



Obed Wild & Scenic River

National Park Service
U.S. Department of Interior
Wartburg, Tennessee

Virtual Geology Field Trip Teacher's Resource Packet



Letter To The Teacher

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Dear educator,

Thank you for participating in Obed Wild & Scenic River's (WSR) Virtual Geology Field Trip. Distance learning is an exciting tool that allows students and teachers, regardless of their location or time zone, to discover the natural and cultural resources protected at Obed WSR.

We hope that these lessons inspire your students to learn more about their local outdoor spaces. After all, "We cannot protect something we do not love, we cannot love what we do not know, and we cannot know what we do not see. And touch. And hear." – Richard Louv

If you have questions, don't hesitate to contact us at:

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Sincerely,

The Education Staff at Obed WSR



National Park Service

On August 25, 1916, President Woodrow Wilson signed the "Organic Act" creating the National Park Service (NPS), a federal bureau in the Department of the Interior responsible for maintaining national parks and monuments. The National Park System has since expanded to 423 units (often referred to as parks), more than 150 related areas, and numerous programs that assist in conserving the nation's natural and cultural heritage for the benefit of current and future generations.

The National Park Service arrowhead was authorized as our official emblem in 1951. The components of the arrowhead may have been inspired by key attributes of the National Park System, with the sequoia tree and bison representing vegetation and wildlife, the mountains and water representing scenic and recreational values, and the arrowhead itself representing historical and archeological values.



[Quick History of the National Park Service \(U.S. National Park Service\) \(nps.gov\)](https://www.nps.gov/learn/history-culture/quick-history-of-the-national-park-service)

National Wild and Scenic Rivers System

The National Wild and Scenic Rivers System was created by Congress in 1968. The rivers protected under this act are free-flowing and possess “*outstanding remarkable scenic, recreational, geologic, fish and wildlife habitat, cultural, or other similar values.*”

As of March 2019, The Wild and Scenic Rivers System protects 13,413 miles of 226 rivers in 41 states and the Commonwealth of Puerto Rico; this is less than one half of one percent of the nation's rivers. By comparison, more than 75,000 large dams across the country have modified at least 600,000 miles, or about 17% (possibly more than 20% – figures are best estimates), of American rivers.

[A National System \(rivers.gov\)](https://www.rivers.gov/)



Obed Wild & Scenic River

The Obed Wild and Scenic River encompasses over 45 miles of free-flowing rivers, including the Emory River, Obed River and two of the Obed's tributaries, Clear Creek and Daddy's Creek. As the only WSR site in TN, this rare system provides critical habitat for threatened and endangered organisms, like Cumberland rosemary and the Alabama lampmussel.

This protected river ecosystem isn't the only showstopper at Obed! People travel from all of the world to go rock climbing and whitewater paddling. While viewing the park from the tallest rock faces, or paddling along our remote waterways, these adventurous visitors get unparalleled views of Obed's wilder side.



Whether you're looking for an adrenaline rush or catching a beautiful sunrise at Lilly Bluff, people have been drawn to the banks of the Obed River for thousands of years.

Throughout many generations, the Obed has touched the lives of the Native Americans, the pioneers, those living during the industrial period of the 1900s, and current day park visitors. The memories made and shared along the rivers of the Obed continually make this place not just a park, but a place of great meaning and inspiration.

Please visit our park website to learn more about our park's natural and cultural resources.

- The Obed Movie is available for viewing at the Obed WSR Visitor Center in Wartburg for free to any visitors. It is also available for purchase. [Multimedia Presentations - Obed Wild & Scenic River \(U.S. National Park Service\) \(nps.gov\)](#)
- [Maps - Obed Wild & Scenic River \(U.S. National Park Service\) \(nps.gov\)](#)
- [Learn About the Park - Obed Wild & Scenic River \(U.S. National Park Service\) \(nps.gov\)](#)
- [Be A Junior Ranger - Obed Wild & Scenic River \(U.S. National Park Service\) \(nps.gov\)](#)

Overview of Virtual Field Trip

This virtual field trip encourages students to think like a geologist as they explore four study sites around the park. Each study site focusses on a different geologically relevant feature that leads students to uncover eastern Tennessee's rocky past.

