

# PENNSYLVANIA ENVIROTHON

**2023**

***Teacher Resource Booklet***



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## 2023 Teacher Resource Booklet

For more than 39 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 “Adapting to a Changing Climate” 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 2023 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 2019 scenario
7. Some Tips for Teaching Envirothon Material
8. Aquatic Ecology \*
9. Current Issue – “Adapting to a Changing Climate” \*
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 mission of the Pennsylvania Envirothon is to provide students with the knowledge and tools necessary to address the natural resource challenges facing today's world.

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

### **Corporate Sponsors**

Shell Oil Company	UGI Utilities	The Hershey Company
Weis	EQT Foundation	PA Trapper's Association
PPL Corporation	Chesapeake Energy	PA American Water
PSECU		

## ***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.

## **2023 PENNSYLVANIA ENVIROTHON**

**What:** Pennsylvania State Envirothon –39<sup>th</sup> Annual

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

**-When/Where:** Virtual Oral Component –May 17-19 ; In Person Station Testing, May 24<sup>th</sup> at Camp Mt Luther, Mifflinburg, PA

**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

Soil/Land Use

Aquatic Ecology

Forestry

Wildlife

\* Adapting to a Changing Climate

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

### Cooperating Agency

USDA Natural Resources Conservation Service

PA Fish & Boat Commission

PA DCNR Bureau of Forestry

PA Game Commission

PA Envirothon

### 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

2020 – “Pennsylvania Envirothon Week”

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 – Grassland and Pastureland Management

2019 – Agriculture and the Environment: Knowledge  
and Technology to Feed the World

2021-- Water Resources Management: Local Control  
and Local Solutions

2022-Waste to Resources

## **2023 NCF-ENVIROTHON**

The winning team of the Pennsylvania Envirothon will advance to the NCF-Envirothon being held July 23 – July 29, 2023 at Mount Allison University-Sackville, New Brunswick. Over forty-seven states, nine Canadian provinces/territories, and two Chinese provinces are expected to participate in this international event!

## OVERVIEW OF THE 2023 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 **2019 Current Issue** station exam. This county level test was based on the theme "Agriculture and the Environment: Knowledge and Technology to Feed the World." These are examples of the types of questions you might experience at any given Envirothon competition.

1. The development of \_\_\_\_\_ agriculture has been made possible by combining the use of Global Positioning System (GPS) and Geographic Information Systems (GIS)?
  - A. Production
  - B. Precision
  - C. Pesticide free
  - D. Predictive
2. Genetic engineering permits increased efficiency in developing new crop varieties with new and desirable traits. This ultimately occurs because there is a \_\_\_\_\_ transfer of genes.
  - A. Random
  - B. Highly targeted
  - C. Greater
  - D. Frequent
3. Plants that have genes from other organisms are referred to as what?

- A. Transferred
  - B. Transgenic
  - C. Translated
  - D. Trans-compliant
4. Crops produced through genetic engineering are sometimes referred to as GMO. What does the acronym GMO stand for?
  5. There are many types of native bees. Some common types of bees are named by their nest-building habits. Name two common bees reflecting their types of nests.
  6. Project Integrated Crop Pollination (ICP) is conducting research on pollinator habitat enhancement and techniques for managing alternative bees for crop pollination. List two species of alternative bees that ICP.
  7. If the soil texture of a field is such that the soil infiltration rate is undesirable, which management practice would be best for improving the infiltration rate?
    - A. Increase the degree of soil tillage
    - B. Decrease manure and fertilizer application
    - C. Increase soil organic matter content
    - D. Decrease use of continuous no-till
  8. Soil organic matter serves all these functions except for one of the following?
    - A. Serves as a reservoir of nutrients for crops
    - B. Retaining moisture
    - C. Reducing water infiltration into soil
    - D. Reducing soil compaction

**Using the provided word bank, answer the following.**

9. The soil's ability to allow water movement into and through the soil profile.
10. The weight of dry soil per unit of volume.
11. The organic component of soil.
12. The stable organic fraction of soil organic matter.

## **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?**

**The 2023 scenario will be posted on the Pennsylvania Envirothon website ([www.envirothonpa.org](http://www.envirothonpa.org)) on Friday May 5th.** 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 Pennsylvania Envirothon oral component presentation segment is taking on a new look and transitioning into the age of technology. Oral presentations will be done digitally, moving away from the use of poster boards and markers. The Oral Component (OC) offers Envirothon teams a chance to address real-life environmental problems as presented through a written scenario. This transition provides teams with the full experience of developing a presentation based on a written scenario from start to finish.

