

# PENNSYLVANIA ENVIROTHON

**2019**

***Teacher Resource Booklet***



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## 2019 Teacher Resource Booklet

For more than 35 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 coaches 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 “Agriculture and the Environment: Knowledge and Technology to Feed the 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.

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 2019 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 2018 scenario
7. Some Tips for Teaching Envirothon Material
8. Aquatic Ecology \*
9. Current Issue – “Agriculture and the Environment: Knowledge and Technology to Feed the 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 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 | UGI Utilities   | The Hershey Company      |
| Weis              | EQT Foundation  | PESCU                    |
| PPL Corporation   | Chief Oil & Gas | PA Trapper's Association |

## **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 an international competition. In Pennsylvania, more than 40,000 students participate each year and the program includes every county in the state.

## **2019 PENNSYLVANIA ENVIROTHON**

**What:** Pennsylvania State Envirothon –36<sup>th</sup> Annual

**Who:** Teams of High School Students from all across Pennsylvania

**When/Where:** Tuesday and Wednesday, May 21 and 22, 2019 – 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.

| <u>Station</u>   | <u>Cooperating Agency</u>                      |
|--|--|
| Soil/Land Use  | USDA Natural Resources Conservation Service    |
| Aquatic Ecology  | PA Fish & Boat Commission                      |
| Forestry   | PA DCNR Bureau of Forestry                     |
| Wildlife   | PA Game Commission                             |
| *Agriculture and the Environment:<br>Knowledge and technology to feed<br>the world | PA Envirothon and PA Department of Agriculture |

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

### Past Current Environmental Issues:

|  |  |
|--|--|
| 1984 - Acid Rain                       | 2002 - Introduced Species                                      |
| 1985 - Hazardous Waste                 | 2003 - Farmland Preservation & Conservation                    |
| 1986 - Solid Waste Management          | 2004 - Natural Resource Management in the<br>Urban Environment |
| 1987 - Water Quality                   | 2005 – Managing Cultural Landscapes                            |
| 1988 - Farmland Preservation           | 2006 – Water Stewardship in a Changing Climate                 |
| 1989 - Recycling                       | 2007 – Alternative/renewable Energy                            |
| 1990 - Wetlands                        | 2008 – Recreational Impacts on Natural Environments            |
| 1991 - Energy Sustainability           | 2009 – Biodiversity in a Changing World                        |
| 1992 - Groundwater                     | 2010 – Protection of Groundwater                               |
| 1993 - Pesticides                      | 2011 – Salt and Fresh Water Estuaries                          |
| 1994 - Acid Rain                       | 2012 – NPS & Low Impact Development                            |
| 1995 - Groundwater                     | 2013 – Grazing and Pastureland Management                      |
| 1996 - Greenways                       | 2014 – Sustainable Agriculture/Buy Locally                     |
| 1997 - Pest Management                 | 2015 – Urban and Community Forests                             |
| 1998 - Watersheds                      | 2016 – Invasive Species  |
| 1999 – Wildfire Management             | 2017 – Agricultural Soil and Water Conservation                |
| 2000 - Wetland Management              | 2018 – Grassland and Pastureland Management                    |
| 2001 - Urban Nonpoint Source Pollution |  |

## **2019 NCF-ENVIROTHON**

The winning team of the Pennsylvania Envirothon will advance to the NCF-Envirothon being held July 28 – August 2, 2019 at North Carolina State University, Raleigh. Over forty-seven states, nine Canadian provinces/territories, and two Chinese provinces are expected to participate in 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 **2017 Current Issue** station. This county level test was based on the theme "Agriculture Soil & Water Conservation Stewardship." These are examples of the types of questions you might experience at any given Envirothon competition.

