West Virginia WETLAND

SCIENCE TECHNOLOGY ENGINEERING ARTS MATHEMATICS

STEAM

Activity Booklet
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Welcome................................................................................. 1
Equipment Decontamination.................................................... 2
Introducing Wetlands.................................................................4
  Defining a Wild & Wonderful Wetland.................................. 6
  Wetland Habitats................................................................... 8
Wetland Ecology........................................................................10
  Wetland Phenology...............................................................15
  Plant Survey...........................................................................16
  Plant Adaptations.................................................................17
  Animal Adaptations...............................................................18
  Bird Survey.............................................................................19
  Wetland Food Web.................................................................20
  Wetland Observations............................................................21
  Wetland Clues.........................................................................22
  Wetland Biodiversity...............................................................24
  Anuran Survey..........................................................................26
  Wetland Macroinvertebrates..................................................27
  Water Chemistry.......................................................................28
  Soil Survey...............................................................................32
Field Trip to WVU Jackson's Mill...............................................34
Wetland Locations.....................................................................41
Wetland Resources....................................................................42
WELCOME

The activities listed in this booklet are designed to teach you about wetlands in the Wild & Wonderful state of West Virginia. As you work through this booklet you will gain knowledge about:

1. Wetland functions and their benefits to waterways and our planet.
2. Interconnections of wetland food webs.
3. Identification of insects, plants, and wildlife commonly found in wetland ecosystems.
4. Locations of wild and wonderful wetlands to explore.

Take this booklet and explore a wetland near you!
All equipment and tools that come in contact with wetland sites should be decontaminated to avoid spreading ranavirus, chytrid fungus, snake fungal disease, or invasive plant species between wetlands.

Decontaminate prior to leaving for the field if possible. If you must decontaminate at the field site, set up the decontamination area at least 30 meters (100 ft) from the wetland edge. There are four required steps for decontamination.

Thanks for doing your part to keep our wetlands healthy!
FOLLOW THESE FOUR EASY STEPS:

1. Brush off all soil, seeds, and vegetative matter.

2. Rinse clean with water. Use stiff brush as needed. Don't forget boot treads. A pump sprayer (2-gallon capacity or sized according to crew needs) makes it easy to rinse when away from a tap.

3. Spray with 10% bleach solution (1 part bleach to 9 parts water) and allow to soak for 5 minutes. Don't forget the bottom of your boots. The bleach solution must be used or replaced each week as it loses its effectiveness over time, unlike concentrated bleach which does not get “denatured” quickly. A small sprayer such as a plant mister or hairspray sprayer works well.

4. Rinse with water. Bleach should **not** be introduced into the wetland.

Watch a video of this process:
What is a wetland?

A land area that is flooded or saturated with water for at least part of the growing season, resulting in wetland soils and specially adapted wetland plants. Common wetland habitats in West Virginia are forested swamps, shrub swamps, emergent wetlands, aquatic beds, fens, and open ponds.
What are three characteristics that define an area as a wetland?

1. 

2. 

3. 

Hint: Check out the graphic on the next two pages if you need help!
In West Virginia, wetlands have water at or near the soil surface.

Slots in the bark help woody stems breathe.

Air-filled stems act like snorkels to bring oxygen to the roots.

Dark organic soil often accumulates in saturated wetland conditions.
Mineral soil in upland areas is above the water table. Shallow roots try to stay above the water table.

Mineral soil in wetlands may alternate between wet and dry through the year, forming a grayish soil with rusty orange iron concentrations.

Plants have special adaptations to survive in the wet environment (hydrophytic plants) and soils develop characteristic wetland features (hydric soils).
In West Virginia, we have several different types of freshwater wetlands. These wetlands vary depending on their amount of water, type of soils, and the plants that grow in them.

Follow the key on the next page to determine which wetland habitats are within the wetland complex you are visiting!
The land is sometimes or always covered in water or has saturated soils.