Teams will have from Friday May 5th through 8:00 a.m., Monday May 15th to complete and submit their 12-minute pre-recorded Oral Presentation. Once the team has its presentation completed and recorded, it will be submitted to the Pennsylvania Envirothon according to the provided instructions.

The video submitted should mimic as closely as possible the team standing in front of a panel and presenting it to them in person. The entire team should be present and using their developed PowerPoint as a visual aid. The only visual aid acceptable is a PowerPoint presentation that the team develops. No video editing, animation, etc, is allowed. The goal of the video is to be a single take of the team using their PowerPoint as a visual aid and presenting their information addressing the points of the scenario to the panel of judges.

On May 17<sup>th</sup> - 19<sup>th</sup>, all teams will participate in a "live Zoom" viewing of their presentation followed by an 8-minute Question & Answer session with a panel of judges. Teams will be assigned a Zoom meeting time between 9:00 a.m. and 4:00 p.m, this will be posted on the PA Envirothon website when the scenario is posted. Teams do not have to be in the same room while participating in the Q&A, but each team member will need to join, participate, and be visible during the Zoom session.

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.

## 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 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 web site – The Competition, Past Competition and Final Presentations. You may also view the presentations by following the YouTube link at: <https://www.youtube.com/watch?v=yIJYlqpGMc&feature=youtu.be>.

The following scenario was used for the 2022 oral component. This provides an example of the types of issues you might be asked to address at any given Envirothon competition.

## 2022 Oral Component Scenario

### Waste to Resources

#### The Scenario:

You live in Smalltown USA, a rural community that enjoys scenic parks, high quality streams, and a cohesive community spirit. Your community landfill, Mt. Trashmore, has submitted an application for an expansion. The surrounding community is concerned about the potential for soil and water contamination from a landfill expansion and from toxic waste and hazardous materials. Outside of the downtown area, all the homes in the community rely on private wells for their drinking water; and the proposed expansion would put the landfill closer to their homes. The Smalltown High School's Environmental Science Class has been studying the causes and impacts of climate change, and the students are expressing concern about an increase in greenhouse gasses from the landfill. Both the proposed expansion and the rising costs of waste disposal have encouraged community efforts to seek alternatives to reduce the volume of material being sent to Mt. Trashmore.

#### The Presentation:

As an Envirothon team, you are the community Sustainability Coalition that has formed in response to the proposed landfill expansion. Your members include a mix of professionals, community leaders, and students. You are presenting alternatives to the landfill expansion and to address the community's concerns.

The Judges are the county solid waste committee, including elected officials, community planners, residents, and Mt. Trashmore representatives. The committee is open to hearing your proposal for alternatives to landfill expansion.

#### Develop a 10-minute presentation that addresses the following tasks:

- I. **Landfills:** What are some ways that the landfills can address the soil and water pollution concerns that the community has shared? What steps can be taken to make efficient use of the land already occupied by the landfill?
- II. **Inorganic waste:** Describe your top priority category of recyclable item that you plan to collect (i.e. glass, metal, plastic, or paper). Why is this type of recyclable category most important to you? What are the possible pitfalls in recycling and recovering this item? What finished products can be made?



- III. **Organic waste:** Describe ways that organic waste can be recovered and recycled. How does recovering organic waste help reduce the need for landfill expansion? What finished product would be created? What are some ways that greenhouse gas concerns can be addressed?
- IV. **Toxic/Hazardous waste:** Mt. Trashmore is not a certified facility to accept toxic and hazardous waste. Explain what types of materials qualify as toxic/hazardous and why they are handled in special facilities instead of in a regular landfill. What are ways that Smalltown can reduce its production of toxic/hazardous waste so that less of that material is generated and sent to a special facility?
- V. **Personal action:** How will you get involved in making a change in your own lifestyle to reduce waste entering the landfill? How will you educate other community members on actions they can take? If you can't enact changes at home, what are the barriers to making changes?

**References:**

Be sure to incorporate/cite at least three (3) spoken, relevant, and reputable references as you present, such as a formal publication or information provided in the 2022 Current Issue Resources.

