

Teacher Guide

An Overview:

Investigation 1 - What is a wetland and what types of wetlands are there? What types of wetlands are in Pennsylvania and where are they? How do we classify wetlands?

Investigation 2 - What are the main components of a wetland? - The 3 H's

Investigation 3 - What do wetlands do? Are wetlands important? - The functions and values of wetlands.

Investigation 4 - How are wetlands protected? - Laws, permits, and an introduction to the wetland delineation.

Investigation 5 - The wetland delineation

Investigation 6 - Case Study: THE BOG

Investigation 1 What is a wetland?

What types of wetlands are there? What types of wetlands are in the United States? Pennsylvania? The Pocono Mountains?

How do classify wetlands?

TIME: 1 90 minute period

OBJECTIVE: Students will develop an understanding of what a wetland is and the different wetland types that exist around the United States, in Pennsylvania, and locally.

PRIOR KNOWLEDGE: There are no prerequisites for this section. This investigation is the foundation for later wetland investigations.

BACKGROUND INFORMATION: Review the handouts "What Are Wetlands?", "Wetland Classification", "Wetland Types", and "Pennsylvania Wetlands." Review the Classification of Wetlands and Deepwater Habitats of the United States for the classification discussion. Available on line at <http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm>

SUGGESTED ACTIVITY: Before students are given the information packet, place students in groups and hand out the worksheet "Test your Wetland IQ: What Do You Know About Wetlands?" After students work on the worksheet, walk to Wetland Site 1 and encourage students to observe the landscape (vegetation, topography, soil conditions) to help them come up with a good definition of a wetland. Students can record their observations and use them while developing the definition. Return to the classroom and discuss the definitions. Next, have the students list all the types of wetlands they can think of, bog, marsh, swamp, fen, vernal pool, etc., and have them try to distinguish the difference between them. Why is a marsh a marsh and not a swamp? Once students have ideas, divide them into groups and have each adopt a wetland type. Provide reference books or information that students could use in order to determine characteristics of each wetland type. Have groups do a mini presentation on their

adopted wetland. Discuss what types of wetlands the students recall seeing in Pennsylvania and more so what types they recall seeing in the Poconos. For those wetland types not found in Pennsylvania, have students discuss where they are found. Discuss the prevalent types of Pennsylvania wetlands and show the students the map of Pennsylvania's wetland distribution. Encourage students to conclude why the wetlands are not evenly distributed (glaciation). Encourage students to conclude why wetlands are not all of the same type (wetlands form under different conditions: different regions, climate, topography, water sources: stream vs. kettle lake, etc.) Introduce the idea of a classification system for wetlands. While many types exist, the individual wetlands classified under those types vary; a classification system identifies many parameters of a wetland and provides a very strong description of a wetland system. End class with using the "Classification of Wetlands and Deepwater Habitats of the United States" to describe several wetlands.

MATERIALS:

⌘ Reference books (list provided)

HANDOUTS: "Test your Wetland IQ: What Do You Know About Wetlands?", "What Are Wetlands?", "Wetland Types", "Pennsylvania Wetlands", "Wetland Classification", and "The Three H's Hydrology, Hydric Soils, and Hydrophytes"

ASSIGNMENT: Assign students the reading "The Three H's: Hydrology, Hydric Soils and Hydrophytes" from the packet. They will need this background information for the next investigation.

Investigation 2 What are the main components that determine a wetland? - Understanding The Three H's: Hydrology, Hydric Soils, and Hydrophytes

TIME: 1 90 minute period

OBJECTIVE: Students will develop an understanding of what hydrology, hydric soils, and hydrophytes are and how to determine their presence in the field.

PRIOR KNOWLEDGE: Students should read the handout "The Three H's: Hydrology, Hydric Soils and Hydrophytes" from the packet for necessary background information. Students should be instructed on how to use field guides.

BACKGROUND INFORMATION: Review the handout "The Three H's: Hydrology, Hydric Soils and Hydrophytes."

