests for recreation, wildlife and watershed quality.
      **4.1 Ecology – 4.1.10.A*

   c. Explain the uses of 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.
      **4.3 Natural Resources – 4.3.10.A, C, 4.3.12.C*

   d. 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.
      **4.2 Watersheds and Wetlands – 4.1.12.A*
      **4.3 Natural Resources – 4.3.10.B*

   e. List products and uses of the 10 important hardwoods grown in Pennsylvania cited in *From the Woods Series: Ten Important Hardwoods* resource and of the important conifers — White pine and Eastern hemlock — described in *The Common Trees of Pennsylvania.*
      *4.3 Natural Resources – 4.3.10.A

   f. Explain the value of forestlands as community water sources. Describe the potential for pollution from timber harvesting and the practices used to minimize erosion and sedimentation.
      **4.2 Watersheds and Wetlands – 4.2.10.A*
      **4.3 Natural Resources – 4.3.10.A*
      **4.5 Humans and the Environment – 4.5.10.C, 4.5.12.C*

   g. 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.

   h. 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 Humans and the Environment – 4.5.10.B, 4.5.12.B*

   i. Predict how human or natural action can produce change to which an organism cannot adapt (Gypsy Moth, Chestnut blight, invasive species, etc.)
      **4.1 Ecology – 4.1.10.A, 4.1.12.A*

   j. Explain the role of fire in forest ecosystems. Describe the basic principles of wildfire prevention and control. Explain the use of prescribed fire.
      **4.1 Ecology – 4.1.10.E*

4. **Community Forestry**

   a. Describe the benefits of maintaining trees in urban and suburban communities and factors affecting their health and survival.
      **4.1 Ecology – 4.1.10.A*

Reference Materials List - 2018

Most of these references materials are excerpted from publications produced by the Pennsylvania State University or the USDA Forest Service. Many topics are covered more than once in different ways. So the volume of material is not as overwhelming as it might appear.

The references are found on the PA Envirothon web site at *www.envirothonpa.org* under *Station Training*.

1. Trees
    - 1.1. Common Trees of Pennsylvania
    - 1.2. From the Woods Series: Ten Important Hardwoods
    - 1.3. Penn State School of Forest Resources: Identifying PA Trees Program
    - 1.4. Tree Rings
    - 1.5. Anatomy of a Tree
    - 1.6. Key to Some Common Trees of Pennsylvania
2. Forest Ecology
    - 2.1. Forest Types of Pennsylvania
    - 2.2. Land cover map 11x17
    - 2.3. Forest Succession and Wildlife
    - 2.4. Habitat Adaptations of Some Common Trees of Pennsylvania
    - 2.5. Pennsylvania Woodlands: #6: Woodland Wildlife Management
    - 2.6. Forest Stewardship Bulletin #9: Understanding Biological Wealth in Our Forests
    - 2.7. Pennsylvania Wildlife No. 6 – Riparian Buffers for Wildlife (Penn State Extension publication)
3. Forest Resources, Management and Protection
    - 3.1. PA Forests 2009 (Excerpts from the *Forestry Inventory and Analysis report)*
    - 3.2. Basic Forest Management
    - 3.3. Forests and Waters
    - 3.4. Forest Measurement
    - 3.5. Insect Threats
        1. Asian Longhorn Beetle; 2. Emerald Ash Borer; 3. Gypsy Moth; 4. Hemlock Wooly Adelgid
    - 3.6. What is an Invasive Plant?
        1. Autumn-olive; 2. Bush honeysuckle; 3. Garlic mustard; 4. Japanese barberry; 5. Japanese knotweed; 6. Multiflora-rose; 7. Tree-of-heaven
    - 3.7. Wildfire and Prescribed Fire in Pennsylvania
    - 3.8. Forest Stewardship Bulletin #4: Forest Terminology
4. Community Forestry
    - 4.1. Sustaining Americas Urban Trees & Forests

Review updated information with these on-line resources.

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

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

Get updated information about Asian longhorned beetle, emerald ash borer, gypsy moth and other insect pests on the DCNR-Bureau of Forestry-Forest Health website http://www.dcnr.state.pa.us/forestry/insectsdisease/index.htm 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 which includes lesson plans on 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. The most pertinent sections are:

Chapter 2. *Forest Field Marks* for "*Stratification"*; "*Predicting a Forest's Future"; "The Forest Food Chain and Ecological Pyramid"*

Chapter 4. *Disturbance and Pioneer Plants* covers *"Ecological Succession: The Process of Vegetation Development Over Time"*

Chapter 8. *Autumn and Winter* has a few paragraphs on *"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: http://www.dcnr.state.pa.us/forestry/yourwoods/serviceforesters/index.htm.

