

Fire in the Forest

(HS ENV 2d; 4a,b)

Time

Two or more 45 minute classes

GSES Standard (# and text) Character Count: 1000

S.ENV2. Obtain, evaluate, and communicate information to construct explanations of stability and change in Earth's ecosystems.

d. Construct an argument to support a claim about the value of biodiversity in ecosystem resilience including keystone, invasive, native, endemic, indicator, and endangered species.

S.ENV4. Obtain, evaluate, and communicate information to analyze human impact on natural resources.

a. Construct and revise a claim based on evidence on the effects of human activities on natural resources.

b. Design, evaluate, and refine solutions to reduce human impact on the environment including, but not limited to, smog, ozone depletion, urbanization, and ocean acidification.

AP Environmental Science Course & Exam Description- College Board

ENDURING UNDERSTANDING

ERT-2

Ecosystems have structure and diversity that change over time.

LEARNING OBJECTIVE

ERT-2.H

Describe how organisms adapt to their environment.

ESSENTIAL KNOWLEDGE

ERT-2.H.1

Organisms adapt to their environment over time, both in short- and long-term scales, via incremental changes at the genetic level.

ERT-2.H.2

Environmental changes, either sudden or gradual, may threaten a species' survival, requiring individuals to alter behaviors, move, or perish.

See other relevant AP Environmental Science learning objectives at the end of this lesson plan.

Phenomenon

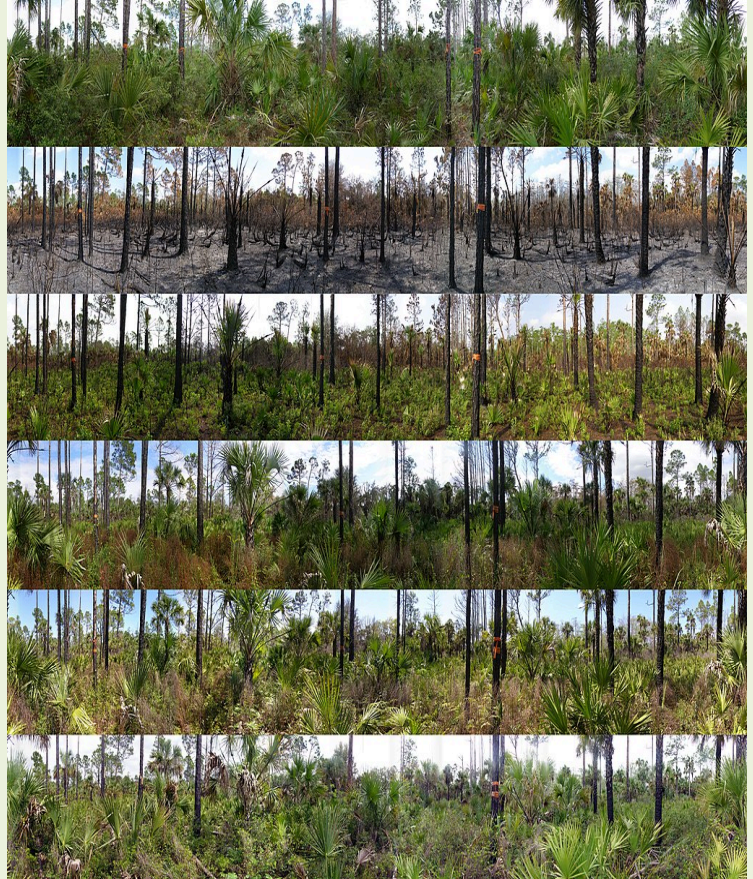


Photo Credit: By U.S. Fish and Wildlife Service Southeast Region - Prescribed Fire Transition Panoramic Before and 2 Years Following Fire
Uploaded by AlbertHerring, Public Domain,
<https://commons.wikimedia.org/w/index.php?curid=29815865>

Time Lapse Video credit: <https://youtu.be/SoQA6gGEyLg?t=13>
Rich Reid, The Nature Conservancy

Lesson Overview Character Count: 1000

Students will observe the phenomenon of a forest burning and then growing back after the fire by viewing the series of panoramic still photos and / or time-lapse videos filmed by [Rich Reid](#) for The Nature Conservancy. They will construct an explanation for the phenomenon they observed. Students will investigate and explore the adaptive strategies of conifers vs. deciduous trees, including rate and pattern of growth, shade-tolerance, and reproductive strategies to determine under which conditions different plants have a survival advantage. They will also research fire-adapted communities in Georgia and consider how these ecosystems can be sustained.

Engage Character Count: 900

Students will observe the phenomenon of a fire-dependent forest burning and growing back after a fire.

Elicit Questions Character Count: 900

Prompt students to ask questions about fire in the forest. Organize students by common questions and allow them to research topics according to their interests.

