



Fire in the Ozark Highlands

Introduction



Lesson 1 - Introduction

Based on the US Forest Service's

["FireWorks Northern Rocky Mountains & Northern Cascades Curriculum"](#)

Smith, Jane Kapler; Abrahamson, Ilana; Berkowitz, Caitlyn; and McMurray, Nancy. 2018. FireWorks curriculum featuring ponderosa, lodgepole, and whitebark pine forests. Missoula, MT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Missoula Fire Sciences Laboratory (Producer).

Lesson Overview This introductory lesson engages students in an exploration of the Ozark Highlands and the ecological role of fire within this region. Using a guided slideshow and structured worksheet, students build foundational knowledge of ecoregions, including climate, geography, dominant plant communities, and wildlife. The lesson includes ecosystem services and prompts students to classify real-world examples from the region. Emphasis is placed on fire as a natural disturbance, with students examining its role in maintaining biodiversity and ecosystems such as glades. Through the accompanying ["Fire in the Ozarks" StoryMap](#), students interact with historical and scientific evidence, including dendrochronology, to better understand the region's historical dependence on the disturbance of fire. The lesson culminates in evidence-based reasoning tasks where students evaluate the impacts of fire suppression and the importance of prescribed burning in current land management.

Subject Areas: Science, Geography, History, Mathematics, and Writing

Duration: 50 minutes

Group Size: Whole class, with students working individually or in pairs

Setting: Classroom

Vocabulary: Ecoregion, Ozark Highlands, Temperate climate, Forest, Canopy cover, Woodland, Ecosystem, Wildlife, Eastern Deciduous Forest, Biome, Post oak, Shortleaf pine, Ecosystem services, Fire, Glade, Forb, Biodiversity, Disturbance, Woody plant encroachment, Prescribed fire

Lesson Goal Students will understand the key environmental characteristics of the Ozark Highlands and explain the role of fire as a natural disturbance in maintaining ecosystem health. Students will use evidence-based reasoning to evaluate how historical and modern fire management practices influence biodiversity and ecosystem services.

- Students will develop an understanding of the defining characteristics of the Ozark Highlands, including its geography, climate, ecosystems, and biodiversity.
- Students will recognize the importance of ecosystem services and how natural systems in the Ozark Highlands support both environmental health and human needs.
- Students will understand the role of fire as a natural disturbance and its historical significance in maintaining Ozark Highlands woodland and glade ecosystems.
- Students will analyze how human activities, including fire suppression and prescribed burning, influence ecosystem structure and function.
- Students will apply scientific reasoning skills to interpret evidence and construct explanations about fire ecology and land management practices.

Objectives

- **Remembering:** Students will be able to define key terms such as ecoregion, ecosystem services, and natural disturbance, and identify the location and states within the Ozark Highlands.
- **Understanding:** Students will be able to summarize the environmental characteristics and ecosystem services of the Ozark Highlands, and explain the historical role of fire in maintaining ecosystem health.
- **Applying:** Students will be able to develop maps and tables by classifying ecosystem services and illustrating the geographic boundaries of the Ozark Highlands.
- **Analyzing:** Students will be able to analyze dendrochronological evidence and historical data to interpret patterns of fire frequency and examine relationships between human activity and fire regimes.
- **Evaluating/Creating:** Students will be able to construct evidence-based claims (using claim–evidence–reasoning) to evaluate the impacts of fire suppression and propose how prescribed fire supports ecosystem restoration and biodiversity.

Academic Standards

Table 1: Next Generation Science Standards - Disciplinary Core Ideas (DCIs)

NGSS Code	Disciplinary Core Idea	Connection to Lesson Activities
HS-LS2-6	Ecosystem Stability and Change	Students analyze how frequent fire historically maintained stable woodland and glade ecosystems, and how fire suppression altered forest density, species composition, and ecosystem structure. They use dendrochronology and StoryMap evidence to evaluate these changes.
HS-LS2-7	Reducing Human Impacts on Biodiversity	Students evaluate prescribed fire as a management strategy that reduces fuel loads, restores open woodlands, and supports biodiversity. They use evidence from the StoryMap and slideshow to assess how prescribed burning addresses ecological changes caused by fire suppression.