At each site, students will make observations, inferences, and participate in a further thinking activity. These scientific exercises will be put to the test with hands on modeling and engaging, place-based explanations in our virtual geology lab. This educational series contains five videos: Introduction, Study Site #1, #2, #3, and #4 (including the conclusion).

To encourage active listening, this program is accompanied by a Geology Field Book. This notebook is designed to be filled out as students are watching the videos. Our rangers have incorporated specific moments when the video should be paused to give time for the students to fill out their books and discuss specific concepts. To print this Publisher file as a booklet, choose to print double sided and flipped on the _____ edge.

There are also a few scientific models that are incorporated into this lesson. Teachers are encouraged to do these models along with the video. You will find a detailed instruction guide and materials list for each model on pages eight and nine. **** add in the hyperlinks below ****

Video Break Down

Geology Distance Learning Video Introduction

Study Site #1: The Boulder Field

Study Site #2: Rock Face

Study Site #3: Gated Area

Study Site #4: Lilly Bluff Overlook and Conclusion



Preparing For Your Virtual Field Trip

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Science Standards

This virtual field trip introduces the concepts of weathering, erosion, sediment, deposition, sedimentary rock formation, scientific modeling, fossil fuels, making observations and inferences, and geologic time.

The related Tennessee Academic Standards for Science are found below:

4th Grade

- [4.ESS1: Earth's Place in the Universe](#) 1) Generate and support a claim with evidence that over long periods of time, erosion (weathering and transportation) and deposition have changed landscapes and created new landforms
- [4.ESS2: Earth's Systems](#) 1) Collect and analyze data from observations to provide evidence that rocks, soils, and sediments are broken into smaller pieces through mechanical weathering (frost wedging, abrasion, tree root wedging) and are transported by water, ice, wind, gravity, and vegetation. 3) Provide examples to support the claim that organisms affect the physical characteristics of their regions.
- [4.ESS3: Earth and Human Activity](#) 1) Obtain and combine information to describe that energy and fuels are derived from natural resources and that some energy and fuel sources are renewable (sunlight, wind, water) and some are not (fossil fuels, minerals).
- [4.ETS2: Links Among Engineering, Technology, Science, and Society](#) 1) Use appropriate tools and measurements to build a model.

6th Grade

- [6.ESS3: Earth and Human Activity](#) 1) Differentiate between renewable and nonrenewable resources by asking questions about their availability and sustainability.

8th Grade

- [8.LS4: Biological Change: Unity and Diversity](#) 1) Analyze and interpret data for patterns in the fossil record that document the existence, diversity, extinction, and change in life forms throughout Earth's history.
- [8.ESS2: Earth's Systems](#) 3) Describe the relationship between the processes and forces that create igneous, sedimentary, and metamorphic rocks. 4) Gather and evaluate evidence that energy from the earth's interior drives convection cycles within the asthenosphere which creates changes within the lithosphere including plate movements, plate boundaries, and sea-floor spreading. 5) Construct a scientific explanation using data that explains the gradual process of plate tectonics accounting for A) the distribution of fossils on different continents, B) the occurrence of earthquakes, and C) continental and ocean floor features (including mountains, volcanoes, faults, and trenches).

High School

- [EARTH AND SPACE SCIENCE: ESS.ESS2: Earth's Systems](#) 4) Analyze surface features of Earth and identify and explain the geologic processes responsible for their formation. 5) Develop a visual model to illustrate the formation and reformation of rocks over time including processes such as weathering, sedimentation, and plate movement. The model should include a comparison of the physical properties of various rock types, common rock-forming minerals, and continental rocks versus the oceanic crust. 8) Using maps and numerical data, evaluate the claims, evidence, and reasoning that forces due to plate tectonics cause earthquake activity, volcanic eruptions, and mountain building.

Preparing For Your Virtual Field Trip Cont.