- Open Water
  - water is deep (>6 feet deep)
  - considered a wetland
  - (not always)

- Open Pond or Stream Bed
  - has no plants

- Fen
  - has a very spongy floor covered by peat moss
  - has mostly underwater or floating plants

- Aquatic Bed
  - has mostly grass-like plants and/or wildflowers

- Emergent Wetland
  - has mostly shrubs

- Shrub Swamp
  - has mostly trees

- Forested Swamp
  - (swamps, vernal pools)

- surface water dries up part of the year; water below surface of the ground OR water is shallow (<6 feet deep)

- classify your wetland habitat

- has mostly grass-like plants and/or wildflowers

- has mostly underwater or floating plants

- has no plants

- has a very spongy floor covered by peat moss

- Open Pond or Stream Bed
  - water is deep (>6 feet deep)
  - considered a wetland
  - (not always)

- Emergent Wetland
  - has mostly shrubs

- Shrub Swamp
  - has mostly trees

- Forested Swamp
  - (swamps, vernal pools)
WETLAND ECOLOGY

Wetlands provide habitat to many different plants and animals, including many species of birds, amphibians, reptiles, mammals, and insects. The more diverse a habitat is, the more species of wildlife it can support. Wetlands offer four basic requirements that all living things need for survival:

1. **WATER**
2. **SPACE**
3. **FOOD**
4. **SHELTER**

Survey the habitat around you. Which animals may have their needs met by this habitat? (List below)

- [ ]
- [ ]
- [ ]
- [ ]
- [ ]
- [ ]
Ecosystem goods and services produce the many life-sustaining benefits we receive from nature—clean air and water, fertile soil for crop production, pollination, and flood control. These ecosystem services are important to environmental and human health and well-being, yet they are limited and often taken for granted.

- US EPA
**WETLAND METAPHORS**

Match the object to the wetland metaphoric function. The first one is done for you.

<p>| | | |</p>
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>1</td>
<td>Soap</td>
<td>Strains and filters dirt and debris from water</td>
</tr>
<tr>
<td>2</td>
<td>Rice</td>
<td>Neutralizes toxic substances</td>
</tr>
<tr>
<td>3</td>
<td>Zoo</td>
<td>Development of animals from babies to adults, circle of life.</td>
</tr>
<tr>
<td>4</td>
<td>Cradle</td>
<td>Provides nutrient-rich foods for wildlife and humans</td>
</tr>
<tr>
<td>5</td>
<td>Strainer</td>
<td>Provides a nursery that shelters, protects, and feeds young wildlife</td>
</tr>
<tr>
<td>6</td>
<td>Antacid</td>
<td>Resting place for migratory birds</td>
</tr>
<tr>
<td>7</td>
<td>Sponge</td>
<td>Helps clean water &amp; the environment</td>
</tr>
<tr>
<td>8</td>
<td>Pillow</td>
<td>Provides shelter to wintering waterfowl and other wildlife</td>
</tr>
<tr>
<td>9</td>
<td>Cabin</td>
<td>Habitat for diverse flora &amp; fauna</td>
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<tr>
<td>10</td>
<td>Bracelet</td>
<td>Absorbs excess water caused by runoff; temporarily retains moisture</td>
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</table>
WETLAND ECOLOGY

Through their biodiversity and water features, wetlands exhibit complex color arrangements. Label the color wheel with things you spot in the wetland habitat.

Wetlands are so full of life that it is easy to overlook things. Careful observation can lead to new discoveries! In the box sketch something new that caught your eye.
Field guides are a reliable tool to use when identifying plants. Botanists observe the arrangement, size, color, shape, and other features of leaves, as well as the location and flowers for identification. Compare the leaves and flowers of two common wetland plants below. Can you note four differences?

1. 
2. 
3. 
4. 
Plants do not always look the same; their looks may change with the season. The study of these biological changes that occur in relation to the season is called **phenology**. Phenology is "Nature's Calendar," and it impacts all living things. Common Buttonbush is shown in each of the four seasons below. Based on your knowledge of the seasons, label the buttonbush photos below.
Scientists use vegetation plots to survey and record plants and their density in a specific area. To conduct your own plant survey, estimate a 1-by-1 meter area. Scan the QR code to access the Field Guide to Common Wetland Plants of West Virginia. Record your findings in the table below.

Date: ______________________
Surveyors: __________________

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>% Cover</th>
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<tr>
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Example % covers:

- 1-5%
- 6-10%
- 11-25%
- 26-50%
- 51-75%
- 76-100%
Wetland plants are known as hydrophytic and need special adaptations to survive underwater or in saturated soils. Just like us, they need to breathe air, and they have developed interesting ways to keep their leaves and roots oxygenated. Can you match the following plant adaptation photos to their descriptions?

- **A**: multi-stemmed shrubs have lots of surface area to breathe
- **B**: air-filled tissue in its stems (aerenchyma tissue)
- **C**: floating leaves stay above the water where they can breathe
- **D**: buttressed roots that spread wide to stabilize the plant in wet soils
Eighty percent of all breeding bird populations in the United States, along with up to half of North America's bird species, rely on wetlands for survival. Some birds, such as the Great Blue Heron, are totally dependent on wetland habitats. Review the photos below. Record the different specialized adaptations of the Great Blue Heron that allows it to thrive in a wetland.
**BIRD SURVEY**

Ornithologists conduct bird surveys to understand the importance of different habitats. Wetlands are important resting, foraging, and mating habitats for many birds. Some common wetland birds are listed below. Scan the QR code to download the Merlin ID App to learn more about each bird. Conduct a 15-minute bird survey for this wetland habitat based upon what you hear and see.