Examples of references:

1. "According to \_\_\_\_\_'s publication entitled \_\_\_\_\_, [fact that supports scenario]."
2. "Research from [organization/agency/etc.] outlined in their article \_\_\_\_\_, suggests [fact that supports scenario]."
3. "An article entitled \_\_\_\_\_, on \_\_\_\_\_'s website, says [fact that supports scenario]."

**Final Notes:**

While preparing, teams should feel free to include details of your choosing, not specifically referenced in the scenario, to aid your presentation. **The Pennsylvania Envirothon will not answer any questions regarding the scenario - you must interpret and respond as you see fit.**

## 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, wedge prisms, 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 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.

# 2023 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 – 2023

The references are found on the PA Envirothon web site unless otherwise noted. New items are underlined. The references are also available on the Pennsylvania Fish and Boat Commission's [Activities and Education Portal](#)

### 1. Books:

Pennsylvania Fishes (ISBN 1-930369-01-8)

Pennsylvania Amphibians and Reptiles (ISBN 1-930369-00X)\*

\* The Pennsylvania Amphibians and Reptiles book is not available electronically. New teams should contact their County Conservation District to obtain a copy of this book.

### 2. Fact Sheets

A River Flows Through It

Caddis Flies

Clams and Mussels

Dobsonfly

Dragons & Damsels

ENA & ELPA

Macroinvertebrate Feeding Frenzy

Mayflies

Phytoplankton

Pond/Stream Study Guide/Key to Macroinvertebrates

Riparian Buffers

Snails

Stoneflies

Stream Reader

Water Walkers

Zooplankton

### 3. PLAY Issues and Select PLAY Pages

Crazy for Crayfish

Dive Into Stream Ecology

Focus on Habitat: Largemouth Bass

Focus on Habitat: Wild Brook Trout

Good Fishing Needs Good Habitat

H2O On the Go

Jump Into Lake Ecology

PA's Most Mighty Migratory Fish

PA's FSI: Fish Scene Investigation

Rivers Run Through Pennsylvania

Six Legs Underwater

Vernal Pools

Water Flows Through Pennsylvania

Water Water Read All About It

### 4. Articles

Ghosts of the Ohio River

Pennsylvania's Threatened and Endangered Fishes

Pennsylvania's Wild Trout Streams

Timbering and Trout

The Good of Wood

Trout Stream Top to Bottom

Wetlands: The Vital Link

5. [2023 Pennsylvania Fishing Summary](#) The Fishing Summary is available on the Pennsylvania Fish and Boat Commission's website. Teams should review information from the following sections.

General 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  
Fish Consumption Advisory

6. *Frog and Toad Calls of Pennsylvania* CD

All frog and toad calls can be found on the [PA Herps](http://www.paherps.com/herps/frogs-toads/) website  
[www.paherps.com/herps/frogs-toads/](http://www.paherps.com/herps/frogs-toads/).

7. *Herp Sweet Home*

8. *Threatened & Endangered Species*

Current List of PA's Endangered, Threatened, and Candidate Species  
Endangered Species and the PFBC  
Threatened & Endangered Species Pages\*

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

\*Participants are responsible for knowing the following Learning Objectives for each of these aquatic animals: 1.b.1 (including calls), 1.b.2, 1.b.3, 1.b.4, 2.c

9. *Aquatic Invasive Species*

PA's Field Guide to AIS (PA Sea Grant)  
Introduction  
Prevention  
Aquatic Invasive Species Pages\*



Plants	Invertebrates	Fish	Algae	Reptiles
Eurasian watermilfoil	Asian Clam	Common Carp	Didymo	Red-eared Slider
Hydrilla	New Zealand Mudsail	Flathead Catfish	Golden Alga	Yellow-Bellied Slider
Water Chestnut	Rusty Crayfish	Northern Snakehead		
Common Reed	Chinese Mystery Snail <del>Spiny Water Flea</del>	Alewife <del>Round Goby</del>		
Purple Loosestrife	Zebra Mussel	Sea Lamprey		

\* Participants are responsible knowing the following Learning Objectives for each of these aquatic plants and animals: 1.b.1, 1.b.2, 1.b.3, 1.b.4, 2.d