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Pre-Program Lessons

This section provides additional classroom activities and techniques to prepare your students for their Obed WSR Virtual Field Trip.

Observation, Inference, and Critical Thinking Practice

These three techniques will be highly used during this program and will be more effective if the students already have been introduced to the concepts. Please find a few sample exercises below:

- Practice observations and inferences on an everyday object

Let's practice our observational skills on our shirts! When I say boulder, you have 30 seconds to write down 4 adjectives, words describing your shirt! Ask yourself - How does it feel? What does it look like? Does it have a smell? Pencils ready, set, boulder! We can then use these observations and our past knowledge to help us make a scientific inference. This is an informed guess or rational conclusion based on facts and evidence. Does the material suggest that the shirt provides warmth, like fleece? Do any of the images or colors allow people to know that you are part of an organization like a school sport or club?

- I Notice, I wonder, it Reminds Me Of...

- [Beetles Project I Notice, I Wonder, It Reminds Me Of - Beetles Project](#)

- Extension:

- Have the students do this activity with local rocks found near your school.
- Follow up questions: Where do you think this rock originated? What forces of weathering shaped this rock? What do you think caused the coloration?
- Have your students write down four things that can be connected to this rock. For example, does anything eat rocks? Are there animals or plants that use rocks as a structure?

- Sound Mapping

- [Sound Map \(sharingnature.com\)](#)

- Extension:

- Discuss what might be influencing the amount or type of sounds
- Discuss when or why the sounds may change
- Try to identify each sound
- Do this activity in another location and compare sound maps

- Clothes Pin Game

This game offers a quick introduction to observations. All you need is a clothes pin and enough room for your students to move around.

- Step 1) Give a brief explanation of the game
- Step 2) Have the students line up arms distance from each other.
- Step 3) Have the students close their eyes and ears.
- Step 4) Have the teacher walk around quietly and place a clothes pin on the outer layer of one of the student's clothing. If a student feels the clothes pin on them, they are to pretend that they DON'T know where the clothes pin is and still try and find it on another student.
- Step 5) Say the magic word and have the students quietly look for the clothes pin. Once they spot it, have the students walk over to a designated area. Encourage the students to be sneaky and to not give away the location.
- Step 6) After some time, gather the group, discuss where it was located, and compare observation strategies. Repeat the game and make the location harder. Did their strategies change over time?

Preparing For Your Virtual Field Trip Cont.

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Review Challenging Geologic Concepts

A general prior understanding of the rock cycle, geologic time and plate tectonics will enhance the effectiveness of this lesson.

Geologic Time activity

The following is a script that can help teachers guide their students through geologic time. The students can do this demonstration at their desks but will need enough room to stretch out their arms:

Outstretch your left arm and focus on your hand. Imagine that your left fingertips are representing the formation of our planet, around 4.6 billion years ago!

Between your fingertips and your wrist – dense metals sank to the center of the Earth and formed the core, while the outside layer cooled and solidified to form the Earth's crust.

More time passes and water vapor has been released into the Earth's atmosphere through volcanism. It then cooled and formed the Earth's first oceans.

The space between your left arm and your shoulder is representing when the first life, simple celled organisms like bacteria and archaea, appeared on Earth 3.7 billion years ago.

Take a big breath in as our timeline travels across your chest. We have reached 2.4-1.5 billion years ago when cyanobacteria made oxygen. This oxygen then began to accumulate in the atmosphere. Outstretch your right arm.

Time is now traveling over our right arm representing 700 million years ago when the first single-celled animals emerged to your wrist 300 million years later when land vegetation evolved.

During the time it takes to reach your palm, Pangea formed causing one of the great Appalachian Mountain chain building events, the Cumberland Plateau began to uplift, and all the sedimentary rocks found in Obed's rock walls were formed.

Dinosaurs roamed the Earth starting in the middle of your right palm and were extinct by your knuckles. Your fingernail represents the time it took for water to cut its way through hundreds of feet of rock, forming the river gorges at Obed and Big South Fork. Now as for humankind, all of homo sapiens' history can be erased from our timeline with one swipe of a nail file.