- Northern Harrier
- Common Yellowthroat
- Canada Warbler
- Great Blue Heron
- Canada Goose
- Red-winged blackbird
- Wood Duck
- Yellow Warbler
- American Woodcock
- Hooded Merganser

Date & Time: ____________________  Weather: ____________________

<table>
<thead>
<tr>
<th>Species Name</th>
<th>Observed (viewed, heard, etc.)</th>
<th>How many do you count?</th>
<th>Behavior (mating, foraging, etc.)</th>
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</table>
The base of productivity in a wetland is plants, dying organisms, and detritus. Populations of larvae, protozoa, bacteria, and fungi live off detritus. They are, in turn, the food of fish, worms, birds, and other life further along in the energy web. Review the food web concept below and think about what animals eat and who eats them.
Animal identification is important, but understanding animal behavior and how each one fits into the food web is equally important. Observe an animal in your wetland habitat. Answer the questions below to understand how the animal fits into the wetland habitat.

**IDENTIFICATION:** Sketch or describe the animal in the box.

**HABITAT DESCRIPTION:**

- [ ]
- [ ]
- [ ]

**WHAT MIGHT IT EAT?**

- [ ]

**WHAT EATS IT?**

- [ ]

**OTHER NOTES:**

- [ ]
WETLAND CLUES

Firsthand observation of clues in the field is a critical step in biological research and assessment. Tracks are some of the most obvious clues of an animal's presence. Each type of animal has a unique track distinguished by the number of toes, claw marks, size, and pattern of the tracks. Other clues, such as pathways, tunnels, nests, and scat are important indicators that animals were present. Can you identify the animals from the clues below?

___________ feather  __________ scat  __________ chewed tree

Draw a clue that you found in the box! Does it indicate a specific animal? What was the animal doing?

__________________________  
__________________________  
__________________________  

22
Circle any tracks that you can identify in the wetland you are visiting.

Footprints (tracks)

- Heron
- Sandpiper
- Goose
- Otter
- Muskrat
- Beaver
- Fox
- Deer
- Turtlet
- Bullfrog
- Dog
WETLAND BIODIVERSITY

The Mountain State is home to 36 salamander species, 24 snake species, 15 frog and toad species, 14 turtle species, and 6 lizard species. Frogs and toads are collectively known as Anurans, meaning a tailless amphibian. Herpetologists estimate anuran populations and diversity by recording which animals they hear calling in an anuran survey.

Herpetology Yoga

Take a photo of yourself or a friend in their favorite herpetology yoga pose. Can you do all four?

1 SNAKE POSE

2 LIZARD POSE

3 FROG POSE

4 TURTLE POSE

Make a paper jumping frog with origami! Scan the QR code for instructions.
A complete list of all anurans found in West Virginia is below. There are three (3) toads and twelve (12) frogs in our wild and wonderful state.

- Blanchard’s Cricket Frog (Acris blanchardi)
- Eastern Cricket Frog (Acris crepitans)
- Eastern American Toad (Anaxyrus a. americanus)
- Fowler’s Toad (Anaxyrus fowleri)
- Cope’s Gray Treefrog (Hyla chrysoscelis)
- Gray Treefrog (Hyla versicolor)
- Mountain Chorus Frog (Pseudacris brachyphona)
- Spring Peeper (Pseudacris crucifer)
- Upland Chorus Frog (Pseudacris ferriarum)
- American Bullfrog (Lithobates catesbianus)
- Green Frog (Lithobates clamitans)
- Pickerel Frog (Lithobates palustris)
- Northern Leopard Frog (Lithobates pipiens)
- Wood Frog (Lithobates sylvaticus)
- Eastern Spadefoot (Scaphiopus holbrookii)

Each species of frog and toad has a unique call. They call for several reasons, but primarily, to attract a mate. Hear each species' unique sound by scanning the QR code!
ANURAN SURVEY

Anuran surveys should be conducted from early spring to early summer when the air is damp or with a light rain. Air temperatures should be between 45 to 65 degrees Fahrenheit, with low wind. To conduct an anuran survey complete the following steps: (1) select a monitoring area, (2) listen for 3 minutes, and (3) record the vocalizations you hear.