Learning Enhancements:

1. **i-Tree** - i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban forestry analysis and benefits assessment tools.
2. **leafsnap** - Leafsnap is a series of electronic field guides being developed by researchers from Columbia University, the University of Maryland, and the Smithsonian Institution. The free mobile apps use visual recognition software to help identify tree species from photographs of their leaves.

SOIL/LAND USE

Essential Topics
New topics/objectives are underlined.

I. Basic Soils Knowledge
- a. Formation
- b. Water in soils
- c. Soil horizons
- d. Hands-on investigations
- e. Soil quality, fertility, and chemistry
- f. Soil biology and diversity

II. Understanding Maps, Surveys and Landforms
- a. Soil survey maps and data tables: **Websoilsurvey**
- 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 and Assessment Anchors 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.
   **4.4 Agriculture and Society – 4.4.10.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.
   **4.2 Watersheds and Wetlands – 4.2.10.A*
3. Explain the importance of wetlands and how to recognize potential wetland areas and hydric soils.
   **4.2 Watersheds and Wetlands – 4.2.10.B, D 4.2.12.D*

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.
   **4.3 Natural Resources – 4.3.10.A, B, 4.3.12.B*
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.
   **4.5 Humans and the Environment – 4.5.10.A, C, 4.5.12.C*
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.
   **4.5 Humans and the Environment – 4.5.10.E*
7. Explain how soil is alive, and how biological diversity is important for soil health and hence human, plant, and environmental health.
   **4.1 Ecology – 4.1.10.B, D, E*
8. Explain the soil food web and the different roles and survival strategies that various soil microbial organisms develop within the soil environment.
   **4.1 Ecology – 4.1.10.C, D, 4.1.12.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, D*
    **3.4 Technology and Engineering Education – 3.4.12.E2*
11. Describe the hydrologic, carbon, and nutrient cycles and how soil management relates to those processes.
    **4.1 Ecology – 4.1.10.B*
    **3.3 Earth and Space Education – 3.3.10.A2*
12. Explain how societal needs, economic forces, and natural forces affect soil resources and how we can ensure long term sustainability of soil health.
    **4.4 Agriculture and Society – 4.4.10.B, C, D*
    **4.5 Humans and the Environment – 4.5.10.A*
13. Explain historical events that led to the creation of the soil conservation service.
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.
    **4.1 Ecology – 4.1.10.F, 4.1.12.D*

15. Describe the basic geological features and rocks of the state of Pennsylvania and how they were formed.

    **4.1 Ecology – 4.1.10.F*

    **3.3 Earth and Space Education – 3.3.10.A1*

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.

    **4.1 Ecology – 4.1.10.F, 4.1.12.F*

    **3.4 Technology and Engineering Education – 3.4.10 and 12.E2*

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.

    **4.1 Ecology – 4.1.10.F, 4.1.12.F*

    **3.4 Technology and Engineering Education – 3.4.10 and 12.B2, 3.4.10 and 12.E2*

18. Compare different kinds of land uses and conservation practices on erosion and sedimentation.

    **4.4 Agriculture and Society – 4.4.10.E*

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

    **4.3 Natural Resources – 4.3.10.C, 4.3.12.C*

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

    **4.2 Watersheds and Wetlands – 4.2.12.A*

    **4.5 Humans and the Environment – 4.5.10.C*

Reference Materials List - 2018

The references are found on the PA Envirothon web site at *www.envirothonpa.org* under *Station Training*.

1. An Introduction to Soils of Pennsylvania
2. Websoilsurvey: http://websoilsurvey.nrcs.usda.gov/app/
3. Websoilsurvey: Introduction to soils part 1
4. Websoilsurvey: Introduction to soils part 2
5. Soil Quality
    a. Bulk Density Moisture/Aeration - pp. 1-4 (The measuring soil bulk density section is optional.)
    b. Infiltration - pp. 1-3 (The measuring infiltration section is optional.)
    c. Organic Matter - pp. 1-4 (The measuring soil organic matter section is optional.)
    d. pH - pp. 1-6 (Use Cornell soil pH kit to measure pH, or whatever pH kit you have available.)
    e. Soil Health Nuggets
    f. Soil Health – What is soil health? Why should I care?
    g. Soil Health Matters: Make Your Soil Healthy
6. Ray the Soil Guy – Soil Health Lessons in a minute (USDA NRCS videos)
    a. Is your soil healthy and functioning?
    b. Have you discovered the cover?
    c. How should healthy soils look?
    d. How to boost your soil's energy.
7. Topographic Map Symbols
8. Soil Biology Primer – pp. 4-17 only
9. Soil References for Landforms and Geologic Terms
    "Soil Structure" and "Soil Texture Triangle"
10. Soil's Not Trivial
11. Cornell Soil pH kits
12. Do You Dig Wetland Soils?
13. The Color of Soil
14. Soil Carbon Sequestration Fundamentals
15. How Does Your Garden Grow? Some information on soil fertility. NASA soil science website about soil fertility and NPK

Learning Enhancements (not required)

The YouTube videos found on the Pennsylvania Envirothon website are courtesy John Chibirka, U.S.D.A. Natural Resources Conservation Service Soil Scientist, and the Lancaster County Conservation District.