Create your own Schoolyard Geologic Time Story

- [Ages Of Rock Module | the Shape of Life | The Story of the Animal Kingdom](#)
- [Lesson One, Schoolyard Geology 0.pdf \(shapeoflife.org\)](#)

On-line Video Resources

- [Four ways to understand the Earth's age - Joshua M. Sneideman - YouTube](#)
- [The Geologic Timescale - YouTube](#)
- [Bill Nye the Science Guy - S05E14 Erosion - YouTube](#) and [Bill nye rock cycle - YouTube](#)
- [How Do We Know Plate Tectonics Is Real? - YouTube](#)
- [What Are Rocks and How Do They Form? Crash Course Geography #18 - YouTube](#)

Scientific Models & Activities Used During the Program

Models and Activities

To help make this virtual field trip as engaging and hands on as possible, we encourage teachers to do some, or all, of these models and activities. It may benefit your class to participate along with the video or incorporate it before or after the study site lesson.

Toast Weathering and Erosion Model

- Materials : bread, toaster, knife, straw, and container
- Procedure
 - Burn toast
 - Place the toast in a clear container
 - Use the knife to scrape (weather) off a burnt area of the toast
 - Point a straw in the direction of the crumbs (sediment) and blow (wind erosion) the pieces around the container
- Extension:
 - Have your students create their own weathering and erosion model.
 - Have students create a Weathering and Erosion Journal. They can carry this journal with them throughout the week and jot down as many examples of weathering and erosion as they see throughout their normal routine.

Weathering and Erosion Drawing Activity

- Materials: one blue, black, and brown colored pencil per student and their Geology Field Books.
- Procedure:
 - Step one: Draw a rock face with some existing cracks.
 - Step two: Draw rain coming down the rock face and filling the cracks.
 - Step three: Draw one of the cracks widening as water molecules freeze and expands.
 - Step four: Draw the rock face again and widen all of the cracks.
 - Step five: Draw the rock face with large sections of rock missing. Further down the page, draw in larger boulders where the pieces of loosened rock would have settled.
- Extension:
 - Discuss or model other forms of physical, chemical, and biological weathering that are shaping the rocks at Obed WSR.

Ice Wedging/ Egg freeze

- Materials: freezer, a few eggs, and a freezer safe bowl
- Procedure:
 - Have your students hypothesis what is going to happen to the eggs after they are placed in a freezer overnight.
 - Freeze the eggs
 - Discuss why the eggs cracked
 - A chicken egg is 80% water. As that liquid freezes, it expands. The shells are not flexible enough to allow for this expansion.
 - This process is happening from the inside out. In rocks and other surfaces, ice wedging occurs when water enters an already existing crack. As the water freezes, it expands and causes the crack to become larger.

Scientific Models & Activities Used During the Program

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Weathering, Erosion, and Deposition Demonstration

- Materials: Cookie sheet (a large flat pan or container), sand and small pieces of gravel, spray bottle or water bottle, water, towel, and something to elevate the pan.
- Procedure:
 - Place a towel down on your work surface
 - Elevate the cookie sheet on one side, creating a slope
 - Orography– Create a sand/ gravel landscape that takes up 3/4s of the pan. Your students can build various sand mountains and hills representing the Appalachian Mountain Chain.
 - Spray or pour water “rain” onto your sand mountains
 - Observe how the water is weathering, or breaking down, the mountains and creating sediment
 - Discuss how the water is then eroding, or moving, the sediment downhill. This water is collecting to form a mini river system.
 - Where does the sediment end up? Discuss how the sediment eventually is deposited at the bottom of the pan.