1. A Whole-Farm Approach to Sustainable Agriculture includes which of the following conservation strategies?
  - A. Reduced Tillage
  - B. Reduced Energy Costs
  - C. Pest reduction by plant and landscape diversity
  - D. All of the above
2. Select the appropriate choice: Preventing P loss from the land involves defining, targeting, and remediating source areas of P that combine low/high soil P levels with a low/high potential for surface runoff and erosion.
  - A. low / low
  - B. high / high
  - C. high / low
  - D. low / high

3. Although P is relatively immobile in the soil, when can it move?
  - A. When the subsoil levels of P are low
  - B. Where soils have become highly enriched with P
  - C. Where there are high levels of organic matter in the soil
  - D. When tillage is extensively used
4. Conservation tillage has pros and cons. Which of the following hold true?
  - A. It can reduce soil erosion losses
  - B. It can reduce surface runoff losses of P
  - C. It can enhance N leaching into/through the soil
  - D. All of the above
5. Livestock fencing for stream protection is very beneficial. Which of the following is an environmental benefit of streambank fencing?
  - A. Streams are unstabilized, encouraging stream migration.
  - B. Improvements in water quality result from increased amounts of nutrients entering the stream.
  - C. Flood attenuation is degraded.
  - D. Reduced streambank erosion improves fish habitat.
6. Terraces are cross-slope channels that control erosion on cropland and are built so that crops can be grown on them. There are two common types, \_\_\_\_\_ which collects water and carries it to a stable outlet, and \_\_\_\_\_ which are designed to hold water and drain completely within 24 hours.
  - A. Runoff and Holding
  - B. Gradient and Storage
  - C. Vertical and Horizontal
  - D. Short and Long

**Using a provided word bank answer the following questions**

7. When a pasture is divided into two or more paddocks with fencing. Livestock are moved from paddock to paddock on a planned schedule based on forage availability and nutritional needs.
8. Using a plan to determine how much fertilizer, manure or other nutrient sources may be safely applied to crops to achieve yields and prevent excess nutrients from impacting waterways.
9. Crops are changed seasonally or every few years in a planned sequence.
10. Part of reduced tillage and continuous no-till systems and may be used with conventional tillage. All tillage operations are reduced and some crop residue is always on the soil surface.

## **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 2019 scenario will be posted on the Pennsylvania Envirothon website ([www.envirothonpa.org](http://www.envirothonpa.org)) on Monday, May 13<sup>th</sup>, 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 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 2018 oral component. This provides an example of the types of issues you might be asked to address at any given Envirothon competition.

### **2018 Oral Component Scenario**

A retiring farmer, Mr. Smith, donated a 125-acre crop farm located outside of Citydale, PA to Farmers for a Better Future (FBF). FBF is a non-profit organization striving to keep working agricultural lands productive while optimizing the environmental and community benefits of farming. Mr. Smith has no heirs and wants his land to stay in agriculture as the surrounding area is rapidly developing. Mr. Smith has also donated an adjoining 30-acre woodlot as a part of his farm. Spring Run, a small headwaters stream, begins in the woodlot on the farm and flows through crop and hay fields into Deer Creek, a larger stream that meanders through the eastern portion of the property. While owned and managed by Farmer Smith, the farm was tilled annually and planted in corn, soybeans, and hay. Cover crops were not utilized.

A team of consultants has been hired by the FBF Board of Directors to create a plan for the land. The Board wants the consultants to create a model farm that is agriculturally productive and environmentally sensitive. The FBF board would like the farm to support wildlife populations because open space in the region has been drastically reduced by development. The Board hopes to utilize the new model farm to educate new farmers and the public about agriculture, grazing, and sustainable land management.

The local community is very interested in the potential for this new model farm. The local Audubon Society has petitioned FBF to help increase habitat for ground-nesting birds in the region since their numbers have plummeted under the local development pressures. The Xerces Society has also asked the FBF to do all it can to manage the property to ameliorate the decline in native pollinators. Citydale Watershed Coalition identified the entire Deer Creek watershed as a priority for restoration and protection. Several nearby restaurants regularly feature seasonal, locally-sourced, menu items such as grass-fed meats; these restaurants have expressed an interest in featuring the new farm's potential products. A nearby USDA meat processing facility has the capacity to handle any meat the farm may produce, and local farmers' markets have space for additional vendors.