### Identification Study List

Fish	Amphibians*	Reptiles	Invertebrates*
American Eel	Bullfrog	Common Snapping Turtle	Backswimmer (ENA, True bug)
American Shad	Eastern Gray Treefrog*	Eastern Box Turtle	Blackfly (ELPA, True fly)
Blacknose dace	Eastern American Toad	Map Turtle	Caddisfly (ELPA)
Bluegill	Fowler's Toad*	Midland Painted Turtle	Crayfish
Bowfin	Northern Green Frog*	Spiny Softshell Turtle	Cranefly/Tipulid (ELPA, True fly)
Brown Bullhead	Northern Leopard Frog*	Spotted Turtle	Damselfly (ENA)
Brown Trout	Northern Spring Peeper*	Wood Turtle	Dobsonfly/Fishfly (ELPA)
Brook Trout	Pickerel Frog*	Broadhead Skink	Dragonfly (ENA)
Chain Pickerel	Wood Frog*	Five-lined Skink	Freshwater clam/mussel
Channel Catfish	Eastern Hellbender	Northern Coal Skink	Freshwater snail
Crappie	Four-toed Salamander	Northern Fence Lizard	Giant Water Bug (ENA, True bug)
Creek Chub	Jefferson Salamander	Eastern Garter Snake	Isopod/Aquatic Sowbug
Darter	Longtail Salamander	Eastern (Black) Rat Snake	Mayfly (ENA)
Largemouth Bass	Marbled Salamander	Eastern Hognose Snake	Predaceous Diving Beetle (ELPA, Beetle)
Muskellunge	Mudpuppy	Eastern Milk Snake	Stonefly (ENA)
Northern Pike	Northern Dusky Salamander	Northern Copperhead	Water Scorpion (ENA, True bug)
Paddlefish	Northern Spring Salamander	Northern Redbelly Snake	Water Strider (ENA, True bug)
Pumpkinseed	Northern Red Salamander	Northern Ringneck Snake	Whirligig Beetle (ELPA, Beetle)
Rainbow Trout	Redback Salamander	Northern Water Snake	Water Boatman (ENA, True bug)
Rock Bass	Red-Spotted Newt/Red Eft	Queen Snake	Water Penny (ELPA, Beetle)
Sculpin	Slimy Salamander	Ribbon Snake	
Smallmouth Bass	Spotted Salamander	Smooth Earth Snake	

Striped Bass		Timber Rattlesnake	<b>Phytoplankton</b> (group of various species)
Yellow Perch			
Walleye			<b>Zooplankton</b> (group of various species)
White Sucker			

\*Must know frog/toad calls

Must know clam/mussel and snail life cycle

Must Know insect life cycle as ENA (Egg, Nymph, Adult) or ELPA (Egg, Larva, Pupa, Adult)

ENA (incomplete) – dragon/damselfly, mayfly, stonefly and true bugs

ELPA (complete) – beetles, caddisfly, crane fly/tipulid, Dobson/fishfly and true flies

