



Fire Ecology Learning Lab

Igniting Curiosity in Young Minds

— Middle School Curriculum —

Who are we?

Christine Mares, NAU and SWFSC:
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Funded by the Southwest Fire Science Consortium



What is the Fire Ecology Learning Lab Middle School Curriculum?

Outreach by the Southwest Fire Consortium, focused on Arizona and New Mexico

Low/no cost lessons for middle school classrooms

Follows NGSS and AZ learning standards

Free to download

Introducing the next generation of wildland fire managers to this topic and career



Overview of Materials

Each lesson includes:

- Lesson plan
- Handouts, homework, reading, and/or other student materials
- Activities that are low or no cost



Lesson 1: Biotic Communities of the Southwest Mural

Estimated Time: 2.5-3 hours plus 30 minutes of homework time

Guiding Question, Phenomena, and Assessment

Q: What are the defining biotic and abiotic characteristics of the biotic communities across New Mexico and Arizona?

P: Fire impacts our local biotic communities and the way that we live in the Southwest. How can we make informed decisions about how to manage wildland fires across our region?

A: Presentation on biotic community, diagram contribution, and participation.

NGSS Standards and AZ Science Standards	Related Learning Goals
<p>DCIs</p> <p>NGSS: <u>MS-LS1-5 From Molecules to Organisms: Structures and Processes</u></p> <p>Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.</p> <p>NGSS: <u>HS-LS1-4 From Molecules to Organisms: Structures and Processes</u></p> <p>Use argument based on empirical evidence and scientific reasoning to support an explanation for how characteristic animal behaviors and specialized plant structures affect the probability of successful reproduction of animals and plants respectively.</p> <p>AZ L3: Genetic information is passed down from one generation of organisms to another.</p> <p>AZ L4: The unity and diversity of organisms, living and extinct, is the result of evolution.</p>	<p>Students will know:</p> <ul style="list-style-type: none">• There are multiple biotic communities across New Mexico and Arizona.• These biotic communities are determined by the biotic communities and abiotic factors.• The plants that are able to grow in each biotic community are evolved/adapted to survive there, based on climate and other conditions, and they pass these adaptations down from generation to generation.• If conditions change, then the populations of an area might change.• Some plants are adapted to live in more than one biotic community.• Plants from other places in the world might be well adapted to thrive in a similar climate zone and might displace the local species.
<p>Cross Cutting Concepts</p> <p>NGSS: <u>Cause and Effect:</u> Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.</p> <p>NGSS: <u>Patterns:</u> Patterns can be used to identify cause and effect relationships.</p>	<p>Students will know:</p> <ul style="list-style-type: none">• Elevation and climate will affect what grows in a region.• There are similarities across biotic communities. <p>Students will be able to:</p> <ul style="list-style-type: none">• Explain the patterns of plant adaptations that relate to survival in different biotic communities.
<p>Practices</p>	<p>Students will be able to:</p>

Name of plant: _____

Size: Height: _____ Width: _____

Water Needs: _____

Temperature range: _____

Important characteristics: _____

Adaptations: _____

Latin name of plant: _____

Biotic community(s) where plant commonly found: _____

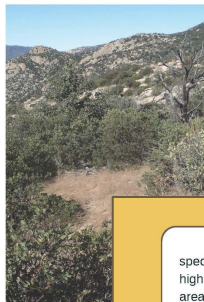
Reproductive cycle: _____

Impact of climate change: _____

Complete after Lesson 5:
Relationship with fire: _____

Interior Chaparral, Introduction

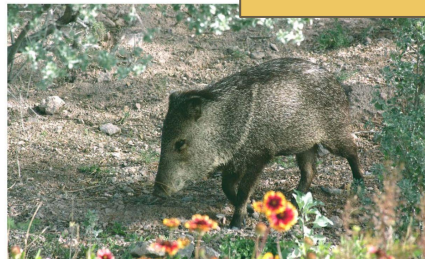
Interior chaparrals are usually located between deserts at their lower elevations and higher elevation woodlands. They are found in patches across the western United States and northern Mexico. Elevation ranges from about 800-2500 m (2500-8200 ft). Interior chaparral shrublands are found throughout the Great Basin, Colorado Plateau, Rocky Mountains, central Arizona including the Mogollon Rim, southern New Mexico, east to Texas, and south into northern Mexico. This **biotic community** is also found in the lower elevations of "Sky Islands", the mountains that rise up from the Sonoran, Mojave, and Chihuahuan Deserts.



These regions are filled with hardy **evergreen** and **deciduous** plants. Most plants are less than 3 m (9 ft) tall. Some regions are covered with little undergrowth. Other areas have more open spacing. These open areas are often filled with grasses and other small plants. Some of the most common shrubs include shrub live oak (*Quercus emarginata*), manzanita (*Arctostaphylos* spp.), deerbrush (*Ceanothus* spp.), bitter cherry (*Prunus emarginata*), mountain mahogany (*Cercocarpus* spp.). The smaller plants that make up the undergrowth depend on the latitude and elevation. The most common undergrowth plants are grasses. These grasses must be able to survive severe drought conditions. They include threeawn (*Aristida* spp.), grama grass (*Bouteloua* spp.), and dropseed grasses (*Sporobolus* spp.).

species in the interior chaparral are highly fire-adapted. However, in areas that have not had regular fire activity, trees from upper elevations are dotted across the landscape, including juniper and piñon.

