

Topic: Wetlands – A Bad Rap

Alabama Science Standard(s)

9: Biology: Ecosystems: Interactions, Energy, and Dynamics: Interdependent Relationships 6: Develop and use models to illustrate interactions between ecological hierarchy levels, including biosphere, biome, ecosystem, community, population, and organism.

9: Biology: Ecosystems: Interactions, Energy, and Dynamics: Matter and Energy Flow 7: Develop and use models to illustrate the flow of matter and energy between abiotic and biotic factors in ecosystems, including loss of heat, 10% rule, and the conservation of matter.

9: Biology: Ecosystems: Interactions, Energy, and Dynamics: Biodiversity 9: Obtain, evaluate, and communicate data to explain how the biodiversity of Alabama contributes to ecosystem services in the state.

9: Biology: Ecosystems: Interactions, Energy, and Dynamics: Biodiversity 9a: Obtain and evaluate data to describe human impact on various Alabama ecosystems.

9: Biology: Ecosystems: Interactions, Energy, and Dynamics: Biodiversity 10: Engage in argument from evidence to support the claim that characteristics of an ecosystem contribute to its resilience and stability, including ecological succession and recovery from disturbance.

9: Earth and Space Science: Earth's Systems: Composition of the Earth 4: Obtain, evaluate, and communicate information about the geologic conditions and processes that form different Earth materials.

9: Earth and Space Science: Earth's Systems: Composition of the Earth 4a: Plan and carry out investigations to explore the processes that form plutonic (intrusive) and volcanic (extrusive) igneous rocks of differing compositions and textures.

9: Earth and Space Science: Earth's Systems: Composition of the Earth 4b: Analyze and interpret data to explain the effects of mechanical and chemical weathering and erosion on Earth's materials by wind, water, ice, and gravity.

9: Earth and Space Science: Earth's Systems: Composition of the Earth 4c: Construct an explanation using evidence from experiments, models, or data of the processes that create and transform igneous, sedimentary, and metamorphic rocks.

9: Earth and Space Science: Earth's Systems: Composition of the Earth 4d: Plan and conduct an investigation on water's effect on surface and subsurface processes.

9: Earth and Space Science: Earth's Systems: Composition of the Earth 4e: Obtain and communicate information about significant geologic characteristics in Alabama and the southeastern United States.

9: Earth and Space Science: Earth's Systems: Weather 7: Obtain, evaluate, and communicate information about the role of energy transfer in wind, precipitation, cloud formation, and front formation.

9: Earth and Space Science: Earth's Systems: Weather 7a: Obtain and communicate information to explain how water cycles through the atmosphere, including condensation, evaporation, clouds, types of precipitation, relative humidity, and dew point.

9: Earth and Space Science: Earth's Systems: Weather 7b: Plan and carry out an investigation to determine the differential heating of land and water and explain how these differences create changes in local and global weather.

9: Earth and Space Science: Earth's Systems: Weather 7c: Construct an explanation of how air masses, source regions, fronts, weather changes associated with frontal passage (including cold, warm, occluded, and stationary fronts), air pressure, air density, temperature, cloud types, and precipitation are related to each other.

9: Earth and Space Science: Earth's Systems: Weather 7d: Use data to construct an explanation of the role of pressure differences in the development of wind systems.

9: Earth and Space Science: Earth's Systems: Weather 7e: Analyze and interpret data to create a surface map, including high-pressure and low-pressure systems, isobars, wind barbs, cloud types, precipitation, and fronts.

9: Earth and Space Science: Earth's Systems: Climate and Severe Weather 8: Obtain and communicate information to explain different climate regions and their impact on patterns of severe weather.

9: Earth and Space Science: Earth's Systems: Climate and Severe Weather 8a: Analyze temperature and precipitation patterns related to factors that influence climate, including proximity to water, topography, elevation, latitude, and orographic effect.

9: Earth and Space Science: Earth's Systems: Climate and Severe Weather 8b: Analyze and interpret data to develop predictions about the formation of meteorological events.

9: Earth and Space Science: Earth's Systems: Climate and Severe Weather 8c: Communicate scientific information to explain the personal, local, and statewide implications of severe weather events in Alabama.

- HS-LS2-2: Use mathematical representations to support explanations of factors affecting biodiversity and ecosystem services.
- HS-LS2-6: Evaluate claims, evidence, and reasoning about the role of ecosystems in maintaining stability and resilience.
- HS-LS4-6: Create or revise explanations based on evidence for how human activities impact biodiversity and ecosystems.
- HS-ESS2-2: Analyze geoscience data to make claims about Earth's materials and surface processes.
- HS-ESS2-5: Plan and conduct investigations of how Earth's systems interact (hydrosphere, biosphere, geosphere).
- HS-ESS3-1: Construct explanations for how resource availability, distribution, and management affect environmental systems.
- HS-ESS3-4: Evaluate solutions that reduce the impacts of human activities on natural systems.

(Crosscutting Concepts: Cause & Effect, Systems & System Models, Stability & Change)

Lesson Objective:

Students will be able to:

- Quantitatively compare how different soil types (peat, potting soil, sand, gravel) absorb and retain water.
- Explain, using soil composition and structure, why peat has a high water-holding capacity.
- Analyze how wetlands influence flooding, erosion, water quality, and groundwater recharge.
- Evaluate the ecological and societal importance of wetlands for wildlife and human communities.
- Use experimental data to construct graphs, calculations, and evidence-based explanations.