ANURAN CALL INDEX DEFINITIONS

1 **Individual** calls can be counted; there is space between calls.
2 Some calls are **overlapping**; but individuals are still distinguishable.
3 **Chorus** is continuous/overlapping; impossible to count individuals.
4 **OB** Indicates a species was observed, but not heard during the survey.

Date & Time: ________________  Air Temperature: ________________
Weather: ________________  Wetland Habitat: ________________

<table>
<thead>
<tr>
<th>Anuran Species</th>
<th>Anuran Call Index</th>
<th>What does the call sound like?</th>
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WETLAND MACROINVERTEBRATES

A macroinvertebrate is an animal without a backbone that is large enough to be observed without the aid of a microscope or other magnification. They spend all or part of their lives in water. These aquatic organisms tend to be more sensitive to environmental changes, such as temperature, pH, or dissolved oxygen level.

Humans often play a role in environmental changes. For example, if an herbicide is sprayed on the edge of a wetland, not only will the chemical spread quickly through the water, but the removal of the vegetation will decrease the hiding spots for young aquatic organisms and increase sunlight exposure and water temperature.

Review the definitions on the next page to learn more about water chemistry.
**WATER CHEMISTRY**

**pH** is a measure of acidity or alkalinity of a solution. A neutral pH is a 7 on the pH scale, with most aquatic life preferring a pH range of 5.5-8.5. Wetlands provide a natural buffer to neutralize acids (acidic) and bases (alkaline) in a solution.

![pH Scale Chart](chart.png)

**Dissolved Oxygen (DO)** is a measure of how much oxygen is dissolved in a solution. Both plants and animals need oxygen to survive. If the levels are too low, it can stress the aquatic life. DO can be affected by weather (wind, rain, etc.) and temperature (cold water holds more oxygen than warm). On a scale of 1-10 parts per million (ppm), 5.5 or higher is ideal for aquatic life.

**Temperature** is an important measurement of how hot or cold a solution is. Most creatures that live in water are cold-blooded, so their body temperatures, metabolism and growth rates are determined (and limited) by the surrounding water temperature.
Review the WV Save Our Streams (SOS) Macroinvertebrate Identification Guide for a list of all insect groups.
MACROINVERTEBRATE SURVEY

Date & Time: ________________  Weather: __________________

Average pH: _____  DO: _____  Average Water Temp: _____________

Draw a sketch of the area you’re sampling, include important features such as trees, vegetation, paths, etc.

Type of wetland habitat: __________  __________  __________

Collect a macroinvertebrate sample by submerging a net, disturbing the bottom substrate, and then sweeping it through the water for a distance of one meter. Place the animals in a pan of water to record your observations.

<table>
<thead>
<tr>
<th>Common Wetland Macroinvertebrates</th>
<th>Abundance (%)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crayfish</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mayfly Larva</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caddisfly Larva</td>
<td></td>
<td></td>
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<tr>
<td>Dragonfly Nymph</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Damselfly Nymph</td>
<td></td>
<td></td>
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<tr>
<td>Scud (sideswimmer)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Whirligig Beetle</td>
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<td></td>
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<tr>
<td>Leeches/Worms</td>
<td></td>
<td></td>
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<tr>
<td>Pouch Snails</td>
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</tbody>
</table>

30
One of the smallest forms of life on our planet is bacteria. Many of them use oxygen in the same way animals do: they combine it with organic matter and turn it into carbon dioxide, water, and energy. Bacteria have adapted to live in a wetland setting, just like plants. In low oxygen environments, like wetland soils, bacteria use nitrates, iron, sulfates, and other chemicals instead of oxygen to get the energy out of organic matter. Removing these chemicals from the water is one of the ways wetlands purify water.
SOIL SURVEY

Soil scientists are often consulted to evaluate and interpret soils. Review the chart on the next page. Soil data can tell us important information, such as whether the area qualifies as a wetland or how much carbon is stored underground. Try your hand at identifying soil textures by digging 10cm down and working through the chart on the next page. Record your observations below for two samples.

- Date & Time:
- Location of soil sample:
- Does the soil have smell? If so, describe it:
- What color(s) do you see in the soil?
- Is there organic material in the top layer?
- What is the texture of the soil?
- Date & Time:
- Location of soil sample:
- Does the soil have smell? If so, describe it:
- What color(s) do you see in the soil?
- Is there organic material in the top layer?
- What is the texture of the soil?
MINERAL SOIL TEXTURE SURVEY

Place approximately 2 tsp. of soil in your palm. Add water by drops and knead the soil until it is moldable and feels like moist putty. Add dry soil to soak up water.

