Activity 36: Wetlands
Maine Geological Survey

This activity differs considerably in style and form from the other activities and it encumbers a very large amount of time, about four (4) weeks. It is an excellent and detailed activity on wetlands and should seriously be considered by teachers with that amount of time to devote to this topic.

Rationale:

Students will one day take on the responsibilities of owning land, serving on a planning committee, or advocating a use of land in the community. Their land use decisions will require a greater scientific understanding of wetlands. In this unit, students will investigate the natural history of a wetland, identify its boundary, and evaluate its functions.

Objectives:

The major objectives of this unit occur in five steps.

1. Investigate the formation of wetlands in Maine.
2. Prepare a series of map overlays researching wetland conditions for a site in the community.
3. Recognize a wetland using the criteria of hydrology, vegetation, and hydric soils.
4. Inventory the functions of the local wetland.
5. Write an evaluation of the local wetland.

Prerequisites for the Teacher:

1. Read the following resources:
    a) Background information found in this unit discussing the relations between glacial features and the formation of wetlands, identification of wetlands, and functions of wetlands.
    b) Tiner, R.W., 1984. Wetlands of the United States: Current Status and Recent Trends, U.S. Fish and Wildlife Service, Washington, D.C., 59 p. (For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402)
    c) Tiner, R.W., 1991, Maine Wetlands and Their Boundaries: A Guide for Code Enforcement Officers, Maine Department of Economic and Community Development, Augusta, 80 p.
2. Students should have already completed a unit on topography.
3. Plan to do this unit when the ground is not frozen.
4. Identify an area suitable for this project. Fortunately, most schools are built on or near wetlands acquired by the town at a low cost. However, a site in the community may have development or preservation potential that will pique student interest. The area should be large enough to accommodate groups of students working along one or more transects of the area.
5. Contact local professionals involved in wetland delineation. Possible sources include the County Soil Conservation Service, a private environmental consulting firm, or the State Department of Environmental Protection.
6. Prepare a set of local slides to be used where noted in the lesson plans.
7. Divide the class into groups of three or four.

Vocabulary List:

pore space	alluvium	porosity	flood plain	permeability
oxbow lake	percolation	delta	estuary	Presumpscot Formation
till	embayment	hardpan	flood zone	basal till
hydrology	ablation	till	ground water	surface geology
runoff kettle	hydrophyte	end moraine	soil	hydric soil

Material List per Student or Group:

- Field trip forms
- Clipboard
- Samples of Presumpscot Formation, basal till, well drained sand
- Three (3) beakers
- Colored pencils
- Slides of geologic Presumpscot Formation, basal till, kettle, end moraine, alluvium, oxbow lake, flood plain, estuary
- Slides of hydrophytes
- Slides of hydrologic criteria
- Slides of hydric soils showing mottling and gleying
- Slides of wetland values
- Surficial Geologic Map of Maine or of local vicinity, if available
- Local topographic maps plus 5 photocopies showing study site
- Local Soils Maps
- Local Flood Zone Maps
- Maine Wetlands and Their Boundaries: A Guide for Code Enforcement Officers by Tiner 1991)
- Rubber boots
- Permission slips for all students for Days 11, 17

Day 1: Wetlands Unit Introduction

Objectives:

1. The learner will demonstrate current knowledge of wetlands by
   a) brainstorming a list of 7 familiar characteristics and 7 functions of a wetland
   b) reporting these to the class
2. The learner will demonstrate an increased understanding of the unit's goals by discussing his/her responsibilities with respect to wetlands. This will include use and knowledge of site description pages, map overlays, wetland criteria, inventory of wetland functions, and written evaluation of local study area.
3. The learner will demonstrate a familiarity with the local site by discussing the issues involved with its development or preservation.

TIME: One 45 minute period

Procedure:

1. Give students the brainstorming assignment.
2. Collect a sample of characteristics and functions. Save the list to compare at the end of the project.
3. Outline the Wetlands Project emphasizing student responsibilities, field trip, and wetland site in the community to be evaluated.
4. Summarize by asking students to explain the purpose for this project.