Background:

Wetlands in Alabama were once considered unproductive land, but scientific research now recognizes them as critical ecosystem regulators. Alabama's wetlands—such as coastal marshes, river floodplain wetlands, bogs, and forested wetlands—function as natural sponges. During heavy rain and tropical storms, these wetlands absorb excess surface water and slowly release it into rivers, lakes, and groundwater systems. This process helps reduce flooding in downstream communities, including areas along the Alabama, Tombigbee, Tennessee, and Mobile River systems.

Wetland soils in Alabama are often rich in organic matter such as peat, giving them high porosity and surface area. These soil properties allow wetlands to retain large amounts of water. Dense wetland vegetation slows surface runoff, traps sediments, and supports chemical and biological processes that help remove pollutants from water before it enters rivers, bays, and estuaries such as Mobile Bay.

Because Alabama's wetlands are located between upland areas and open water, they play a crucial role in nutrient cycling, sediment capture, and water purification. However, wetlands have limited capacity to absorb pollutants and floodwaters. In Alabama, the loss or degradation of wetlands due to development, drainage, and land-use changes has been linked to increased flooding, poorer water quality, and declines in wildlife habitat. Protecting and restoring wetlands is therefore essential for maintaining environmental health, public safety, and economic stability across the state.

Vocabulary:

- Erosion** – the movement of soil or rock by water, wind, or ice
- Estuary** – a coastal wetland where freshwater mixes with saltwater
- Purification** – the process of removing contaminants from water
- Runoff** – water that flows over land into bodies of water
- Sediment** – soil particles transported by water
- Wetland** – an area saturated with water long enough to support water-adapted plants

Academic Language:

Grade 9-12 (can be aligned to other grades/subjects)

Length of Lesson: 2-3 class periods

Materials:

Peat, potting soil, sand, gravel
Sieves with filter material
Cylinders, measuring cups
Scales

ADVANCED PREPARATION:

1. Display images of Alabama wetlands (coastal marshes, riverine wetlands, bogs).
2. Show diagrams or photographs of wetland soil profiles.
3. Optional: Have students collect local soil samples (with permission).
4. Prepare laboratory stations with:
 - Peat, potting soil, sand, gravel
 - Sieves with filter material
 - Graduated cylinders or measuring cups
 - Digital scales
 - Student Data Sheets

SETTING THE STAGE:

1. Review wetland ecosystem services:

- Flood control
- Erosion reduction
- Water purification
- Wildlife habitat

2. Introduce the hypothesis:

Soil composition influences water storage capacity, which affects flooding and water quality.

INSTRUCTIONS:

Laboratory Investigation: Soil Water Retention

1. Students work in cooperative lab groups.
2. Each group prepares four sieves lined with filter material, each containing a different soil type.
3. Record dry mass of each soil sample and container.
4. Add exactly one cup (250 mL) of water to each soil sample.
5. Allow soils to absorb water for 30 minutes.
6. Drain excess water and record wet mass.
7. Calculate:
 - Mass of water absorbed
 - Percent water retained:
$$\frac{\text{Wet Mass} - \text{Dry Mass}}{\text{Dry Mass}} \times 100$$
8. Graph results and compare across soil types.

Data Analysis & Discussion

Students analyze and discuss:

- Which soil retained the most water and why?
- How organic matter affects porosity and capillary action.
- How wetland soil loss could impact:
 - Flood severity
 - Sediment transport
 - Water quality
- Predict outcomes in watersheds dominated by low-absorption soils.

EVALUATION:

Summative Assessment

Opinion/Position Paper (2–3 pages):

- Explain how wetlands affect daily life (flooding, drinking water, recreation).
- Use experimental data as evidence.
- Argue what would happen if wetlands disappeared.
- Propose science-based solutions to protect wetlands.

EXTENSION:

1. Mock town hall debating wetland development.
2. Research Alabama wetland protection laws.
3. Develop a wetland protection policy brief.
4. GIS mapping of wetland loss and flood risk.

ALABAMA in 5: Turtles

Wetlands are especially important for turtles because they provide the stable water conditions turtles need to survive. Many Alabama turtle species depend on wetlands for feeding, nesting, movement, and temperature regulation. When wetland soils absorb and slowly release water, they help maintain consistent water levels in rivers, ponds, and marshes, preventing habitats from drying out during droughts or becoming too turbulent during floods.

Wetland vegetation and soils also improve water quality by trapping sediments and filtering pollutants. Clean water supports the aquatic plants and invertebrates that turtles eat and reduces exposure to toxins that can harm turtle health and reproduction. Soft, organic-rich wetland soils are also important for nesting, allowing turtles to dig nests and successfully incubate eggs. When wetlands are lost or degraded, turtle populations are often among the first to decline. Increased flooding, erosion, and pollution can destroy nesting sites, reduce food availability, and fragment turtle habitats. Protecting wetlands therefore, directly supports turtle survival and helps maintain healthy turtle populations within Alabama's ecosystems.

REFERENCES:

National Water Summary – Wetland Resources: Alabama. (2025). *U.S. Fish and Wildlife Service state summary.*

<https://www.fws.gov/sites/default/files/documents/National-Water-Summary-Wetland-Resources-Alabama.pdf>

Alabama in 5: Turtles (Box Turtles)