### **The Presentation:**

As an Envirothon Team, you will play the role of the team of consultants. Create a ten-minute presentation for the FBF Board of Directors as role-played by the judges. Using the provided farm maps as a guide, create a management plan for how the land should be utilized. Highlight potential opportunities for the future of Mr. Smith's donated land. Incorporate/cite at least three (3) spoken, relevant, and reputable references as you present, such as a formal publication or information provided in the 2018 Current Issue resources. During the presentation, address the following:

**I. Task 1** - Outline a **basic grazing plan for raising multiple species of livestock**. Describe which livestock species you have chosen to raise on the farm, what you will grow on the farm, and why. Outline changes you will need to make to the land in its current condition to implement your plan.

**II. Task 2** - Describe best management practices and land management techniques you will implement on the farm to **improve water quality and soil health**. Detail approaches to ensure both productivity and environmental sensitivity.

**III. Task 3** - Describe how the farm can **support wildlife and pollinators**. Describe how your management practices will influence wildlife and pollinator populations. What impacts will wildlife and pollinators have on the farm?

**IV. Local Community Benefits** - Describe the ways that agriculture can be beneficial in an urban and suburban setting. How can this site become a model farm to both producers and community members? How will you highlight the sustainable land management on the farm? In what ways will this farm impact the Citydale community?

## 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. **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.
4. **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.
5. **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 2019 Envirothon!

### REFERENCE MATERIAL AVAILABLE ON THE PENNSYLVANIA ENVIROTHON WEBSITE

[www.envirothonpa.org](http://www.envirothonpa.org)

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

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.

# 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

The basic resources for each objective are found on the Pennsylvania Envirothon web site at under Station Training.

*\*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 given 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 - 2019

The references are found on the Pennsylvania Envirothon web site under *Station Training*. The references are also available on the Commission's Learning Center page: [www.fish.state.pa.us](http://www.fish.state.pa.us).

### 1. *Books:*

Pennsylvania Fishes (Available online.)

Pennsylvania Amphibians and Reptiles (Available in 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: Wild Brook Trout

Focus on Habitat: Largemouth Bass

Freaky Fish of PA

Good Fishing Needs Good Habitat

Flex Your Mussel Knowledge

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

- Identifying Threats to PA's At Risk Aquatic Species
- Identifying Conservation Actions to Protect PA's At-Risk Species
- 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 *2019 Pennsylvania Fishing Summary* (available January 1, 2019):
  - General Fishing Regulations, Tackle and Bait
  - Unlawful Acts
  - All Fish Species - Inland Waters
  - Largemouth, Smallmouth, Spotted Bass
  - Pymatuning and Conowingo Reservoirs
  - Delaware River Fishing
  - Lake Erie Fishing
  - Muskellunge, Pike, Pickerel and Panfish
  - Reptiles, Amphibians, Endangered Species
  - Aquatic Invasive Species
  - Trout Fishing Regulations
  - Special Regulation Areas
  
5. *Frog and Toad Calls of Pennsylvania* CD
  - New teams should contact PA Envirothon to obtain a copy.
  
6. *Herp Sweet Home* (PA Amphibians & Reptiles Curriculum)
  
7. *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) \*

| <b>Invertebrates</b>      | <b>Fish</b>       | <b>Amphibians &amp; Reptiles</b>  |
|---------------------------|-------------------|-----------------------------------|
| 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<br>Rattlesnake |

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

8. PA's Field Guide to AIS (PA Sea Grant)

Introduction

Prevention

Species Pages\*

| <b>Plants</b>         | <b>Invertebrates</b> | <b>Fish</b>        | <b>Pathogens</b>                   | <b>Algae</b> | <b>Reptiles</b>  |
|-----------------------|----------------------|--------------------|------------------------------------|--------------|------------------|
| Eurasian watermilfoil | Asian Clam           | Common Carp        | VHS (Viral Hemorrhagic Septicemia) | Didymo       | Red-eared Slider |
| Hydrilla              | New Zealand Mudsail  | 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)

| <b>Fish</b>     | <b>Amphibians</b>          | <b>Reptiles</b>           | <b>Invertebrates</b>     |
|-----------------|----------------------------|---------------------------|--------------------------|
| 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 Shoftshell 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 Regional Education Specialists**

|                     |   |              |
|---------------------|---|--------------|
| Northwest Region    | 11528 State Highway 98, Meadville, PA 16335 | 814-336-2426 |
| Southwest Region    | 236 Lake Road, Somerset, PA 15501           | 814-443-9841 |
| Northcentral        | 450 Robinson Lane, 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 |

## Current Environmental Issue

### *“Agriculture and the Environment: Knowledge and Technology to Feed the World”*

There are many articles that estimate the population of the Earth to be approximately 9 billion by the year 2050. One of the primary concerns for the agricultural industry is how will farmers be able to grow enough food to feed this growing population, while also protecting natural resources such as soil, water, air, wildlife, and forestry resources.