Follow-Up Activity:

1. Pass out Day 11 and Day 17 field trip permission slips.
2. A major component of the unit will be the student's written interpretation of the local wetland. The interpretation should describe the wetland's formation, significant features, analysis of map research, and evaluation of functions.
3. Define: till, basal till, ablation till, porosity, permeability, percolation, pore space

Day 2: Relating Porosity and Permeability to Wetlands

Objectives:

1. The learner will demonstrate an increased understanding of the effects of pore space on ground water percolation by:
   a) timing the rate for samples of well drained sand, the Presumpscot Formation, and basal till
   b) describing each sample in terms of its porosity and permeability
2. The learner will demonstrate an increased understanding of porosity and permeability by relating these physical properties to the formation of wetlands.

TIME: One 45 minute period

Materials:

- Beakers
- Samples of Presumpscot Formation (essentially the marine clays that formed when the ocean covered parts of Maine that are now dry land)
- Samples of basal till (unstratified glacial deposit of all particle sizes)
- Samples of well drained sand

Procedure:

1. Review purpose of wetland project and how Maine's natural history is important to the formation of wetlands.
2. Introduce the concepts of pore space, percolation rate, permeability, and porosity.
3. Set up permeability observations for samples of a well-drained sand, the Presumpscot Formation, and basal till. Have students record the time it takes water to percolate through each sample.
4. Compare the results. Discuss the results of the test with respect to porosity and permeability of each sample.

Follow-Up Activity:

Have students speculate on which samples are most likely to form wetlands.

Day 3: Relating Glacial Deposits to Wetland Formation

Objectives:

1. The learner will demonstrate an increased understanding of the Presumpscot Formation by:
   a) describing how it was deposited.
   b) relating it to the formation of wetlands.
2. The learner will demonstrate an increased understanding of basal till by:
   a) describing how it was deposited.
   b) relating it to the formation of wetlands.

TIME: One 45 minute period

Background Information:

The formation of many coastal and freshwater wetlands in Maine is a result of sediments deposited during the region's glacial past. Between about 13,000 and 11,000 years ago, large quantities of suspended fine sand, silt, and clay were carried to the ocean by meltwater streams. As the sediments fell out of suspension, they created muddy glacio-marine deposits called the Presumpscot Formation. Because Maine's land surface had been depressed by the weight of the glacial ice, the Presumpscot Formation was deposited far inland in some parts of Maine, reaching elevations of 300-400 feet above sea level. Known for its low permeability and poor drainage, portions of it support wetland vegetation. The Presumpscot Formation is also identified by its brownish gray to gray to dark bluish color and its great tightness when dry (Thompson, 1978).

The most extensive glacial sediment was deposited beneath the glacier or during melting at the ice margin. Known as till, the blanket- like deposits consist of a mixture of various sized particles: boulders, cobbles, pebbles, gravel, sand, silt, and clay. Key to the formation of wetlands is till that was deposited beneath the glacier. In this case the sediment particles are finer because of the glacial grinding action. Pore spaces are clogged with silt or clay and the weight of the glacier greatly compacted the material. This variety of till is known as hardpan or basal till (Thompson, 1978). These physical characteristics give basal till its low permeability and poor drainage, which favor wetland development. In contrast, till deposited at the ice margin consists of uncompacted, larger particles (more sand and gravel-size sediment) that tend to be well drained. It is called ablation till.

Materials:

Slides of Presumpscot Formation and tills (locations can be found on some of the surficial geology maps published by the Maine Geological Survey.)

Procedure:

Describe the Presumpscot Formation and basal till using slides or diagrams.

Day 4: Map Extent of Presumpscot Formation and Basal Till

Objectives:

1. The learner will demonstrate understanding of the correct use of a map key to interpret the symbols of the local surficial geologic map.
2. The learner will demonstrate the ability to interpret the surficial geology map by plotting the extent of the Presumpscot Formation and areas of basal till (generally shown as just "till" on Maine maps).
3. The learner will demonstrate reinforcement of the role of the Presumpscot Formation by discussing its correlation with wetlands.
4. The learner will demonstrate reinforcement of the role of basal till by discussing its correlation to wetlands.

TIME: One 45 minute period

Background Information:

Surficial geologic maps are available from the Maine Geological Survey. These maps have clear explanations for each map symbol. Map scales range from 1:500,000 for a state-wide version to 1:62,500 (15 minute quadrangles) to 1:24,000 (7-1/2 minute quadrangles).