SUGGESTED ACTIVITY: Before going out to the field, students should be given an introduction on how to use a field guide. The worksheet "How to Use Plant Identification Guides" (provided) provides information on plant guides and gives the student a chance to

practice using the guides. Once in the field, groups of students will work at different stations set up at Wetland site 2. A total of 6 stations will be set up. The three main station types will include the Hydrology Station, the Hydric Soils Station, and the Hydrophyte Station. A wetland and an upland station will be set up for each station type. Below is a closer look at the stations. Students should not be told if a station is an upland or a wetland station.

- **Hydrology Station:** Students can search for indicators of hydrology and record on data sheets. Standing water, channels, water stained leaves, buttressed (heavily exposed) tree roots, or any other clue that indicates the presence of water can be considered indicators of hydrology. Students may dig a soil pit to see if it fills with water or to check for the formation of water beads. Students should try to determine the source and movement of the water. Students can record their findings on provided data sheets.
- **Hydric Soil Station:** Students will examine a soil pit previously dug in order to understand a little about soils and where they should be taking their soil samples (which is approximately 12-15 inches down, or at the interface between the A and B soil horizon). Students can take soil samples in wetland and upland sites to determine soil colors utilizing a soil chart, such as the Munsell soil color chart. Data can be recorded on provided data sheets. Students should conclude whether or not the soils located at their station are hydric. Students should be able to support their conclusions.
- **Hydrophyte Station:** Students will be given plant keys and an indicator status list in order to (1) identify vegetation and (2) determine the indicator status of the vegetation. Data will be recorded on provided data sheets. Students should conclude what the dominant plant types (with status) are at their station and if, after considering their findings, they believe they are in an upland or wetland. Students must justify their answers.

Once students work through the stations, they can come together and discuss: (1) What, if any, indicators of hydrology were observed at the stations and if observed, what the source and movement of the water at the site was (2) How the conclusion was made if a soil was hydric or not (3) What types of vegetation were identified, how they were classified, and where they were located and (4) based on their findings if they believed they were in an upland or wetland.

MATERIALS:

- ✂ Soil Augurs
- ✂ Munsell Soil Color Charts
- ✂ Plant ID Guides (list provided)
- ✂ Vegetation Indicator Status Books (National List of Plant Species that Occur in Wetlands (1988) Region I - Northeast)
- ✂ Data Sheets
- ✂ Hand Lenses (optional)

HANDOUTS: “ How to Use Plant Identification Guides”

ASSIGNMENT: Students can be given a list of reputable wetland related web sites in order

to create a list of several wetland function and values. Students may also be assigned an animal or plant that is dependent on wetlands and then research and document why wetlands are important to that particular organism. (Let students know that quick answers such as "food" are not acceptable. If an organism relies on a wetland for food, have them discuss what the food actually is and why it is found in wetlands).

Investigation 3 What do wetlands do and why are they important? - The Functions and Values of Wetlands

TIME: Approximately 30 minutes

OBJECTIVE: Students should realize that wetlands are not just mosquito infested "wastelands" but that they are extremely valuable to the natural world and to humans. Students can understand not only that wetlands are important, but why they are important.

PRIOR KNOWLEDGE: Students should understand the difference between a function (the ecological processes of a wetland; how a wetland environment operates; what it does, e.g. provides wildlife habitat) and a value (something worthy, desirable, or useful to humanity; although the term is used often in ecology to refer to processes (e.g., primary production) or ecological structure (e.g., trees) as they are "valuable" to the way an ecosystem functions, the term generally should be limited to an anthropocentric connotation. Humans decide what is of "value" in an ecosystem.

BACKGROUND INFORMATION: Review the handout "Wetland Functions and Values."

SUGGESTED ACTIVITY: Begin the lesson with students discussing what functions and values they discovered during their previous activity and also how wetlands were important to their assigned organism. Try to get students to the conclusion that since wetlands are so important (and since half the nation's wetlands have been destroyed), their preservation and protection must be a priority. Understanding their value and role in the ecosystem will help lead into the laws that help protect wetlands. Finally, engage students in a discussion as to how and why wetlands are important to humans (relate to food web dynamics, social values, economics).

HANDOUTS: "Wetland Functions and Values"

Investigation 4 How are wetlands protected? - Laws, permits, and an introduction to the wetland delineation

TIME: 1 Hour

OBJECTIVE: Students will develop an understanding of the laws protecting wetlands and the associated permits for necessary disturbance activities within wetlands. Students will learn that obtaining a permit is a complicated process. Students will become familiar with the regulatory

definition of a “wetland” and the wetland delineation process.