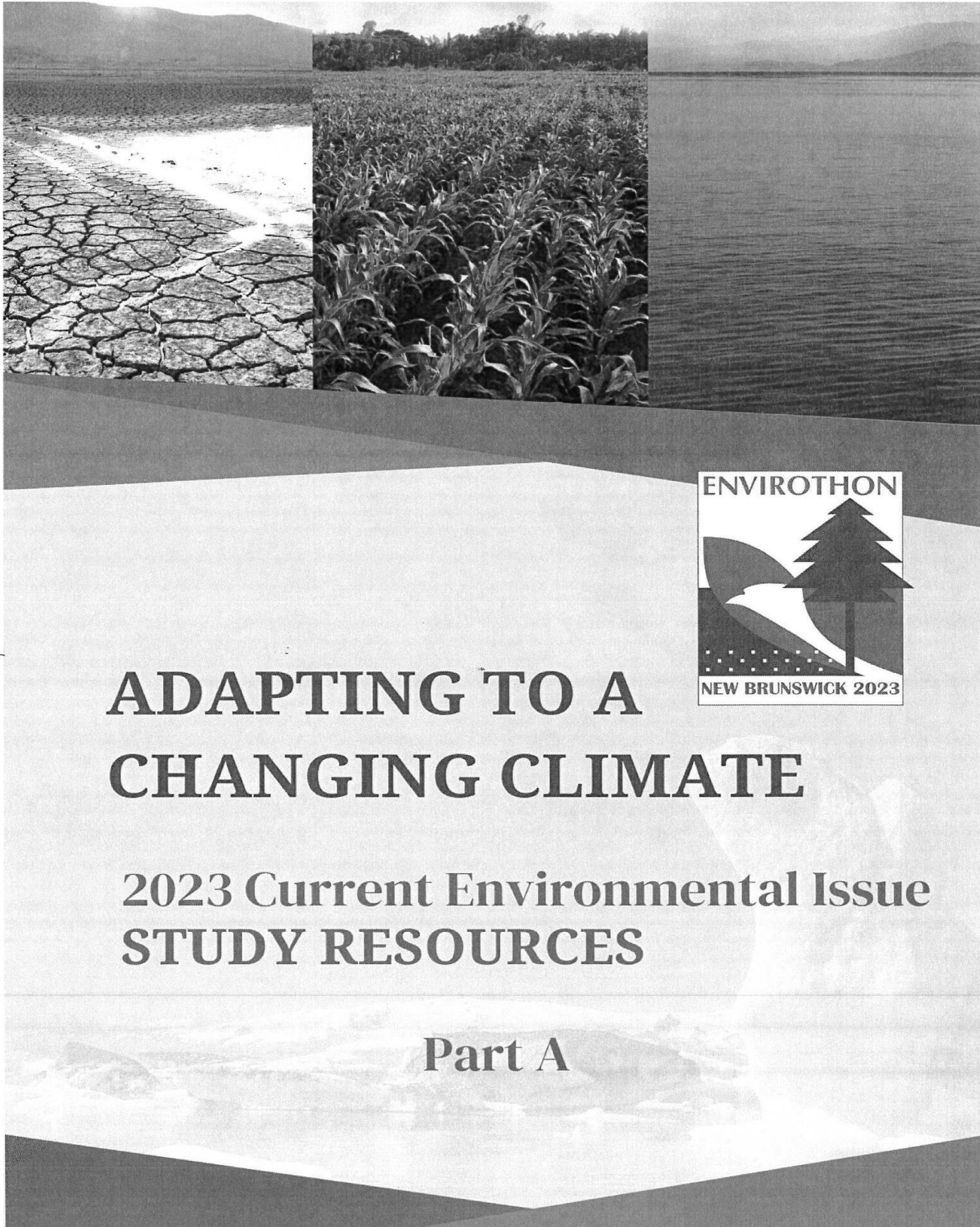
### **Pennsylvania Fish and Boat Commission**

#### **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

## Current Environmental Issue

<https://envirothon.org/wp-content/uploads/2022/09/2023-Current-Issue-Part-A.pdf>



**NCF-Envirothon 2023 New Brunswick**  
**Adapting to a Changing Climate**  
**Current Environmental Issue Study Resources – Part A**

**Table of Contents**

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### **Key Topic 1: Factors Contributing to a Changing Climate**

1. Describe climate change and the process through which it occurs.
2. Outline the factors, both anthropogenic and natural, which influence climate and climate change.
3. Describe the major economic sectors that contribute to greenhouse gas (GHG) emissions.
4. Describe major energy sources and explain how each contributes to climate change.
5. Outline indicators of climate change.

### **Study Resources**

Resource Title	Source	Located on
Basics of Climate Change	<i>US Environmental Protection Agency, 2019</i>	Pages 4-9
Causes of Climate Change	<i>Government of Canada, 2019</i>	Pages 10-12
VIDEO: Climate Change 2022: Impacts, Adaptation & Vulnerability – CLICK LINK	<i>Intergovernmental Panel on Climate Change (IPCC), 2020</i>	Page 30; 14 Minutes
Sector by sector: where do global greenhouse emissions come from?	<i>Our World in Data, Hannah Ritchie, 2020</i>	Pages 31-36
Energy and the Environment Explained	<i>US Energy Information Administration, 2021</i>	Pages 37-48

*\*Please Note: Hyperlinks found in text are not considered required reading; however, included video links are required to watch.\**

**Study Resources begin on the next page**



## **Key Topic 2: Measuring and Monitoring a Changing Climate**

6. Describe the history of international collaboration on climate change and analyze the successes and shortcomings.
7. Describe the various sources of scientific data which are used as evidence of climate change and explain how we know this data to be reliable.
8. Evaluate climate data and draw conclusions based on that data.
9. Explain the use of modelling in forecasting climate and the sources of uncertainty in climate projections.