Materials:

- Surficial geologic maps of the area
- Topographic maps of the area
- Photocopy of topographic map showing the study site
- Colored pencils

Procedures:

1. Have 5 photocopies showing the study site prepared before this lesson for each student or group.
2. With the study site at the center, have students draw a two square mile box on each photocopy of the local 7-1/2 minute topographic map.
3. Take time to explain what a surficial geology map is and how to use the key.
4. Cut out a 2 square mile box from a piece of paper to frame the study site on the surficial geology map.

5. Find the Presumpscot Formation and/or areas of till on the surficial geologic map.
6. Transfer the framed information from the map to the first of five photocopied topographic maps.
7. Use colored pencils to highlight the symbols.

Follow-Up Activity:

Define: kettle, terminal moraine, or end moraine.

Day 5: Relating Glacial Topography to Wetland Formation

Objectives:

1. The learner will demonstrate an increased understanding of a kettle by:
   a. explaining how it forms.
   b. describing the features used to identify it in the field.
   c. relating the topography of a kettle to the formation of a wetland.
2. The learner will demonstrate an increased understanding of an end moraine by:
   a. explaining how it forms.
   b. describing the features used to identify it in the field.
   c. relating the topography of an end moraine to the formation of a wetland.

TIME: One 45 minute period

Background Information:

While low permeability of a substrate plays the greatest role in the origin of a wetland, glacial topography plays a supporting role. In general any depression will collect run-off and/or ground water, creating a wetland. Irregularly shaped depressions may have been carved out of the bedrock or till surfaces as the glacier advanced across the land. Other poorly drained areas may have formed in valleys or on the flat floors of meltwater channels.

In addition to the carved depressions, more specialized features were formed as the glacier melted. One such feature is known as a kettle. Kettles formed when blocks of ice were left behind by the retreating glacier. The ice blocks became completely or partially buried by drift. Years later a depression formed when the block melted (Timson and Pickart, undated). Kettles, found throughout Maine, are identified by their steep-sided bowl shapes. Diameters range from a few meters to more than 2 kilometers at the Schoodic Lake Kettle in Washington County. They range in depth from less than a meter to tens of meters. If the kettles are deep enough, they intersect the water table forming a pond or lake. Over time this initial pond or lake stage develops into a bog, as wetland plants decompose and fill in the kettle (Cameron and others, 1984).

A second topographic feature known as an end moraine formed parallel to a stationary margin of the ice sheet. Till, and/or sand and gravel were deposited directly from the ice sheet as ridges. These ridges accumulated to dimensions of 1-25 meters in height, 6-300

meters in width, and 30 meters to several kilometers in length. Following the retreat of the glacier, the exposed till and adjacent end moraine restricted the ground water drainage. With these conditions, the area remained saturated or inundated and wetland vegetation thrived. The Merriland Ridge end moraine in Wells exemplifies this scenario. Glacial deposits in contact with the northern side of this moraine are largely composed of silt, clay, and peat (Smith, 1977). Topography and substrate provided the conditions to form a wetland.

Materials:

Slides of kettles and end moraines

Procedure:

1. Review the importance of Maine's natural history to the formation of wetlands.
2. By using slides or diagrams, describe the formation of kettles and end moraines.
3. List the characteristics that are used to identify kettles and end moraines in the field or on a topographic map.

Day 6: Mapping Kettles and End Moraines

Objectives:

1. The learner will demonstrate reinforcement of correctly using a map key to interpret the symbols of the local surficial geologic map.
2. The learner will demonstrate an ability to interpret the surficial geology map by plotting the location of kettles and end moraines.
3. The learner will demonstrate reinforcement of the role of the kettles by discussing their correlation with wetlands.
4. The learner will demonstrate increased understanding of the role of end moraines by discussing their correlation to wetlands.

TIME: One 45 minute period

Background Information:

Surficial geologic maps are available from the Maine Geological Survey. These maps have clear explanations for each map symbol. Map scales range from 1:500,000 for a state-wide version to larger-scale 15 minute quadrangles and 7-1/2 minute quadrangles.