Explore Character Count: 900

What would happen if there were a wildfire in the schoolyard? A very hot fire that burns trees up to the crown would probably kill them - and the loss of trees would affect wildlife that depend on live trees for shelter and food. But some types of trees (and animals) are adapted to survive fires. This gives them a competitive advantage over species that are less likely to survive fire. Students will investigate the danger - and value - of fire in the forest as well as plant and animal adaptations to fire.

Student-Directed Research

Use the Jigsaw protocol to assign articles (or topics) to student “expert” groups based on their questions and interests. The “experts” will each share their article (or topic) when they have returned to a “home” group consisting of one expert on each article (topic).

Fire Ecology and Adaptations

- [Fire-Adapted Ecosystems](#) - Defenders of Wildlife
- [Fire Ecology and the Natural Role of Fire](#) - PBI
- [Fire Ecology Basics](#) - NPS article

Georgia Wildfire Suppression and Prescribed Burns

- [Wildfire Suppression and Prevention in GA](#) - Ga Forestry Commission
- [Prescribed Burns](#) - GA Forestry Commission
- [Prescribed Fire StoryMap in the GA Wildlife Action Plan](#) - GA DNR Wildlife Resources Division

Plant and Animal Adaptations to Fire

- [5 Amazing Adaptations of Pyrophytic Plants](#) - Encyclopedia Britannica
- [Serotinous Cones in a Toaster Oven](#) and [Opening Pine Cone Time Lapse](#) - videos
- [How Plants Use Fire](#) - NOVA PBS

Wildfire Prevention, Suppression, and Management Strategies

- [Wildfires and Fire Management](#) - NPS
- [Wildfire Suppression](#) - US Dept of Interior
- [Managing Wildfire](#) - US Forest Service
- [Natural burn policy at Yellowstone](#) during 1988 fire
- [Yellowstone burn recovery](#) - NASA video

Historic and Cultural Uses of Fire

- [Fire as a Historic, Cultural, and Indigenous Practice](#) - RRG
- [Cultural Burning and the Connection between Basketry and Fire](#) - Redbud Resource Group
- [Fire-scarred Trees Reveal 700 Years of Natural and Cultural Fire History in Norway](#) - Ecological Society of America

Prescribed Fire / Controlled Burns

- [Prescribed Fire StoryMap in the GA Wildlife Action Plan](#) - GA DNR Wildlife Resources Division
- [Ground Level Post-Fire Time-Lapse](#) - TNC
- [Tree-View Post-Fire Time-Lapse](#) - TNC

Explore Georgia's Fire-Dependent Longleaf Pine Ecosystem

Students will learn about the longleaf pine ecosystem by reading (and by observation, if located in the sandhills)

- [360 View of Longleaf Pine Ecosystem in Georgia](#) - Georgia Public Broadcasting video (2 min 15 sec)
- [Longleaf Pine Ecosystem](#) - New Georgia Encyclopedia

- [Meet the Menagerie of Wildlife Amid the Pines](#) - Arbor Day Foundation
- [Long-Term Conservation Plan for Longleaf Pine](#) - Texas A&M

Investigate a Wildfire with an Interactive Simulation

Students will investigate factors that affect the rate of spread and intensity of a wildfire in different terrains and with different management tools, using the Concord Consortium interactive app.

- [Concord Consortium Wildfire Risks and Impacts](#) - register for free teacher guide to lesson and class dashboard
- [Concord Wildlife Risks and Impacts Module](#) with [5 lessons and worksheets](#): Feeling Hot Hot Hot!, Earth Wind and Wildfire, Growth of a Wildfire, Risky Business, Wildfires in the Future
- [Concord Wildfire Simulation Tool](#) - use simulation to see wildfire spread in different terrains, with management tools

Engineer Character Count: 900

N/A

Explain Character Count: 900

Students should return to their original explanation and revise it to demonstrate new knowledge and understandings about the phenomenon of fire in the forest. Students should be able to articulate some of the following points in an explanation that makes a claim, based on evidence, about the effects of human activities on natural resources and refines solutions to reduce human impact on the environment OR that makes a claim about the value of biodiversity in ecosystem resilience including keystone, invasive, native, endemic, indicator, and endangered species.

Fire can be destructive, but it is also a natural process to which some plant and animal species have adapted.