Sedimentary Rock Formation

- Materials: Jar with lid, different types of sediment (sand, gravel, larger stones), water, and sponges.
- Procedure:
 - Discuss how a large ancient river system transported sediment from the Appalachians to the Obed area. To show how sedimentary rocks form, we first have to explore how sediment settles out of water.
 - Create a sediment jar:
 - Fill the jar half way with different types of sediment
 - Fill the rest of the jar up with water
 - Shake and let rest for 48 hours.
 - Eventually, the water at the top of the jar will evaporate. Over time, rain falls, collects, and creates streams and rivers. This water brings more sediment, it begins to build upon itself, creating layers. Demonstrate this by stacking different colored sponges. Each color is representing a new layer of sediment.
 - These layers of sediment are quite heavy. Over time, as more water evaporates, they compress down and start to cement together, forming sedimentary rocks.
 - Demonstrate this by stacking different colored sponges. As more rain brings more sediment, it begins to build upon itself, creating layers.

Cumberland Plateau Model

- Materials: sandstone and shale.

After Your Virtual Field Trip 10

Post-Program Lessons

Follow-up classroom activities that allow for reflection on the experience are a great way to wrap up programming. We encourage teachers to conduct activities that allow students to share their experience and express their new awareness with others. Artwork, displays, reports, and essays are all great ways to keep students thinking and learning about the national park in their backyard.

Reflection Questions

- Why should geologic features be protected by the National Park Service?
- What are three questions that I now have about TN's geologic past or future?
- What might the Obed look like in 1,000 years?
- What type of rock (sedimentary, metamorphic, or igneous) would you be and why?

How Geology Impacts Human History

The geologic processes discussed in this lesson not only impact the earth's surface, but have played a large role in human history. This could be a great opportunity to allow students to discover how the Cumberland Plateau (a large tableland rising over 1,000 feet above its neighboring valley) influenced human migration, settlement, and wars.



Discover more on Cumberland Plateau by following these links:

- Field Guide: Roadside Geology of Tennessee, by Marcy B. Davis
- [Appalachian Plateaus Province \(U.S. National Park Service\) \(nps.gov\)](https://www.nps.gov/plateaus/)
- Map of the Appalachian Plateaus Province: [4901E017-1DD8-B71B-0BB17CD20ECF1341-large.jpg \(618x800\) \(nps.gov\)](https://www.nps.gov/plateaus/4901E017-1DD8-B71B-0BB17CD20ECF1341-large.jpg)
- Geology and History of the Cumberland Plateau: [Geology and History Web Version \(nps.gov\)](https://www.nps.gov/plateaus/geology-and-history/)
- Geology field notes for the Obed: [NPS Geodiversity Atlas—Obed Wild and Scenic River, Tennessee \(U.S. National Park Service\)](https://www.nps.gov/geodiversity-atlas-obed-wild-and-scenic-river-tennessee/)
- [Civil War Comes to Cumberland Gap - Cumberland Gap National Historical Park \(U.S. National Park Service\)](https://www.nps.gov/cumberland-gap/)

Evaluation

In an effort to continually improve our programming, we would greatly appreciate you filling out our program evaluation form: <https://forms.office.com/g/EB63PCWVT7>



Obed WSR Programming

Please visit our website to learn more about Obed's educational opportunities and public programming.

- [Education - Obed Wild & Scenic River \(U.S. National Park Service\) \(nps.gov\)](#)
- [Calendar - Obed Wild & Scenic River \(U.S. National Park Service\) \(nps.gov\)](#)
- [Special Events - Obed Wild & Scenic River \(U.S. National Park Service\) \(nps.gov\)](#)

Additional Educational Resources

- Distance Learning Programs in other National Park Sites: [Educator Resources - Teachers \(U.S. National Park Service\) \(nps.gov\)](#)
- Every Kid Outdoors Feral Initiative: [Every Kid Outdoors | National Park Foundation \(nationalparks.org\)](#)
- The Nature Conservancy's education page: [Nature Lab](#)
- USGS Educator Resources: [Educational Resources | U.S. Geological Survey \(usgs.gov\)](#)

NPS Career and Internship Information for you and your students

- [Volunteer with Us \(U.S. National Park Service\) \(nps.gov\)](#)
- [Are You A Teacher - Teachers \(U.S. National Park Service\) \(nps.gov\)](#)
- [Work With Us - Youth Programs \(U.S. National Park Service\) \(nps.gov\)](#)