Materials:

- Surficial and Topographic geologic maps of the area
- Colored pencils

Procedure:

(Before starting this section, make certain that the map used actually has kettles and moraines depicted upon it. Some areas do not. If your area does not, you may wish to use the nearest adjacent map showing these features)

1. Use the cut-out 2 mi^2 box to frame the study site on the surficial geology map.
2. Find the kettles and end moraines on the surface geology map.
3. Transfer the framed information from the map to the second of the five photocopied topographic maps.
4. Use colored pencils to highlight the symbols.

Follow-Up Activity:

Define: alluvium, flood plain, oxbow lake, estuary, and delta

Days 7 and 8: Relating Modern Drainage Patterns to Wetland Formation

Objectives:

1. The learner will demonstrate an increased understanding of a flood plain by:
   a. explaining how it forms
   b. describing the features used to identify it in the field
   c. relating its topography to the formation of a wetland
2. The learner will demonstrate an increased understanding of an oxbow lake by:
   a. explaining how it forms
   b. describing the features used to identify it in the field
   c. relating its topography to the formation of a wetland
3. The learner will demonstrate an increased understanding of alluvium by:
   a. describing its composition
   b. listing its method of transportation and deposition
   c. relating its deposition in a flood plain to the formation of a wetland
4. The learner will demonstrate an increased understanding of an estuary by:
   a. explaining how it forms with the help of sea level rise
   b. relating the Presumpscot Formation to its formation
   c. describing the features used to identify it in the field

TIME: Two 45 minute period

Background Information:

Since Maine was deglaciated, modern stream drainage patterns have evolved. Where a stream channel's gradient decreases, there is less energy to keep eroded material in suspension. Consequently, the eroded material is deposited as sediment called alluvium. It commonly accumulates as a stream meanders across a valley creating a flood plain. The coarse sediments deposited by floods build up at the edge of the channel forming a natural levee, while silt and clay settle farther from the stream. Because of low permeability, flood plains underlain by fine alluvium are often recognized as wetlands.

Likewise, wetlands also form in oxbow lakes. These features occur as the stream meanders so much that two bends connect and the course of the stream is shortened. The abandoned channel becomes an oxbow lake. Eventually, the lake fills in with silt, clay, and organic material from floods or surface runoff. The shallow water environment provides a habitat for wetland vegetation.

A final location where deposition of alluvium forms wetlands is at the inlet to a large water body. The stream's energy quickly dissipates in the lake or pond so that sediments accumulate at the mouth of the stream to form a delta. As the water depth decreases, conditions exist for wetland plants to survive. More dramatic are the estuaries that have formed where rising sea level has flooded the land, resulting in the deposition of alluvium and tidal mudflats, creating large expanses of salt marsh.

Materials:

Slides of flood plains and oxbows adjacent to a river or lake, slides of estuaries or embayments with associated wetlands.

Procedure:

Using slides, describe each of the modern drainage features they will be visiting on the field trip.

Day 9: Mapping Alluvium, Oxbow Lakes and Estuaries

Objectives:

The learner will demonstrate increased ability in correctly using a map key to interpret the symbols of the local surficial geologic map and topographic map.

1. The learner will demonstrate an ability to interpret the surficial geologic map by plotting the location of stream alluvium.
2. The learner will demonstrate an ability to interpret the topographic map by plotting the location of oxbow lakes and estuaries.
3. The learner will demonstrate increased understanding of the role of alluvium by discussing its correlation with wetlands.
4. The learner will demonstrate increased understanding of the role of oxbow lakes and estuaries by discussing their correlation to wetlands.

TIME: One 45 minute period

Background Information:

Modern alluvial deposits are shown on many surficial geologic maps. Oxbow lakes are noticeable in stream valleys on certain topographic maps. A superb example is the Saco River valley in the Fryeburg quadrangle.

Materials:

- Surficial geologic maps of the area, topographic maps of the area
- Colored pencils

Procedure:

1. Use the cut-out 2 square mile box to frame the study site on the surficial geologic map.
2. Find the areas of alluvium on the surficial geologic map.
3. Transfer the framed information from the map to the third of the five photocopied topographic maps.
4. Cut out a 2 square mile box from a piece of paper to frame the site on the topographic map. Check for oxbows and estuaries on the topographic maps.
5. Use colored pencils to highlight these symbols.