Place ball of soil between thumb and forefinger. Gently push the soil with thumb, squeezing it upward into a ribbon. Form a ribbon of uniform thickness and width (1/8 inch). Allow the ribbon to emerge and extend over forefinger until it breaks from its own weight. Does soil form a ribbon?

Does soil feel very gritty?

Does soil feel very smooth?

Does soil feel very gritty?

Does soil feel very gritty?

Does soil feel very gritty?

Does soil feel very gritty?

Wet a small pinch of soil in palm until it is very wet. Rub soil around with your finger.

Neither grittiness nor smoothness predominates.

Does soil make a weak ribbon less than 1 inch long before breaking?

Does soil make a medium ribbon 1 to 2 inches long before breaking?

Does soil make a strong ribbon 2 inches or longer before breaking?

Add drops to make soil more wet. Add dry soil to soak up water.

START

Loamy Sand

Sandy

Silt

Clay

Sandy Clay

Loamy

Sandy

Neither grittiness nor smoothness predominates.

Does soil remain a ball when squeezed?

Is soil too wet?

Is soil too dry?

Is soil too wet?

Is soil too dry?
FIELD TRIP TO
WVU JACKSON'S MILL

Nestled in Lewis County you'll find WVU Jackson's Mill, a 500-acre historic and educational facility owned and operated by WVU Extension. We invite you to visit this area, as it is the historic home to West Virginia's 4-H camping. Today it continues to serve thousands of 4-H'ers each summer and throughout the year.

At Jackson's Mill there are paved, gravel, and dirt trails that you can utilize to explore two different wetlands, an emergent wetland on a pond edge and a forested swamp. Visit the "Classify Your Wetland Habitats" on page 12 to key out each wetland habitat. The following pages encourage you to observe the differences between the two wetlands and go on a scavenger hunt to locate plants and animals that live there.
Rhododendron is West Virginia's state flower. It is also a beautiful pollinator in our wetlands, attracting butterflies and hummingbirds to feed on its nectar. It grows in acidic soils, moist dry forests, and in swamps.

Did you know that rhododendrons are also nature's thermometer? Tell the temperature by looking at their leaves. Are they flat or curled?

Great Rhododendron

Rhododendron is West Virginia's state flower. It is also a beautiful pollinator in our wetlands, attracting butterflies and hummingbirds to feed on its nectar. It grows in acidic soils, moist dry forests, and in swamps.
Species Highlight

The Northern Green Frog has an average length of 2 to 3.5 inches and is commonly found in emergent wetlands. They are known as "sit-and-wait" predators, and will commonly feed on invertebrates, insects, and small fish.

Did you know that broadleaf and narrowleaf cattails have hybridized? This means all cattails in West Virginia are now considered invasive. While cattails are highly specialized to live in wet areas, they can grow in dense clusters, which cuts off resources to other plants.
Invasive Cattail
Sallow Sedge
Canada Goose
Box Elder Tree
Green Darner Dragonfly
Common Rush

SPRINGO!

WOW! The Wonders of Wetland: An Educator's Guide
Look for things that live and grow in this habitat. As you spot photos in the table, shout "SPRINGO"! How many can you find?
SITE SKETCH
Now that you are familiar with both wetlands, make a sketch of each wetland. You can draw it up close or from far way. What are the main differences you notice?

Forested Swamp

Emergent Wetland on Pond Edge
There is no shortage of wetlands to visit in our Mountain State. To highlight West Virginia's wetland diversity, short videos and fact sheets have been created for 12 wetlands. Scan the QR code below to learn more!

Visit the wetland near you or check out all 12!
Many of the activities in this STEAM Wetland Booklet have been adapted from WOW! The Wonders of Wetlands: An Educator's guide. To become trained in the Curriculum Guide visit www.projectwet.org and look up your local Project WET Coordinator. In West Virginia, this training workshop is provided free of cost to both formal and informal educators!

With 70 pages of background material followed by more than 40 cross-referenced activities, this guide is a valuable resource for K-12 teachers. Activities are neatly organized into five sections: wetlands definitions, wetlands plants and animals, water quality and supply issues, soils and people. The appendix also provides instructions for planning and developing a schoolyard wetland habitat.
Wetlands across the state have inspired past and present cultures to create music, art, and literature. Scan the QR code to learn more about basket weaving, an Appalachian Folk Art that the Cherokee tribe is known for. Plants and trees utilized for this art form are often sourced from wetland habitats.