Students will learn the concepts of how agriculture and all natural resource areas are interrelated, and how the use of new technologies is key to increase food production.

#### **Key topics include:**

- Sustainable farming
- Climate change
- Soil health
- Pollination
- Integrated Pest Management
- Precision agriculture and new technology

#### **Learning Objectives:**

1. Understand the importance of moving toward sustainable farming systems to conserve natural resources, mitigate climate change, reduce erosion and protect water quality and quantity, and promote pollination;
2. Comprehension of farming practices that build soil organic matter such as composting, crop rotations, cover crops, conservation tillage, and management intensive grazing systems to improve soil health;
3. Understand integrated pest management and biological pest control techniques used to prevent insect pest, disease, and weed problems; and
4. Understand the role of new technology: agricultural biotechnology, precision agriculture, and using UAV (drones, GIS, etc.) to increase farm efficiency for food production.

## Reference Materials List – 2019

The references are found on the Pennsylvania Envirothon web site under *Station Training*.

1. 2019 Current Environmental Issue: “Agriculture and the Environment: Knowledge and Technology to Feed the World” (This information is a collection of several articles from different sources. Specific websites and sources are indicated at the top of the different articles.)
  - a. Agroecology
  - b. Sustainable Agriculture
  - c. Soil: The Foundation of Agriculture
  - d. Integrated Pest Management (IPM) Principles
  - e. Climate Change Impacts on Agriculture and Food Supply
  - f. Agriculture – Extreme Weather Resilience
  - g. Local and Regional Food Systems 101
  - h. Precision Agriculture
  - i. Ag Technology
  - j. Biotechnology
2. Farming for Bees – Guidelines for Providing Native Bee Habitat (The Xerces Society)
3. Farming with Pollinators – Increasing Profit and Reducing Risk (The Xerces Society)
4. Soil Quality (This information is also used as a reference for the Soil/Land Use Station.)
  - 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 – What is soil health? Why should I care?
  - f. Soil Health Matters: Make Your Soil Healthy

### Learning Enhancements (not required)

1. Soil Health and Soil Health Institute Video (featured on American Farmer TV)
2. The Hope in Healthy Soil Video
3. High Tech Agriculture - 9 Billion Mouths to Feed: The Future of Farming Video

\*\*You may also see questions relating to the current environmental issue in the soil and land use, forestry, aquatic ecology, and wildlife stations’ reference materials.

# FORESTRY

## Learning Objectives - 2019

The basic resources for each objective are found on the Pennsylvania Envirothon web site under Station Training.

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

After completing study on this issue, students will:

### 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*
- d. 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*

### 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 *Forests of Pennsylvania 2016*. 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.
- 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. Explain how forests grow, describe steps to planning for their management, and understand how to sell and market trees.  
*\*4.3 Natural Resources – 4.3.10.A*  
*\*4.5 Humans and the Environment – 4.5.10.C, 4.5.12.C*
- f. 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.
- g. 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*
- h. 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*
- i. 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*

## Reference Materials List - 2019

Most of these references materials are excerpted from publications produced by the Pennsylvania DCNR Bureau of Forestry, 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 Pennsylvania Envirothon web site 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
2. Forest Ecology
  - 2.1. Forest Types of Pennsylvania
  - 2.2. Forest Succession and Wildlife
  - 2.3. Habitat Adaptations of Some Common Trees of Pennsylvania
  - 2.4. Pennsylvania Woodlands: #6: Woodland Wildlife Management
3. Forest Resources, Management and Protection
  - 3.1. Best Management Practices for Pennsylvania Forests
  - 3.2. Forests of Pennsylvania 2016
  - 3.3. Agricultural Alternatives – Managing Small Woodlots
  - 3.4. Wildfire
  - 3.5. Insect Threats - 1. Asian Longhorn Beetle; 2. Emerald Ash Borer; 3. Gypsy Moth; 4. Hemlock Woolly Adelgid; 5. Spotted Lantern Fly
  - 3.6. Invasive Plants - 1. Autumn-olive; 2. Bush honeysuckle; 3. Garlic mustard; 4. Japanese barberry; 5. Japanese knotweed; 6. Multiflora-rose; 7. Tree-of-heaven
  - 3.7. Forest Measurements and Management 2019