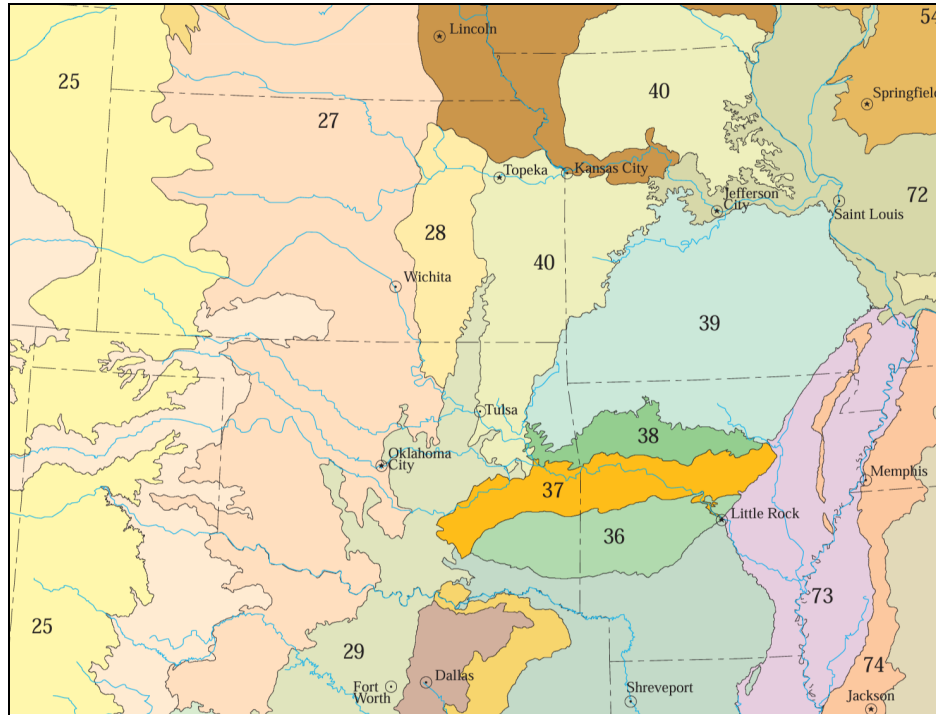
Table 2: Next Generation Science Standards - Science & Engineering Practices (SEPs)

SEP	Connection to Lesson Activities
Analyzing and Interpreting Data	Students interpret tree-ring patterns, fire scars, historical population data, and maps of the Ozark Highlands. They classify ecosystem services using real examples from the region.
Constructing Explanations	Students explain why fire every 3–4 years maintains glade ecosystems, how fire suppression changed forest structure, and how prescribed fire supports ecosystem restoration.
Engaging in Argument from Evidence	Students construct CER responses using StoryMap data to support claims about fire frequency, population density, ecosystem change, and prescribed fire effectiveness.

Table 3: Next Generation Science Standards - Crosscutting Concepts (CCCs)

CCC	Connection to Lesson Activities
Cause and Effect	Students examine how frequent fire causes open woodland structure, how fire suppression causes increased forest density and reduced herbaceous growth, and how prescribed fire causes restoration of historical conditions.
Stability and Change	Students analyze how ecosystems remained stable under frequent fire, how removing fire led to major ecological changes, and how prescribed fire is used to reverse those changes.
Systems and System Models	Students consider the Ozark Highlands as an ecological system where climate, vegetation, wildlife, and fire interact. Ecosystem services classification reinforces how natural systems support human systems and how human decisions influence ecosystem health.

Teacher Background The Ozark Highlands (EPA Level III Ecoregion 39) provides an ideal setting for introducing students to ecoregions and the ecological role of fire. As emphasized in the lesson slideshow, an ecoregion is an area defined by shared environmental characteristics—such as climate, landforms, soils, plants, and animals—that shape the ecosystems found there. The Ozark Highlands covers most of southern Missouri and northern Arkansas, with smaller portions extending into northeastern Oklahoma and southeastern Kansas, giving students a regional example that is both scientifically rich and geographically familiar.



The Ozark Highlands ecoregion is represented as “39” in this selection from the US Environmental Protection Agency’s [“Level III Ecoregion Map.”](#)

The region’s temperate climate has sufficient rainfall to support extensive woodlands dominated by oak–pine woodlands and forests that are closely tied to the region’s relationship with fire. The Ozark Highlands support a wide range of wildlife and provide valuable ecosystem services, including timber production, water filtration, and recreational opportunities. Although the Ozark Highlands is known for its rugged terrain, the emphasis in this lesson is on how its diverse plant communities and fire-adapted species reflect the natural processes that shape the region’s ecosystems. Frequent fire is important to Ozark Highlands ecosystems because it is one of the core natural processes that historically shaped the region’s woodlands, glades, and plant communities. In the Ozarks, fire isn’t just a disturbance—it’s a driver of ecosystem health, structure, and biodiversity.