Day 10: Field Trip Preparation

Objectives:

The learner will demonstrate the ability to correctly complete a Site Description Page by using a set of slides to fill out the form.
TIME: One 45 minute period

Background Information:

The Site Description Page found at the end of this activity is to be used by students to summarize the conditions they observe at each stop of the field trip. SOME OF THE FEATURES DISCUSSED IN THE PREVIOUS LESSONS MAY NOT BE FOUND IN YOUR PART OF MAINE. CAREFUL SELECTION OF APPROPRIATE SITES IS IMPORTANT.

Materials:

- Blank Site Description Page
- All signed permission slips should have been returned to the teacher by this day.

Procedures:

1. Explain use and procedure for completing Site Description Page.
2. Use a slide from a previous lesson to exemplify how to complete the page.
3. Discuss route and expectations of the field trip.
4. Remind students of appropriate dress: old clothes and old shoes or boots, coat, rain gear, lunch, camera (if desired), notebooks, and pens.

Day 11: Field Trip to Local Wetlands

Objectives:

1. The learner will demonstrate the ability to recognize the type of glacial or drainage feature by relying on previous class discussion to complete a Site Description Page at each site.
2. The learner will demonstrate increased knowledge of the soil's role in wetland formation by identifying samples of Presumpscot Formation and till, if present.
3. The learner will propose a hypothesis that describes the formation of the study site by comparing its topography and surficial geology to the field trip sites.

TIME: Half to full day

Background Information:

Plan a field trip to as many sites as possible in your area that exemplify the features discussed in class: Presumpscot Formation, basal till, kettle pond, end moraine, flood plain, alluvium, oxbow, delta, and estuary.

Materials:

- First aid kit (as a safety procedure)
- Clipboard
- Pencil
- Site Description Page
- Corresponding topographic, surficial geologic, and wetlands maps
- Magnets to post the maps on the side of the bus
- Clothes to get dirty in

Procedures:

1. At each stop, ask students to decide what type of feature they are observing.
2. Discuss natural history of the site.
3. Help students complete the Site Description Page.

Follow-Up Activities:

1. Write an interpretation of how the study site formed.
2. Define: hydrology, ground water, and runoff.

Day 12: Hydrologic Criteria for Recognizing Wetlands

Objectives:

1. The learner will demonstrate an increased understanding of how a wetland is recognized by listing the three criteria for delineating a wetland.
2. The learner will demonstrate an increased understanding of the hydrologic clues used to identify wetlands by reviewing relevant slides to list the clues.

TIME: One 45 minute period

Background Information:

The definition that scientifically delineates wetlands was adopted by the Environmental Protection Agency and the Army Corps of Engineers. They define wetlands as: those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Notice that the definition focuses on hydrology as the key factor on which vegetation and hydric soils depend. Wetland hydrology, as it is described in "Maine Wetlands and Their Boundaries," can be caused by three situations.

1. Inundation by flooding or ponding;
2. Saturation due to the water table being near or at the surface;
3. Periodic flooding by the tides (Tiner, 1991). Since these conditions do not last throughout the year, the following list of indirect evidence is used to indicate wetland hydrology.
    - Water-stained or silt covered leaves, stems, trunks
    - Water-carried branches and twigs around bases of trees
    - Water-carried plant stems deposited by ocean tides
    - Water-carried debris deposited in branches of trees or shrubs well above the ground
    - Recent water-carried deposits of sand or silt on the ground
    - Evidence of intermittent streams
    - Water level marks on bridge abutments, rocks, trees
    - Multiple tree trunks

- Shallow or exposed roots
- Mottling of soil
- Oxidized rhizospheres (oxygen has moved through root channels and oxidated adjacent soil)

Materials:

Slides of hydrologic criteria

Procedures:

1. Have students read the definition of a wetland and identify the criteria for a wetland: hydrology, vegetation, and soils.
2. Based on the list of evidence for wetland hydrology found in the Background Information section, have students observe examples of these clues outdoors or by slides.
3. Discuss hydrology as an indicator of wetlands.

Follow-Up Activities:

1. Explain how hydrology is analyzed to identify wetlands in a brief essay.
2. Define flood zone and levee. [Omit this in any abridged edition of this activity]

Day 13: Relationship of Wetlands to Flood Zones

[Omit this in any abridged version of this activity.]