- When humans increase the frequency or intensity of naturally-occurring fires through arson or as a consequence of inadvertent actions, it can harm the environment, cause injury or loss of human lives, and damage buildings or property.
- When humans suppress naturally-occurring fires to protect lives, property, or the environment, it can contribute to the accumulation of dead and decomposing wood in the forest, resulting in a more intense and damaging fire when one eventually occurs, and/or it can hasten progression to the next stage of succession where different species flourish, replacing the fire-adapted species that specialized in survival or quick recovery after a forest fire.
- Georgia's sandhills ecosystem features long leaf pines, gopher tortoises, red-cockaded woodpeckers, indigo snakes, quail, and other plant and animal species that are "fire-adapted" so that they thrive when frequent (every 1 - 5 years) low-intensity forest fires prevent later-succession species from taking over.
- In the absence of regular fire or other disturbances, the long leaf pine community would be replaced by a hardwood community through succession
 - This happens when slower-growing hardwoods eventually catch up to the pines in height, which "closes the canopy" (preventing sunlight from reaching the forest floor). In these conditions, hardwood seedlings - which are adapted to need less sunlight - can sprout and grow in the shade, whereas pine seedlings cannot. So the next generation of trees in the forest will consist of hardwoods - until and unless fire, logging, or other disturbance shifts the situation so that fast growing pines can grow in a clearing.
- Adaptations to fire may help individual trees survive, or may help the species rebound even after individual trees are killed. Not all fire-adapted species have the same features or characteristics.
 - Adaptations that can help individual trees survive: deep roots; ability to resprout; thick bark; self-pruning lower branches that keep fire from climbing a "ladder" and reaching the crown; high moisture content; epicormic buds that remain dormant and embedded in the trunk until exposed and activated by fire
 - Adaptations that help a species survive even if individual trees are killed by fire: serotinous pine cones that only open to release seeds after they have experienced heat, smoke, or fire; fast growth whenever a seedling is exposed to full sun (such as when fire creates a clearing in the forest)
- Fire can be managed in different ways, depending on the circumstances of the fire, its location, the potential for harm or destruction, the weather and potential for bringing the fire under control; the extent to which the ecosystem is fire adapted, and the management priority.

- All fire can result in unintended consequences and harmful effects - yet suppression of fire can lead to larger, more catastrophic fires when they eventually happen. Some of the considerations:
 - Fire can hold back succession, favoring earlier-stage wildlife and game species that hunters prefer
 - Fire can cause air pollution and affect human health
 - Fire can harm plants and animals in the short term, and may also lead to regeneration of succession

Environmental Stewardship / PBL Character Count: 900

Students who live in the Georgia sandhills or other ecoregions where longleaf pines are native, can plant an arboretum or natural area with longleaf pines and related species.

- [Planting Instructions for Longleaf Pines](#) - SC Forestry Commission
- [Longleaf Restoration](#) - GA Forestry Commission (GFC [seedlings](#) - longleaf pines not always available)
- [Longleaf Seedlings](#) - The Longleaf Alliance and [private nurseries](#)

Extend Character Count: 900

Consider showing Rhett Turner's documentary [Secrets of the Longleaf Pine](#) - GPB (56 min) for a more complete explanation of the value of the longleaf pine ecosystem in Georgia, including the endangered, endemic, and keystone species that inhabit it, and the role of fire in disturbing succession so that this intermediate stage can be extended or repeatedly regenerated.

These lessons collections include activities that may be useful to reinforce student knowledge or clarify misconceptions.

- [Fire Ecology Lesson Collection](#) - Association for Fire Ecology
- [Southwest Fire Science Lessons](#) SW Fire Science Consortium

Evaluate Character Count: 900

Students will be prompted to return to their initial explanation of fire in the forest and expand or refine it to incorporate new knowledge, experience and perspectives gained during the lesson research and investigations. See Explanation section for details.

Smokey vs Burner Bob

Students should be able to use the information they have learned to analyze the marketing campaigns of [Smokey the Bear](#) (slogan: "Only You Can Prevent Forest Fires") and [Burner Bob](#) ("Pyrodiversity Enkindles Biodiversity") whose characters were both created to influence public perceptions about fire. Students should use the information they have learned to interpret the messages; identify key beneficiaries of each message and the target audiences as well as unintended consequences; and discuss the relevance and importance of the messaging strategies with respect to fire.

Marketing Campaigns

- [Smokey the Bear and Wildlife Management Lesson Plans](#) - Smokey the Bear online / [Smokey Campaign History](#)
- [Burner Bob](#) - The Longleaf Alliance / [Burner Bob Protects the Indigo Snake](#) coloring book
- [Fire in the Forest - Good or Bad?](#) GA Forestry Commission

Re-Teach Character Count: 900

These videos may be useful for reteaching the lesson:

- [Secrets of the Longleaf Pine](#) video - Rhett Turner (56 min)
- [Wildfire Basics](#) and [When is Fire Good?](#) from the Wildfire video series from PBS Learning Media

How this Lesson incorporates "Gather / Reason / Explain / Act / Teach" or "Obtain / Evaluate / Communicate" framework

Check relevant sections and add a line that describes specific, related lesson activities on the right. Character Count: 144

Gather / Obtain includes any of the following:

☐ Obtaining Information

Students will gather or obtain data and information by . . .