View of [Missouri's Pioneer Forest](#) found in the Mark Twain National Forest showing a combination of shortleaf pines and various other trees, such as oaks, in autumn.

Students explore the concept of ecosystem services, defined as the “conditions and processes through which ecosystems sustain and fulfill human life.” Examples of Ozark Highlands ecosystem services help students better appreciate the relationships between the Ozark Highlands and human systems.



A [Virgin Pine Forest](#) prescribed burn being conducted in an area of pines and oaks where surface fuels were primarily composed of leaves and pine needles.

Early burns in this area were low-intensity, with particular care taken to minimize fire impacts on old-growth trees.

Modern land management reflects the historic role of fire in the region. Agencies such as the USDA Forest Service use prescribed fire to reduce fuel loads, control invasive species, and restore open woodland structure. These practices seek to emulate the historic fire frequencies that once shaped the region's ecosystems. Through this lesson, students explore how natural processes, human activity, and ecological management interact to influence ecosystem health in the Ozark Highlands. This lesson will help students develop a deeper understanding of how ecological processes in the Ozark Highlands influence human activities, and how human decisions, in turn, affect ecosystem health.

Welcome to “Fire in the Ozark Highlands!”

Table 3: Key Terms

(The order below corresponds to the first appearance of a term in the slideshow presentation. “Other terms of interest” not in the slideshow that could help with conceptual understanding are also included.)

Ecoregion	Areas where ecosystems (and the type, quality, and quantity of environmental resources) are generally similar.
Ozark Highlands	The Ozark Highlands is a rugged, hilly to mountainous region predominantly covered in oak-hickory and oak-hickory-pine forests and noted for its abundance of clear, high-gradient streams and cold-water springs.
Temperate Climate	Of or relating to moderate climates, intermediate between tropical and polar and with distinct warm to hot summer seasons and cool to cold with seasons.
Forest	A formation dominated by trees, in which the canopy is more closed than open. (Canopy cover is > 80%)
Canopy Cover	The proportion of the forest floor covered by the vertical projection of the tree crowns.
Woodland	A formation in which tree cover is greater than shrub cover, but the canopy is not closed. (Canopy cover is 31-80%)
Ecosystem	The complex of living organisms and the abiotic environment with which they interact at a specified location (Clewett & Aronson, 2013).
Wildlife	Any organisms living independently of humans; undomesticated species of plants and animals (Art, 1993).
Eastern Deciduous Forest	A diverse, complex biome covering the eastern third of the U.S. to Canada, characterized by four distinct seasons, temperate climate, and dominance of broad-leafed trees that lose leaves in autumn (US Forest Service).
Biome	A biome, within the context of forestry and ecological management, is defined as a large, regional ecosystem characterized by a distinct, consistent, and dominant vegetation structure, associated animal life, and specific environmental factors like climate and soil (US Forest Service).
Post Oak	The post oak is a member of the “white oak” group of trees. Oaks in this

	group have leaves that are “lobed” without “bristle-tips” Post oak leaves are sometimes described as having a “cross-like” shape. (Images in the slideshow)
Shortleaf Pine	Shortleaf pine is a medium-sized native evergreen conifer characterized by relatively short needles and moderately thick, flaky bark that starts out black and gradually turns reddish-brown as it ages (US Forest Service).
Ecosystem Services	The benefits humans receive from nature that are essential for human well-being, including clean air, potable water, food, fuel, and climate stabilization (US Environmental Protection Agency). (Further information about ecosystem service is included in the slideshow.)
Fire	The US Forest Service views fire as a natural, essential ecosystem process necessary for restoring landscapes, recycling nutrients, and reducing hazardous fuel buildup. It is defined primarily as a wildland fire—a non-structure fire in vegetation—which encompasses two main types: prescribed fires (planned, intentional ignitions) and wildfires (unplanned, natural, or human-caused ignitions).
Glade	Open, rocky barren areas dominated by drought-adapted forbs and warm-season grasses. Glades appear as small or large essentially treeless openings within landscapes primarily dominated by woodlands (Nelson, 2010).
Forb	An herbaceous (nonwoody) plant that is not grass or grass-like (Clewett & Aronson, 2013).
Biodiversity	The variety and variability of living organisms and the ecological complexes in which they occur. It encompasses the variety of all life forms—including genes, species, and ecosystems—and is crucial for sustaining ecosystems and providing services such as food security, natural hazard mitigation, and climate stabilization (US Environmental Protection Agency).
Disturbance	Any discrete event that disrupts the plant or animal community