Objectives:

1. The learner will demonstrate an increased understanding of a flood zone by describing what it is.
2. The learner will demonstrate an increased understanding of other resources available to locate wetlands by researching flood zone maps.
3. The learner will demonstrate an ability to interpret a flood zone map by plotting the location of the flood zone.
4. The learner will complete a key and title for the map.

TIME: Two (2) 45 minute periods.

Background Information:

Although wetlands can be located via the use of hydrologic criteria in the field, flood zone maps are available to investigate where wetlands may exist. Flood zone maps are available at no cost from the Maine State Planning Office.

Procedures:

1. Explain how a flood zone forms and how it is depicted on the map.
2. Begin by cutting out a 2 square mile box from a piece of paper to frame the study site on the flood zone map.
3. Transfer the framed information from the map to the fourth of the five photocopied topographic maps.
4. Use colored pencils to highlight these symbols.

Follow-Up Activities:

Coloring of map symbols and key can be worked on outside of class.

Day 14: Vegetative Criteria for Recognizing Wetlands

Objectives:

1. The learner will demonstrate an increased understanding of the vegetative clues used to identify wetlands by reviewing slides of 10 common wetland plants.
2. The learner will list features that will help to identify the plants in the field.
3. The learner will demonstrate an understanding of the concept of hydrophyte by defining it based on the day's lesson.

Background Information:

The second criteria for identifying a wetland is the presence of vegetation that is growing in water or on a substrate that is at least periodically inundated or saturated. These types of plants are known as hydrophytes. Although certain species may be represented entirely as hydrophytes, the term only refers to the individual plants (Tiner, 1991). For example, broad-leaved cattail grows only in wetland conditions, whereas red maple may or may not be found in a wetland. Note that hydrophytes cannot exist without wetland hydrology.

Maine Wetlands and Their Boundaries: A Guide for Code Enforcement Officers, by Tiner (1991) includes a good wetland vegetation key with excellent sketches of flora.

Procedures:

1. Review slides to identify 10 common wetland plants using their obvious features.
2. Explain to students that the plants they have observed are hydrophytes. Have them devise a definition of hydrophyte.
3. Discuss the importance of plants as indicators of wetlands.

Follow-Up Activities:

1. Explain why vegetation is analyzed to identify wetlands.
2. Define: mottling, gleying, hydric soil

Day 15: Soil Criteria for Recognizing Wetlands

Objectives:

1. The learner will demonstrate an increased ability to classify soil samples either as a hydric organic soil or a hydric mineral soil by analyzing the sample for plant remains and color.
2. The learner will demonstrate an ability to recognize mottling and gleying by analyzing soil samples (or slides).

TIME: One 45 minute period.

Background Information:

The third criteria for identifying a wetland is the presence of hydric soils that have developed as an area has been saturated or inundated long enough for anaerobic conditions to persist (Tiner, 1991). Hydric organic soils occur as hydrophytes partially decompose and are deposited in kettles, ponds, flood plains, swamps, peat bogs, or estuaries. Hydric mineral soils may have originated from the glacial deposition of the Presumpscot Formation or basal till. On the other hand they may be the result of more modern deposition in flood plains, ponds, or estuaries.

Procedures:

1. Obtain soil samples ahead of time.
2. Review criteria for identifying wetlands - hydrology, vegetation, and soils.
3. Model steps of soil analysis: (Slides of soils exemplifying these qualities are helpful.)
   a) plant remains?
   b) color?
   c) mottling?
   d) gleying?
4. Have students determine whether or not the remaining soil samples are hydric.
5. Have students describe a hydric soil in terms of mottling and gleying.
6. Discuss purpose of soil analysis.

Follow-Up Activities:

Explain why soil is analyzed to identify wetlands.

Day 16: Relationship of Wetlands to Soil Type

[Omit in any abridged version of this activity]

Objectives:

1. The learner will demonstrate an increased understanding of other resources available to locate wetlands by researching soils maps.
2. The learner will demonstrate an increased understanding of soil map units by describing the soil types at the study area.
3. The learner will demonstrate an ability to interpret a soils map by plotting the location of each soil type on the fifth photocopy of the topographic map.
4. The learner will complete a key and title for the map.

TIME: One 45 minute period.