### **Study Resources**

Resource Title	Source	Located on
A Short History of International Climate Change Negotiations – from Rio to Glasgow	<i>Mark Maslin, University College London, 2021</i>	Pages 50-56
Climate Models	<i>US National Oceanic and Atmospheric Administration (NOAA), 2022</i>	Pages 57-59
Climate Change Projections	<i>Government of Canada, Canadian Centre for Climate Services, 2021</i>	Pages 60-61

*\*Please Note: Hyperlinks found in text are not considered required reading; however, included video links are required to watch.\**

**Study Resources begin on the next page**



### **Key Topic 3: Risks and Impacts to Natural Resources and Society from a Changing Climate**

10. Explain the consequences of climate changes on aquatic, forest, wildlife and soil ecosystems.
11. Describe the social and economic impacts of climate change.

#### **Study Resources**

<b>Resource Title</b>	<b>Source</b>	<b>Located on</b>
Climate Impacts on Ecosystems	<i>US Environmental Protection Agency, 2017</i>	Pages 63-66
Impacts to Canadian agriculture from climate changes	<i>Agriculture and Agri-Food Canada, 2020</i>	Pages 67-70
Impacts on ecosystems and fisheries	<i>Fisheries and Oceans Canada, 2019</i>	Pages 71-74
5 Ways Climate Change Impacts Forests	<i>North Carolina State University, Forestry and Environmental Resources Research, 2021</i>	Pages 75-78
How Climate Change Impacts the Economy	<i>Renee Cho, Columbia Climate School, 2019</i>	Pages 79-84
This is how climate change could impact the global economy	<i>Natalie Marchant, Article in World Economic Forum, 2021</i>	Pages 85-86
Earth Observation to Mitigate Impacts of Climate Change and Support Sustainable Business Decisions	<i>L3HARRIS GEOSPATIAL, 2022</i>	Pages 87-94
Social Dimensions of Climate Change	<i>The World Bank, 2022</i>	Pages 95-96
The Disproportionate Impact of Climate Change on Indigenous Communities	<i>Paige Laduzinsky, KCET, 2019</i>	Pages 97-101
Southeast Asia to bear the brunt of worsening global climate, IPCC warns	<i>Robin Hicks, Eco-Business, 2021</i>	Pages 102-105
Climate change triggers mounting food insecurity, poverty, and displacement in Africa	<i>World Meteorological Organization (WMO), 2021</i>	Pages 106-109

*\*Please Note: Hyperlinks found in text are not considered required reading; however, included video links are required to watch.\**

**Study Resources begin on the next page**





## **Key Topic 4: Policies and Programs for Adapting to a Changing Climate**

12. Explain how various levels of government, non-governmental organizations, and individuals are involved in mitigating and adapting to climate change at the local, national, and international levels.
13. Describe innovative technologies and programs designed to combat climate change.
14. Explain the importance of primary resource sectors (forestry, agriculture, fisheries) to the economy of New Brunswick.
15. Describe the unique challenges faced by regions largely dependent on primary resources, and how climate change influences these challenges
16. Explain how to best apply climate change risk assessment and adaptation measures in regions with primary resource dependent economies.

### **Study Resources**

<b>Resource Title</b>	<b>Source</b>	<b>Located on</b>
VIDEO: UN Sustainable Development Goals – Overview – CLICK LINK	<i>United Nations, 2018</i>	Page 112; 2 Minutes
Federal Adaptation Policy Framework for Climate Change	<i>Government of Canada, 2016</i>	Pages 113-118
Memorandum of Cooperation between the Government of Canada and the Government of the State of California of the United States of America concerning Climate Action and Nature Protection	<i>Government of Canada, 2022</i>	Pages 119-123
How Can Technology Help Combat Climate Change	<i>World Economic Forum, 2022</i>	Pages 124-127
Carbon Sequestration	<i>University of California – Davis, 2021</i>	Pages 128-132
A Profile of the Natural Resource Sector in New Brunswick	<i>NBJobs.ca, 2021</i>	Pages 133-141
Atlantic Provinces, Regional Perspectives Report	<i>Government of Canada, 2022</i>	Pages 142-150
Perspectives on Canada’s East Coast region; in Canada’s Marine Coasts in a Changing Climate	<i>Savard, J.-P., van Proosdij, D. and O’Carroll, S.; (ed.) D.S. Lemmen, F.J. Warren, T.S. James and C.S.L. Mercer Clarke; Government of Canada, Ottawa, ON; 2016</i>	Pages 151-189