PRIOR KNOWLEDGE: Before discussion, students may want to read over the handout “Wetland Protection: The Laws, the Permits, and the Wetland Delineation” to help prepare them for lecture and discussion.

BACKGROUND: Review handout “Wetland Protection: The Laws, the Permits, and the Wetland Delineation.”

PEDAGOGICAL SUGGESTIONS: This section may be the hardest section for students to truly understand. It may be appropriate for teachers to go through with the students what laws protect wetlands and what role the different types of permits play. Try to get students to the conclusion that since wetlands are regulated, the first step to protecting them is to identify their boundaries and define their extent. This process is known as wetland delineation. There are a few different protocols for delineating wetlands, the most widely accepted being the 1987 United States Army Corp of Engineers Wetlands Delineation Manual. This manual uses a three parameter approach for the identification and delineation of wetlands. See the Wetland Delineation section in the packet for further descriptions.

ACTIVITY: The main activity for this section is discussion. It may be difficult for students to understand the laws at first, and therefore, teachers may need to approach the discussion in several different ways. If discussion goes well and time remains, students can get into groups and discuss how they would perform a wetland delineation (what factors they would like at, what tools they would need, etc.). Students may present their ideas to the other groups. This is good exercise to prepare students for their next activity, a delineation in the field.

HANDOUTS: “Wetland Protection: The Laws, the Permits, and the Wetland Delineation”

Investigation 5 The Wetland Delineation

TIME: | 90 minute period

OBJECTIVE: Students will use knowledge obtained during prior investigations to do a wetland delineation. Students will become familiar with the delineation process while reinforcing main components of a wetland.

PRIOR KNOWLEDGE: The only prerequisite is the knowledge obtained from previous wetland investigations.

BACKGROUND: Review handout “Wetland Protection: The Laws, the Permits, and the Wetland Delineation”, focusing on the wetland delineation section.

SUGGESTED ACTIVITY: Students will be lead to an area where the upland/wetland boundary exists. Teachers will be given information regarding where the line is. Students will

need to work together (in groups) to determine where the wetland boundary lies. Students will need to identify vegetation, take soil samples, and look for indicators of hydrology. The accumulated data can be recorded on data sheets taken from the 1987 United States Army Corp of Engineers Wetlands Delineation Manual. The determined wetland boundary can be flagged in many locations to create a boundary line. Students may either draw a map of the wetland boundary and flags or the exact location of the flags can be determined using GPS handheld units. Students can then download the information and determine the wetland boundary using GIS.

MATERIALS:

- ✂ Soil Augurs
- ✂ Munsell Soil Color Charts
- ✂ Plant ID Guides (list provided)
- ✂ Vegetation Indicator Status Books (National List of Plant Species that Occur in Wetlands (1988) Region I - Northeast)
- ✂ Data Sheets
- ✂ 1987 United States Army Corp of Engineers Wetland Delineation Manual
- ✂ Pink flagging (rolls)
- ✂ Hand Lenses (optional)

SUGGESTED ON GOING ACTIVITY: Students may continue to delineate the entire wetland on site (and other on site wetlands or wetlands in the area) and locate wetlands using GPS units. Information can be downloaded and wetland maps of the area created.

ASSIGNMENT: Have students research the definition of a “bog.” Ask students to research and document three things from a bog that can be used by people.

Investigation 6 - Case Study: THE BOG

TIME: | 90 minute period

OBJECTIVE: Students will discover what a unique habitat a bog is while reinforcing the general characteristics of wetlands.

PRIOR KNOWLEDGE: The only prerequisite is the knowledge obtained from previous wetland investigations.

BACKGROUND: Review handout “Case study: The Bog.”