Background Information:

Another source for locating wetlands is a soils map. They are available at no cost from the local Soil Conservation Service (see Appendix B). Information is available from SCS explaining how the maps were compiled, along with a book describing each map unit. For York County, a booklet was printed describing the suitability of the county's soil types.

Procedures:

1. Describe how a soils map is made.
2. Begin by cutting out a 2 square mile box from a piece of paper to frame the study site on the soils maps.
3. Transfer the framed hydric soil map unit’s information from the map to the fifth of five photocopied topographic map.
4. Use colored pencils to highlight these symbols.

Follow-Up Activities:

Coloring of map symbols and key can be worked on outside of class.

Day 17: Mock Wetlands Identification

Objectives:

1. The learner will demonstrate increased understanding of the three criteria of a wetland by explaining why they are used.
2. The learner will demonstrate some understanding of wetland identification by applying knowledge of wetland clues to complete three WETLAND IDENTIFICATION FORMS.

TIME: Half day to full day.

Background Information:

The WETLAND DELINEATION DATA FORM has a format similar to what is used by professionals. The form is organized with the most obvious evidence of wetlands first - vegetation. Since students have probably not done any plant identification, it is best to point out to students the 5 most abundant species in the observation plot and give students the indicator status. From there they can estimate the percent cover, calculate the weighted status, and find the average. The indicator status is based on the abbreviations used in the key:

1. OBL: obligate wetland species are only found in wetland habitat.
2. FACW: facultative wetland species are usually found in wetland habitat, but may be found in uplands.
3. FAC: facultative species have a nearly equal abundance in wetlands and uplands.
4. FACU: facultative upland species are usually found in upland habitat, but may be found in wetlands.
5. UPL: upland species are only found in non-wetland habitat.

The soils section requires students to analyze the soil for its color, presence of organic material, mottling, and gleying. The hydrology section completes the observations by asking students to look for indirect evidence of inundation, saturation, or periodic flooding. The form is finished by writing a rationale for the wetland or non-wetland decision.

Since this activity would be too challenging with a large group, it is recommended that the teacher seek assistance from other knowledgeable teachers or staff from the

following agency: County Soil Conservation District, Maine Department of Environmental Protection, or a private environmental consulting firm.

Materials:

- Need signed field trip permission slips
- WETLAND IDENTIFICATION FORM
- "Key to Common Wetland Plants of Maine" (contained in Maine Wetlands and Their Boundaries: A Guide for Code Enforcement Officers by Tiner, 1991)
- One (1) shovel

Procedure:

1. Group students with a guest instructor to review wetland criteria in the field.
2. Have students obtain the materials and take the class to the study area.
3. The guest instructor(s) should lead students through the process of identifying a plot as either wetland or upland.
4. Students should try identifying the last plot on their own with limited assistance.

Days 18-20: Wetlands Have Value

Objectives:

1. The learner will demonstrate an increased awareness of the values of wetlands by choosing two functions and elaborating on their observed relevance to the study site. Functions that are more easily observed or researched include:
   - Fish and wildlife habitat
   - Botanical habitat (there are many rare plants in Maine's peat bogs)
   - Ground water recharge
   - Pollution filter
   - Hunting and trapping
   - Sediment deposition
   - Recreation
   - Flood control
   - Aesthetic (scenic)
   - Erosion control
2. The learner will demonstrate an increased understanding of the study site's value by analyzing the six map overlays for these functional values.

TIME: Three 45 minute class periods.

Background Information:

The functions of a wetland are probably what will surprise people the most. Often used to prevent the disturbance of a wetland, these functions pit developer against environmentalist. For example, habitat for endangered wildlife or areas of ground water recharge are identified and used to stop development. Conversely, certain functions have been overextended and used to prevent sound development. Although not all functions apply to every wetland, the range of potential values is extensive.

In general there are three categories of values recognized by the U.S. Fish and Wildlife Service. First is the value of habitat for fish and wildlife (i.e. fish, shellfish, birds, furbearing animals). Second is an environmental function that includes aspects of water quality maintenance such as pollution filtering and sediment removal. Third are the socio-economic values that are exemplified by flood and erosion control, sediment deposition, ground water recharge, timber production, livestock grazing, hunting, and

recreation. For further discussion of these wetland functional values, read "Wetlands of the United States: Current Status and Recent Trends" by Ralph Tiner, March 1984.