Envirothon Soils Study Session 1

Envirothon Soils Study Session 2

Envirothon Soils Study Session 3

WILDLIFE STATION

Essential Topics

1. Knowledge of Birds and Mammals
    a. Bird and mammal identification
    b. Natural history of birds and mammals
    c. Pennsylvania Wildlife Habitats and Ecosystems

II. Understanding Wildlife Ecology
    a. Managing the requirements of Wildlife
    b. Ecosystem dynamics:
        - Predator-prey relationships
        - How energy moves through the food chain
        - Succession
    c. Adaptations
    d. Population Dynamics
    e. Biodiversity
        - Levels of biodiversity
        - Values of biodiversity

III. Conservation and Wildlife Management
    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. Invasive Species
    b. Habitat loss and fragmentation
    c. Endangered and threatened species
    d. Managing Wildlife and People
    e. Reintroduction of native species
    f. Wildlife Diseases
    g. Human Impact on Biodiversity

Learning Objectives

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

Envirothon Students will be able to:

1. **Knowledge of Wild Birds and Mammals**
    a. Identify wildlife species using mounted specimens, skins/pelts, pictures, skulls, silhouettes, decoys, wings (waterfowl), scats, tracks, eggs, animal sounds, or other common signs. Wildlife signs may be real or reproduced.
    b. Identify wildlife species or signs. Wildlife species or signs may be presented in any form as described above.
    c. Identify general food habits (herbivore, omnivore, carnivore), habitats (terrestrial, aquatic, fossorial), and habits (diurnal, nocturnal) using skull morphology and/or teeth.
    d. Answer questions concerning the natural history of wild bird and mammal species and identify birds and mammals if given natural history information.
    e. Identify and be able to group animals that would be associated with specific ecosystems.
    f. Evaluate a specific habitat and select or list species most likely to live there.
    g. Describe various niches of birds and mammals in their ecosystems and be able to cite examples.

2. **Understanding Wildlife Ecology**
    a. Know the meaning of "habitat", and be able to name the habitat requirements for wildlife and the factors that affect wildlife suitability.
    b. Know and understand basic ecological concepts and terminology. Define and explain basic ecological concepts and terminology, e.g., limiting factor, biological carrying capacity, cultural carrying capacity, territory, home range, population, community, succession, forest fragmentation, etc.
        *4.1 Ecology – 4.1.10.A
    c. Understand the difference between an ecosystem, community and population. Be able to explain how communities interact with their non-living surroundings to form ecosystems.
    d. Understand wildlife population dynamics such as birth, mortality, age-structure, sex ratio, and mating systems. Understand the impact of limiting and decimating factors of common wildlife species on wildlife management. Define and explain terms associated with wildlife biology and wildlife populations, e.g., natality, mortality, precocial, altricial, crepuscular, nocturnal, delayed implantation, carnivore, niche, herbivore, insectivore, omnivore, producer, primary consumer, secondary consumer, etc.
        **4.1 Ecology – 4.1.10.A*
    e. Recognize that all living things must be well-adapted to their native environment in order to survive. Be able to identify, describe and explain the advantages of specific anatomical, physiological and/or behavioral adaptations of wildlife to their environment.
    f. Know the meaning of the term "Biodiversity," and understand why biodiversity is important to people and wildlife.
        **4.1 Ecology – 4.1.12.A*
    g. Understand the importance of the 3 levels of biodiversity: genetics, species and ecosystem or community, and understand the implications of biodiversity loss at each level.
        **4.1 Ecology – 4.1.10.A*
    h. Describe and be able to model food chains, food webs, trophic levels.
        **4.1 Ecology – 4.1.10.C*

3. Conservation and Management of Wildlife

a. Know the preferred habitat types and specific habitat requirements of common wildlife species. Understand how this knowledge helps us better protect both the land and the wildlife species that depend on it.
b. Understand the difference between biological and cultural carrying capacity, and be able to identify social and ecological considerations where human use of land conflicts with wildlife habitat needs.
c. Identify common wildlife management practices and methods that are being used to manage and improve wildlife habitat.
d. Understand the role of the Game Commission as the agency responsible for the protection, conservation, and management of wild birds and mammals of Pennsylvania.
   **4.1 Ecology – 4.1.12.A*
e. Know that the Game Commission as the agency responsible for hunting and trapping regulations and upholding the Game and Wildlife code in the state of Pennsylvania.
f. Answer questions concerning hunting and trapping regulations - related to pages indicated in the Reference section.
g. Describe ways each person can help in the protection, conservation management and enhancement of wild bird and mammal populations.
   **4.1 Ecology – 4.1.12.A*