	structure and changes available resources, substrates, or the physical environment (Krebs, 2016).
Woody Plant Encroachment	The transition of grassland habitats into woodland ecosystems characterized by the expansion of native woody species, driven by fire suppression and land-use changes, which transforms open landscapes into closed woodlands (US Forest Service).
Prescribed Fire	Any fire intentionally ignited by management in accordance with applicable laws, policies, and regulations to meet specific objectives.
Other terms of interest...	
Savanna	A formation in which the overstory is dominated by woody vegetation growing as scattered individuals or in clusters. (Canopy cover is 11-30%)
Prairie	The usual term to designate grasslands in North America (Clewett & Aronson, 2013). (Canopy cover is 0-10%)
Fire Frequency	Number of fires per unit time in a specified area.
Eastern Redcedar	An evergreen tree that is susceptible to fire kill because of its thin bark, shallow roots, inability to resprout, and highly combustible evergreen foliage. Where this tree dominates, species diversity is commonly low. Even though it is a native species, eastern redcedar is often considered to be invasive.
Ecosystem Health	The ability of natural systems to maintain their structure, function, and resilience over time while providing essential ecosystem services (US Forest Service).
Fire Ecology	A branch of ecology that focuses on fire and its relationship to the living and nonliving environment. It studies the role of fire in ecosystems, including how it acts as a natural catalyst for renewal and its impacts on vegetation, soil, and animal populations (US Forest Service).

Materials and Preparation

- Make copies of the student worksheet for each student. If electronic submissions are preferred, have students download the worksheet as a Word document and convert it to an appropriate format. If students will be submitting electronically, be sure they are able to insert images from an art/drawing application or from hand-drawn images.
Worksheet prompts could also be copied and pasted into learning management systems, such as Canvas LMS, Google Classroom, or Blackboard Learn.
- Download the slideshow presentation. Make any necessary changes to the presentation.
- Download the slideshow script. Read through the script and this lesson plan's background information to become familiar with concepts and terminology related to the Ozark Highlands. Looking over the student worksheet key could also improve familiarization with content and possible student responses.
- Practice progressing through the slideshow while reading the script. Using the “Click” prompts may take some practice.

Procedure

- Hand out the student worksheets or give instructions for submitting work electronically.
- Present the “Fire in the Ozark Highlands” slideshow using the slideshow script to assist with narration and to guide students through the first part of their worksheets.
- Upon conclusion of the slideshow, direct students to the “Fire in the Ozarks” StoryMap. The last slide of the slideshow displays the website, and the worksheet also has this information.
- Time permitting, go over the worksheets as a class by referring to the “Student Worksheet Key.”

Assessment

- Student worksheet.
- A student worksheet key has been provided as one of this lesson's resources.

Evaluation For this introductory activity, it is suggested that verbal or written responses are not evaluated rigorously. Grades for this activity should focus on the effort exhibited in the completion of the worksheet or focus on discussion participation.

- Completion of the student worksheet.
- Participation in discussions during the slideshow.

References/Resources

Daily, Gretchen C. *Nature's Services: Societal Dependence on Natural Ecosystems*. Island Press, 1997.

Krebs, Charles Joseph. *Ecology: the Experimental Analysis of Distribution and Abundance*. HarperCollins, 1994.

Krebs, Charles J. *Why Ecology Matters*. The University of Chicago Press, 2016.

Nelson, Paul. *The Terrestrial Natural Communities of Missouri*. Missouri Dept. of Conservation, 2010.

Art, Henry Warren. *The Dictionary of Ecology and Environmental Science*. H. Holt, 1993.

Fire Effects Information System Glossary

(<https://www.fs.usda.gov/database/feis/glossary2.html#F>)

EPA Level III Ecoregion Map:

<https://www.epa.gov/eo-research/level-iii-and-iv-ecoregions-continental-united-states>

Image Credits:

Post Oak Image of Tree, Leaf, and Acorn:

<http://texastreeid.tamu.edu/content/TreeDetails/?id=107&t=O>

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Shortleaf Pine Image of Tree, Leaf, and Cone:

<http://texastreeid.tamu.edu/content/TreeDetails/?id=70>

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