Materials:

Slides showing values of wetlands.

Procedures:

1. Discuss the three values of wetlands: fish and wildlife, environmental quality, and socio-economic by reviewing and revising earlier brainstorming list of wetland characteristics and functions.
2. Assign writing assignment on wetland functional values.
3. Return to the wetland and point out to students the evidence of different functional values. This can be done by using slides or photographs.
4. Have students complete wetland report.

Day 21-23: Relationship of Wetlands to Soil Type

Objectives:

The learner will demonstrate an increased awareness of the beliefs of environmentalists and developers by debating the effects of changes to federal wetlands regulations.

TIME: Two 45 minute period.

Background Information:

At the time of the writing of this final draft, the Bush Administration had proposed new rules for identifying wetlands. Environmentalists claimed that if the law were enacted it would severely reduce the amount of wetland habitat for wildlife. Developers saw the proposal as a means of jump-starting the economy and clarifying the cumbersome wetlands regulations.

Procedures:

1. Give groups of students a brief synopsis of the views of different interest groups in town (i.e. environmental, development, state wildlife, town planner, tax collector, neighbors, etc.)
2. Assign students to the interest group they will represent. Have them research the views of the group to prepare for a mock town meeting.
3. Conduct a town meeting to debate the merits of the proposed changes to federal wetlands regulations.

Activity 36: Wetlands
Maine Geological Survey

WORKSHEET 1: SITE DESCRIPTION PAGE

Name_____Town: _____

Name of Feature and Location: _____

DIMENSIONS	Length	
	Elevation	
	Width	
	Thickness	
VEGETATION	Upland	
	Wetland	
CURRENT LAND USE	Isolated	
	New development	
	Partial development	
	Total development	
	Disturbed	
	Undisturbed	
	Distinctive features	

Activity 36: Wetlands
Maine Geological Survey

WORKSHEET 2: WETLAND IDENTIFICATION FORM

Field Investigators: _____

_____

Name of site: _____ Transect/Plot#:_____

Date: _____ Town: _____

VEGETATION:

Dominant Species	Indicator Status*	% Cover	Weighted Status
Tree Layer	1 2 3 4 5	x	=
	1 2 3 4 5	x	=
Shrub Layer	1 2 3 4 5	x	=
	1 2 3 4 5	x	=
Herb Layer	1 2 3 4 5	x	=
	1 2 3 4 5	x	=

(*) OBL=1; FACW=2; FAC=3; FACU=4; UPL=5

Total Weighted Indicator Status = _____

If total is <2.6, plot is dominated by wetland plants.

If total is >3.4, plot is dominated by upland plants.

SOILS

HYDRIC ORGANIC SOILS:

1. Is soil a black, somewhat greasy muck with plant remains decomposed beyond recognition? Yes ___ No ___
2. Is soil a black to orange brown peat made of plant remains that are easily recognized? Yes ___ No ___

HYDRIC MINERAL SOILS:

1. Is sub-surface layer gleyed? Yes ___ No ___
2. What is color of gleying? neutral gray ___ greenish-gray ___ bluish-gray ___ none___
3. Is there mottling? Yes ___ No ___
4. Color? yellow ___, orange ___, brown ___ or red ___ for Fe ; black ___ or dark brown ___ for Mn

HYDROLOGY

1. Is ground surface inundated? Yes ___ No ___ Depth of surface water ___
2. Is the soil saturated? Yes ___ No ___
3. Check any indirect evidence that the surface has been covered or saturated with water:

___ water-stained or silt covered leaves, stems, and trunks
___ water-carried branches and twigs around bases of trees
___ water-carried plant stems deposited by tides
___ water-carried debris deposited in branches of trees or shrubs well above ground
___ recent water-carried deposits of sand or silt on the ground
___ evidence of intermittent streams
___ water level marks on bridge abutments, rocks, trees
___ multiple tree trunks
___ shallow or exposed roots

SUMMARY

1. Is wetland vegetation dominant? Yes ___ No ___
2. Is hydric soil present? Yes ___ No ___
3. Is there evidence of wetland hydrology? Yes ___ No ___
4. Overall, is the field unit wetland? Yes ___ No ___ Inconclusive___
5. Rationale for overall decision.

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