4. Issues Involving Wildlife and Society

a. Understand how non-native (exotic), invasive species threaten our environment and the biodiversity of many wildlife species. Understand that non-native (exotic), invasive plants impact wildlife habitat and thus have a tremendous impact on native wildlife.
b. Learn about the complexities of decision-making in making land use decisions that affect wildlife, and understand that wildlife resources are under constant pressure caused by human population growth, environmental degradation, and habitat reduction.
c. Know that Wildlife species are subject to diseases resulting from exposure to microbes, parasites, toxins, and other biological and physical agents.
d. Understand the terminology and factors that affect threatened and endangered wildlife species. Know the meaning of extinct, extirpated, endangered, threatened, candidate species and reintroduction.
e. Identify the characteristics that many extinct and endangered species possess, and be able to identify many species wildlife that are endangered and threatened.
f. Understand the role of the Endangered Species Act in helping to conserve endangered and threatened species. Know the organizations and agencies responsible for listing and protecting endangered species on global, federal, state and provincial levels.
g. Describe major causes of habitat loss in Pennsylvania and how habitat loss affects wildlife.
h. Identify and explain the major causes of loss of biodiversity in our state and worldwide. 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 vehicles.
     - 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.

**4.1 Ecology – 4.1.10.D*

i. Identify and describe examples of wildlife species and their adaptations that enable them to survive in an urban environment and possible issues for people. (for example raccoon, opossum, skunk, red fox, robin, house finch, house sparrow, little and big brown bats, white-tailed deer)

**4.1. Ecology – 4.1.7.10.A, D*

j. Understand the characteristics, symptoms, effects, and what measures are being taken to discover outbreaks and prevent spread of the Avian Influenza (required for the 2018 Envirothon).

**4.1 – Ecology – 4.1.10.D*

Reference Materials List - 2018

The references are found on the PA Envirothon web site at *www.envirothonpa.org* under *Station Training*.

1. Pennsylvania Species, Ecosystems & Biodiversity
2. Helping Wildlife: Working with Nature booklet
3. Envirothon Skull Reference Resource
4. Elk management, research, biology and history – The following bulleted sections are required for the Envirothon competition.
    1. Elk Biology and Natural History
    2. Elk Management and Research
5. 2017 – 2018 Pennsylvania Digest of Hunting and Trapping (For your reference, this link provides you with the entire guide. The following bulleted sections are required for the Envirothon competition.)
    1. Fluorescent Orange Requirements
    2. Wildlife Classifications – found on page 8 of the Digest
    3. State Game lands Regulations
    4. Mentored Youth Hunting Program and Youth Hunting Opportunities
    5. Elk Hunting (the Zones are not required)
6. Avian Influenza (PA Game Commission website)
7. Wildlife Profile 2018 – Envirothon students will be able to identify, describe the natural history, determine the wildlife biology, and evaluate habitat for the animals listed in the profile. Identification signs can include: a picture, a replica, decoy, fur, hair, feather, gnawing, rubbing, pellet, nest, scat, track, song or sound. Students should review the Pennsylvania Game Commission Wildlife Notes, sounds, songs, tracks, etc. which correlate to the 12 animals designated in the Wildlife Profile 2018.

    Wildlife Profile 2018

Eastern Coyote	Woodchucks	Canada Goose
Elk	Squirrels	Ruffed Grouse
Shrews	Swifts, Martins, Swallows	Sparrows and Towhees
Cottontail Rabbit	Tanager	Kingfisher

    - Mammal Sounds – The Cornell Lab of Ornithology Macaulay Library website
    - Bird Songs – Utilize the Identiflyer or visit The Cornell Lab of Ornithology All About Birds website
    - Animal Tracks – Envirothon Animal Track Sheet or visit iTrack wildlife (Animal tracks App) Additional resources to review: Pocket Guide to PA Animal Tracks by the Pennsylvania Trappers Association and Mammal Tracks and Scat: Life-Size Pocket Guide by Lynn Levine
    - Beaks & Tongues (pdf) - Pennsylvania Songbirds – Chap. 1 Bird Biology, Lesson 6 – Used with permission from the PA DCNR Bureau of State Parks and Audubon PA
    - Feet are Neat (pdf) - Pennsylvania Songbirds – Chap. 1 Bird Biology, Lesson 7 – Used with permission from the PA DCNR Bureau of State Parks and Audubon PA
8. Mowing and Wildlife: Managing Open Space For Wildlife Species
9. Food Plots