**Bureau of Forestry Service Foresters** can help coaches prepare for local Envirothon events. See the Bureau's web site for the service forester assigned to your county.

### 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

The basic resources for each objective are found on the Pennsylvania Envirothon web site under Station Training.

*\*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 - 2019

The references are found on the Pennsylvania Envirothon web site 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

The basic resources for each objective are found on the Pennsylvania Envirothon web site under Station Training.

*\*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. Animal tracks may be original or molds made of the prints. 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 Chronic Wasting Disease, Epizootic Hemorrhagic Disease, Lyme Disease, and Hantavirus (required for the 2019 Envirothon).
- \*4.1 – Ecology – 4.1.10.D*

### **Reference Materials List - 2019**

The references are found on the Pennsylvania Envirothon web site under *Station Training*.

1. Pennsylvania Species, Ecosystems & Biodiversity
2. Helping Wildlife: Working with Nature booklet
3. Envirothon Skull Reference Resource
4. 2018 – 2019 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.)
  - a. Fluorescent Orange Requirements
  - b. Wildlife Classifications – found on page 8 of the Digest
  - c. State Game lands Regulations
  - d. Mentored Youth Hunting Program and Youth Hunting Opportunities
  - e. Chronic Wasting Disease (CWD) pages 35-38



5. Woodcock Habitat Management (PDF from PGC website)
6. Wildlife Diseases (PA Game Commission website)
  - a. EHD – Epizootic Hemorrhagic Disease
  - b. Lyme Disease
  - c. Hantavirus
7. Wildlife Profile 2019 – 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, skull, 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 27 animals designated in the Wildlife Profile 2019.

**Wildlife Profile 2019**

|  |   |
|--|---|
| <u>River Otter</u>   | <u>Mallard Ducks</u>  |
| <u>Woodcock</u>  | <u>Fisher</u>   |
| <u>Striped Skunk</u>   | <u>Opossum</u>  |
| <u>White-tailed Deer</u>   | <u>Blackbird, Oriole, Cowbird, Starling</u>   |
| <u>Black-capped chickadee, Tufted titmouse, White-breasted nuthatch</u>  | <u>Gray Catbird, Northern Mockingbird</u>   |
| <u>Puddle Ducks</u> - Black Duck, Gadwall, Northern Pintail, Green-winged Teal, Blue-winged Teal, American Wigeon, Northern Shoveler | <u>Mice and Voles</u> - Deer mouse, White-footed mouse, Meadow Vole, Woodland jumping mouse |

- a. Mammal Sounds – visit The Cornell Lab of Ornithology Macaulay Library
- b. Bird Songs – Utilize the Identifier or visit The Cornell Lab of Ornithology All About Birds

**\*\*The eight Bird Songs that are required for the 2019 Envirothon include:**

- Black-capped chickadee and White-breasted nuthatch – Yard Birds One
- Cowbird, Oriole, and Starling – Yard Birds Two
- Gray Catbird and Tufted titmouse – Yard Birds – Eastern
- Mallard – Lakes & Rivers

All of these bird songs can be found on the Identifier (card identified), which is typically what the PA Game Commission uses during the wildlife test.

- c. Animal Tracks – iTrack wildlife (Animal tracks App), MyNature The handheld nature guide, and the Envirothon Animal Track Sheet. 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.

**Learning Enhancements – Information is not required.**

Wildlife Station Training videos/webinars produced by the PA Game Commission and Lancaster County Conservation District are found on the PA Envirothon website.

Wildlife Training Video – Session 1

Wildlife Training Video – Session 2

Wildlife Training Video – Session 3