Answer Here or N/A

- ☐ Asking Questions/Defining Problems
- ☐ Planning & Carrying Out Investigations
- ☐ Using Models to Gather Data
- ☐ Using Mathematics / Computational Thinking

Answer Here or N/A
 Answer Here or N/A
 Answer Here or N/A
 Answer Here or N/A

Reason / Evaluate *includes any of the following:*

- ☐ Evaluating Information
- ☐ Analyzing Data
- ☐ Using Mathematics / Computational Thinking
- ☐ Developing Evidence
- ☐ Constructing Explanations / Solving Problems
- ☐ Using Models to Predict & Develop Evidence

Students will reason and evaluate data or other info by . . .

Answer Here or N/A
 Answer Here or N/A
 Answer Here or N/A
 Answer Here or N/A
 Answer Here or N/A
 Answer Here or N/A

Explain / Communicate *includes any of the following:*

- ☐ Communicating Information
- ☐ Arguing from Evidence (written & oral)
- ☐ Using Models to Explain or Communicate

Students will explain and communicate by . . .

Answer Here or N/A
 Answer Here or N/A
 Answer Here or N/A

Act

- ☐ Student-Directed Stewardship Project or Civic Action

Students will solve a real-world problem by . . .

Answer Here or N/A

Teach

- ☐ Presentation of Project to Stakeholders / Reflection

Students will share their findings and reflect by . . .

Answer Here or N/A

How this Learning Experience Integrates 3-D Science *The checked elements are integrated in this lesson:*

Science and Engineering Practice

- ☐ Asking Questions and Defining Problems
- ☐ Developing and Using Models
- ☐ Planning and Carrying Out Investigations
- ☐ Analyzing and Interpreting Data
- ☐ Mathematical and Computational Thinking
- ☐ Constructing Explanations and Designing Solutions
- ☐ Engaging in Argumentation from Evidence
- ☐ Obtaining, Evaluating and Communicating Information

Crosscutting Concepts

- ☐ Patterns
- ☐ Cause and Effect
- ☐ Scale, Proportion and Quantity
- ☐ Systems and System Models
- ☐ Energy and Matter
- ☐ Structure and Function
- ☐ Stability and Change

Core Ideas

Physical Science

- ☐ Matter and Its Interactions
- ☐ Motion and Stability / Forces and Interactions
- ☐ Energy
- ☐ Waves and their Applications in Info Transfer

Earth and Space Science

- ☐ Earth's Place in the Universe
- ☐ Earth's Systems
- ☐ Earth and Human Activity

Life Science

- ☐ Structure and Processes
- ☐ Ecosystem Interactions, Energy and Dynamics
- ☐ Heredity, Inheritance and Variations
- ☐ Biological Evolution, Unity and Diversity

Engineering

- ☐ Engineering Design Process
- ☐ Links among Engineering, Technology, Science and Society

How this Learning Experience integrates STEM: Character Count: 900

Students will use the Concord Consortium wildfire simulator to learn about computer modeling to predict, track and analyze wild and prescribed fires. These additional tools for professionals can be explored:

- [Wildland Fire Modeling](#) is a computerized method for predicting a fire's progression to make management decisions.
- [California Wildlife Visualizations](#) is a data map of all wild and prescribed fires over 5000 acres in the past 50+ years
- [Predicting Wildfire with Ai](#) - you tube video
- [QuicFire Simulation](#) - US Forest Service

What parts of this lesson are suited for Outdoor Learning and why?: Character Count: 900

Students will observe lessons in the schoolyard to determine whether fire-adapted tree species are present.

Is there a project or series of which this Lesson is a part?

EEA CoOL Schoolyards Lesson Collection

Is another version of this Lesson available?

Choose yes or no.

no

Lesson Name: Character Count: 144

ENDURING UNDERSTANDING

EIN-4
The health of a species is closely tied to its ecosystem, and minor environmental changes can have a large impact.

LEARNING OBJECTIVE

EIN-4.B
Explain how species become endangered and strategies to combat the problem.

ESSENTIAL KNOWLEDGE

EIN-4.B.1
A variety of factors can lead to a species becoming threatened with extinction, such as being extensively hunted, having limited diet, being outcompeted by invasive species, or having specific and limited habitat requirements.

EIN-4.B.2
Not all species will be in danger of extinction when exposed to the same changes in their ecosystem. Species that are able to adapt to changes in their environment or that are able to move to a new environment are less likely to face extinction.

EIN-4.B.3
Selective pressures are any factors that change the behaviors and fitness of organisms within an environment.

EIN-4.B.4
Species in a given ecosystem compete for resources like territory, food, mates, and habitat, and this competition may lead to endangerment or extinction.

EIN-4.B.5
Strategies to protect animal populations include criminalizing poaching, protecting animal habitats, and legislation.