# FORESTRY

## Learning Objectives - 2023

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 2017*. 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, wedge prism, and clinometer), 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 - 2023

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
  - 1.4. Key to Some Trees of Pennsylvania
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. Forest Stewardship #5 - Wildlife
3. Forest Resources, Management and Protection
  - 3.1. Forest Stewardship Best Management Practices for Pennsylvania Forests
  - 3.2. Forests of Pennsylvania, 2017
  - 3.3. Agricultural Alternatives – Managing Small Woodlots
  - 3.4. Wildfire and Prescribed Fire in Pennsylvania
  - 3.5. Just Say No to High-grading, Selective Cutting, and Diameter Limit Cutting
  - 3.6. Insect Threats - 1. Asian Longhorn Beetle; 2. Emerald Ash Borer; 3. Gypsy Moth; 4. Hemlock Woolly Adelgid; 5. Spotted Lantern Fly
  - 3.7. What is an Invasive Plant?
  - 3.8. Invasive Plants - 1. Autumn-olive; 2. Bush honeysuckle; 3. Garlic mustard; 4. Japanese barberry; 5. Japanese knotweed; 6. Multiflora-rose; 7. Tree-of-heaven
  - 3.9. Pennsylvania Envirothon Forest Measurements and Management 2019
  - 3.10. Basal Area: A Measure Made for Management

**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

- 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. Landforms 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 - 2023

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. From the Surface Down 2<sup>nd</sup> Edition (New for 2020)
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. Cornell Soil pH kits
11. Do You Dig Wetland Soils?
12. The Color of Soil
13. Soil Carbon Sequestration Fundamentals
14. 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*

After completing study on this issue, students will:

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 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 of 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.
    - Funding for wildlife management.

*\*4.1 Ecology – 4.1.10.D*

- i. Identify and describe examples of wildlife species and adaptations that enable them to survive in an urban environment creating 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 Chronic Wasting Disease, Epizootic Hemorrhagic Disease (EHD), and West Nile Virus (required for the 2021 Envirothon).

*\*4.1 – Ecology – 4.1.10.D*

## Wildlife Reference Materials – 2023

The references are found on the Pennsylvania Envirothon website at [www.envirothonpa.org](http://www.envirothonpa.org) under *Station Training*.

1. [Pennsylvania Species, Ecosystems & Biodiversity](#)
2. [Helping Wildlife: Working with Nature booklet](#)
3. [Envirothon Skull Resource](#) – compiled by the Pennsylvania Game Commission
4. [2022-2023 Pennsylvania Digest of Hunting and Trapping](#) – The following sections are required for the Envirothon competition.
  - [Fluorescent Orange Requirements](#)
  - [Wildlife Classifications](#)
  - [State Game Lands Regulations](#)
  - [Mentored Hunting Program](#)
  - [Chronic Wasting Disease \(CWD\)](#)
5. [North American Model of Wildlife Conservation](#) (Summary from Project WILD)
6. Wildlife Health (PA Game Commission website)
  - [Rabies](#)
  - [Rabbit Hemorrhagic Disease](#)
  - [Avian Influenza](#)
7. Wildlife Profile 2023 – 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 animals designated in the **Wildlife Profile**.
  - [Elk](#)
  - [Cottontail](#)
  - [Pheasant](#)
  - [Beaver](#)
  - [Striped Skunk](#)
  - [Diving Ducks](#)
  - [Eagles/Osprey](#)

- [Blackbirds+](#)
- [Tanagers](#)
- [Thrushes](#)
- [Vireos](#)
- [Mice & Voles](#) / [Shrews](#)

Mammal Sounds – [The Cornell Lab of Ornithology Macaulay Library](#) website

Birds Songs – Utilize the [Identiflyer](#) or visit [The Cornell Lab of Ornithology All About Birds](#) website

The ten **Bird Songs** that are required for the 2023 Envirothon include:

1. American Robin
2. Starling
3. Cowbird
4. Redwing blackbird
5. Wood thrush
6. Bluebird
7. Scarlet tanager
8. Ring-necked pheasant
9. Eastern meadowlark
10. Bald eagle

All of these bird songs can be found on the Identiflyer, which is typically what the PA Game Commission uses during the wildlife test.

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