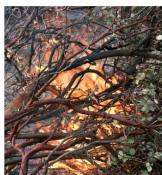
Many different species of wildlife can be found across interior chaparrals. Large mammals include mountain lions, coyotes, bobcats, foxes, javelina, deer, and bighorn sheep. As there are few trees, birds like quail, vireos, and towhees live on the ground. Squirrels, mice, and other small mammals are also found in chaparral habitats. Snakes and lizards are also found in these communities. Payson and parts of Prescott contain interior chaparral on their lands in



Interior Chaparral, Fire

Interior Chaparral is one of the few biotic communities that continues to follow its natural **fire return interval**. Historically, when interior chaparral burns it was a **stand-replacing, high severity** event. This has continued to be true. Most interior chaparral species are highly **fire-adapted**. Many native plants from this region resprout quickly after burning and some produce fire-resistant seeds that grow in the next wet season. These regular fires kill most trees in the region. This pattern prevents interior chaparrals from becoming woodlands or forests. These regions burn regularly, and they depend on fire to maintain the ecosystem. Fires removed dry fuel and invasive plants. These areas historically burned every 35-100 years, and this pattern has continued.

At higher elevations, some interior chaparrals are temporary. They quickly grow after fires, filling areas that were recently burned with new plants. These areas were forests before they burned and now are forests as trees grow and mature, replacing the smaller shrubs. Temporary chaparral shrublands are found in patches across the U.S., from the Cascade Mountains into the western Great Basin, Plateau, and Rocky Mountains, across central Arizona into the Mogollon Rim, southern New Mexico, western Texas, and northern Mexico.



Over the past century people have allowed the natural fire regime to be suppressed in some interior chaparrals, which has built up of fuel. When this fuel ignites, it increases the severity of the fire. This pattern of fire suppression has occurred in many areas. These fires are particularly severe and move quickly through dry brush, people, livestock, and wild



Name of Biotic Community : _____

General description: _____

Important Native Plant Species: _____

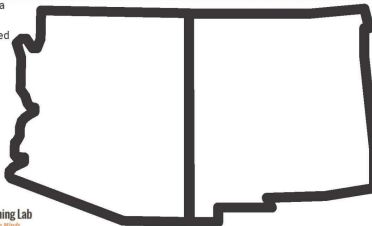
Invasive Species: _____

Important Native Animal Species: _____

Elevation Range: _____ to _____

Other notes: _____

Map: Shade the area where your biotic community is located



Average Annual Precipitation by Year

Precipitation

Year 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021 2022

Average annual precipitation: _____

Overview of Seasonal Temperature and Precipitation Patterns: _____

Annual high: _____

Annual low: _____

Potential impact of climate change: _____

Overview of Themes

Theme 1: Biotic Communities

Theme 2: Wildland Fire

Theme 3: Wildland Fire Management



Biotic Communities: Theme 1 Lessons

Lesson 1: Biotic Community and Climate Research and Mural

Lesson 2: Explore and define your local biotic community

Lesson 3: Compare and contrast fire, cellular respiration, and decomposition



Which biotic communities are covered?

Desert Scrub

Desert Grasslands

Grasslands

Interior Chaparral

Sagebrush Shrubland

Oak Woodlands

Piñon-Juniper Woodlands

Ponderosa Forests

Mixed Conifer Forests



Wildland Fire: Theme 2 Lessons

Lesson 4a: Classroom Fire Safety

Lesson 4: Wildland Fuel Properties Experiment - Burning trays of fuel to demonstrate fuel properties

Lesson 5: Biotic Communities and Fire Adaptations

Lesson 6: Student Designed Experiment

Lesson 7: Determining Fire Regimes of Biotic Communities



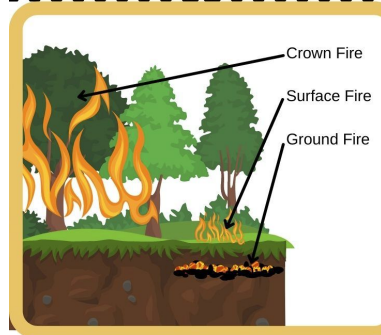
Fuel Size and Shape

Fuels can have different sizes and shapes. Depending on its size and shape, the fuel will burn differently. Grasses burn fairly quickly at a low temperature. Large pieces of wood contain much more stored energy. These take longer to burn and will reach a much higher temperature.



Fuel Moisture

As anyone who has ever tried to start a fire with wet wood will tell you, wet fuel is much more difficult to burn than dry fuel. Areas with dry grasses, leaves, branches, or wood are much more likely to burn than areas with green, moist plants. Wet, green plants often slow fires. Dry plants will spread fire. This can vary by season, temperature, and drought.



Fire Type

Wildland fires are categorized by where they are burning:

- Ground fires burn the organic matter that is under the leaf litter. This type of fire is uncommon in New Mexico and Arizona.
- Surface fires burn leaf litter, woody debris, grass, and small plants.
- Crown fires burn through the crowns of shrubs and trees. Grass fires are called crown fires because the entire fuel is consumed.

Wildland Fire Management: Theme 3 Lessons

Lesson 8: Historical Fire Management and Tree Ring Exploration

Lesson 9: City Council Debate about Controlled Burn

Lesson 10: Letter to Wildland Fire Managers



Next Steps and Timeline

Late October: Finish curriculum and post Beta version on SW Fire Science website

Winter: Collect teacher reviews and make edits to curriculum

Spring 2022: Add wildlife, funded by NM Share with Wildlife Grant

Summer 2022: Train the trainer events



You can help!

Work with classroom teachers to conduct burning experiments:

Lesson 4: Burning fuels to demonstrate fuel properties

Some classroom teachers might not feel comfortable working with fire

They could use your expertise in their classes!



Questions? Ideas? Suggestions?



Contact Information

Would you be interested in working with classroom teachers to help beta test lessons?

Please contact: Mollie Parsons -
mollie@ceriseconsultants.com

Visit the SW Fire Science Consortium
website to learn more about their work:
swfireconsortium.org/