SUGGESTED ACTIVITY: Before going out, students can discuss previous assignment. Students can travel out to the bog and notice the obvious transition from uplands to the wetland system known as a bog. If any students from the Ecology Club are in the class, perhaps they could give a formal tour of the bog, introducing the students to some bog inhabitants (black spruce, balsam firs, cotton grass, and cranberries). Students could also take out plant

keys and try to identify some of the bog vegetation that they did not recall seeing in the forested wetland. Students may discuss what type of animals might inhabit this bog. Students may discuss what makes this bog different from other types of wetlands. Allow time for students to just look around and discover what a unique habitat this bog really is. Hand lenses may allow for deeper exploration by providing a closer look at smaller plants such as cranberry and sphagnum moss.

If time allows teachers may have an overall closing for all of the wetland investigations, discussing main points from each investigation. This may help link all of the investigations together to help students realize that each investigation connects to help form a strong understanding of wetlands.

MATERIALS:

- ✂ Plant ID Guides (list provided)
- ✂ Vegetation Indicator Status Books (National List of Plant Species that Occur in Wetlands (1988) Region I - Northeast)
- ✂ Hand Lenses (optional)

HANDOUTS: “Case study: The Bog”

Field Guides

Brown, L. 1979. *Grasses: An Identification Guide*. Houghton Mifflin Co., Boston, MA. 240 pp.

Cobb, B. 1963. *A Field Guide to the Ferns and Their Related Families*. Houghton Mifflin Co., Boston MA. 281 pp.

Hotchkiss, N. 1972. *Common Marsh, Underwater, and Floating-leaved Plants of the United States and Canada*. Dover Publications, Inc., New York, NY.

Newcomb, L. 1977. *Newcomb’s Wildflower Guide*. Little, Brown and Co., Boston, MA. 490 pp.

Peterson, R. T. and M. McKenney. 1968. *A Field Guide to Wildflowers - Northeastern and Northcentral North America*. Houghton Mifflin Co., Boston, MA.

Petrides, G. A. 1972. *A Field Guide to the Trees and Shrubs*. Houghton Mifflin Co., Boston, MA. 428 pp.

VEGETATION DATA FORM

Name: _____

Section: _____

Date: _____

Vegetative layer (tree, shrub/sapling, herb, woody vine)	Species Common Name	Species Scientific Name	Indicator Status (OBL, FACW, FAC, FACU, or UPL)

% OBL _____ % FACW _____ % FAC _____ %FACU _____ %UPL _____

% OBL, FACW and FAC _____

SOIL DATA FORM

Name: _____

Section: _____

Date: _____

Soil Sample No.	Matrix Color	Mottles Present (Y/N)	Mottle Color	Gleyed (Y/N)	Hydric (Y/N)

Considering your acquired data, are the soils at your station hydric? Why or why not?

HYDROLOGY DATA SHEET

Name: _____

Section: _____

Date: _____

Is the site inundated? _____

Are the soils saturated? _____

List indicators of hydrology: _____

What is the source of the water at this site? _____

What is the direction of the water? _____

Is this an area of recharge or discharge? Meaning, is this an area where the water is likely to infiltrate into the ground (recharge) or exit the site (discharge)? How did you reach your decision? _____

Bog Wildlife

As mentioned in the packet, animal populations in bogs are generally low because of low productivity and the unpalatability of most bog vegetation. However, some animals can be found roaming through bogs such as the one at Pocono Mountain. Wildlife that may be observed includes:

White tail deer (seeking cover or food)

Black Bear (foraging on berries)

Wetland Related Web Sites

- ✂ EPA's wetland related web site: <http://www.epa.gov/owow/wetlands/>
- ✂ Army Corp of Engineers wetland related site:
<http://www.wes.army.mil/el/wetlands>
- ✂ USGS plant guide to 300 wetlands species that inhabit northeastern United States: <http://www.npwrc.usgs.gov/resource/1999/neflor/neflor.htm#table>
- ✂ The U.S. Fish and Wildlife Service's wetland web site:
<http://www.wetlands.fws.gov>
- ✂ Hydric Soils of the United States: Introduction and Field Indicators:
<http://www.statlab.iastate.edu/soils/hydric>
- ✂ Classification of Wetlands and Deepwater Habitats in the United States:
<http://www.npwrc.usgs.gov/resource/1998/classwet/classwet.htm>
- ✂ A good wetland resource site: <http://www.eco-pros.com/wetlands.htm>

There are many other wetland related web sites on the Internet. General searches on wetlands provide lists of many wetland related web sites.