



Colorado Wildfire

Middle School Hazard Lesson

Setting the Stage



Wildfire burns through the Black Forest area near Colorado Springs, 2013. Photo Credit:
<https://vimeo.com/84393594>

Driving Question:

How have wildfires changed in Colorado over time?

Learning Goals:

- Analyze wildfire data to identify patterns of wildfire history and risk in Colorado.
- Communicate information about the causes and effects of wildfires in your community. Explain what community members should do to be safe in the event of a wildfire.

Part 1

How is wildfire risk changing in Colorado?

KWL Chart

What I
Know

What I
Wonder

What I
Learned
(Activity 3)

How is wildfire risk changing in Colorado?



Watch: [Colorado's Forests: Past, Present and Future](#)

How is wildfire risk changing in Colorado?

| KWL Chart | |
|-----------------------------------|--|
| What I K now | |
| What I W onder | |
| What I Learned (Activity 3) | |

Part 2

Jigsaw Station 1: Colorado Wildfire Fast Facts

Description

A **wildfire** is an unplanned, unwanted wildland fire. Wildfires include unauthorized human-caused fires, escaped wildland fire use events (where appropriate management response to naturally-ignited wildland fires escape), escaped prescribed fire projects, and all other wildland fires where the objective is to put the fire out (Botts, et al., 2015). While this section's emphasis is on wildfires as an unwanted hazard, it also discusses wildfire in the context of how and why wildland fires occur.

A **wildland fire** is any non-structure fire that occurs in areas of vegetation or natural fuels, and can be either prescribed fire or wildfire. Wildland fire occurs when vegetation, or "fuel," such as grass, leaf litter, trees, or shrubs, is exposed to an ignition source and the conditions for combustion are met, resulting in fire growth and spread through adjacent combustible material. Wildland fires are either ignited by lightning or by some consequence of human activity. In Colorado, lightning accounts for only 17 percent of wildfires, with human ignitions accounting for the remainder (*Colorado Natural Hazards Mitigation Plan*, 2013). Human causes vary and can include escaped debris pile burning, campfires, fireworks, construction sparks, downed transmission lines, and arson.

Wildland fires can occur during any time of year. Although there are frequent references to a "fire season," ignitions are a result of the ability of fuels to support combustion. In addition to an ignition source, the fuel type, amount of fuel, distribution pattern, and moisture content—coupled with weather and topography—will determine the conditions for combustion and resulting fire behavior. Fire behavior characteristics, often referred to as "outputs," include intensity, residence time (i.e., the time required for the active flame zone to pass a stationary point at the surface of the fuel), rate of spread, ember production, ember transport distance, and fire size. These fire behavior outputs determine the influence the wildfire has on adjacent and surrounding fuels through radiant, convective, and conductive heat.

Wildland fire is a natural ecological disturbance process, and in many cases it is necessary ecosystem health. Historically, "natural" fire varied in size, intensity, and severity, creating a mosaic of native vegetation communities across different landscapes. Multiple fire events will occur over time and the frequency and length of the fire return interval is dependent upon the vegetation type and climatic conditions. This natural variation of fire has declined in North America over the past two centuries due to a number of human influences. These influences have significantly altered the natural fire regime and created extensive areas of homogeneous forests (forests of the same composition including trees of the same age, size, species etc.), causing a significant and widespread change in fire effects and fire's influence on ecosystems and people.



Wildfires become wildland-urban interface fires when they transition from natural areas of vegetation to a combination of vegetation and the built environment, such as the Waldo Canyon Fire in 2012. Fire Adapted Communities, Waldo Canyon Fire 2012, National Interagency Fire Center Photo Gallery. Kari Greer/US Forest Service

The introduction and increasing growth of development adjacent to and intermixed within the natural vegetation across the landscape poses additional risk to people and property. In the context of wildfire, the combustible components of buildings, infrastructure, and associated accessories make them susceptible to ignition and are also considered fuel for the fire. A fire burning in this situation has transitioned from a wildfire to a **wildland-urban interface (WUI) fire**, where a combination of vegetation and man-made structures provide fuel for the fire.

This situation increases the complexity, cost, and risk of wildfire in Colorado. In most WUI fire situations, fire suppression resources are quickly overwhelmed and multiple structures are lost.

The terms wildfire hazard and wildfire risk are distinctly different. **Wildfire hazard** refers to the fuels in a given location and represents the intensity with which an area is likely to burn if a fire does occur there. **Wildfire risk** is the probability and consequence of a wildfire burning in an area (based on the wildfire hazard, potential losses, and weather conditions). Identifying wildfire hazard is an important first step in assessing the risk of wildfires. Wildfire risk assessments can be analyzed on different spatial scales, depending on the intended use of the assessment.

Read: [Colorado Planning for Hazards—Wildfire](#) (First 3 sections only)

Jigsaw Station 1: Colorado Wildfire Fast Facts

Wildfires and Human Behavior

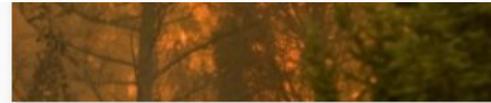
Wildfires are distinct from other natural hazards in two ways:

1. Wildfire activity is not limited to natural environmental causes (such as earthquakes, tornados, or hurricanes) because ignition can also result from human activity;
2. Humans have the ability to significantly reduce wildfire threat by altering, redirecting, or (in some cases) extinguishing a wildfire.

Wildfires in Colorado



Between 2010 and 2014, an average of 1,192 wildland fires, excluding prescribed fires, occurred annually in Colorado. The number of acres can vary greatly; for example, in 2014, a reported 24,949 acres burned throughout the state, while in 2012 a total of 246,445 acres burned due to wildland fires. Annual structural losses across the state also fluctuate. Between 2012 and 2013, more than 1,200 structures were damaged or destroyed by wildfires that swept across the state, resulting in nearly \$1 billion in property damage (Badger, 2015). Other years, however, have reported significantly fewer structural losses and damage.



Kari Greer/ NIFC (creative commons license); Castle Rock Fire, Ketchum, ID 2007; National Interagency Fire Center Photo Gallery

Wildfire size (reported as acres burned) is not always indicative of its impact. The Royal Gorge Fire that began on June 11, 2013 outside of Cañon City, burned a total area of 3,218 acres and destroyed 90

percent of the Royal Gorge Bridge and Park. The Royal Gorge Bridge itself was relatively unaffected, but 48 of 52 buildings—including the visitor center, Aerial Tram, Incline Railway, and other attractions—were destroyed (*Royal Gorge Bridge*, 2014). Examples like this illustrate the long-lasting impacts that wildfires can have on the local economy and the variety of community values at risk.

CoreLogic, a national provider of financial and property information, estimates that Colorado ranks as one of the leading states across the western United States in terms of residential properties potentially at risk of future wildfire damage. A 2015 report shows that Colorado has nearly 100,000 homes that are either at high or very high risk of wildfire – translating into \$28 billion of residential assets exposed to potential future wildfire damage (Botts, et al., 2015). These trends also reflect a larger pattern associated with increased development in wildfire-prone areas in the West. Community wildfire risk will continue unless more action is taken to reduce and/or mitigate the threat.

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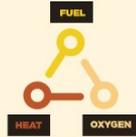
Read: [Colorado Planning for Hazards—Wildfire](#) (First 3 sections only)

Jigsaw Station 2: How Wildfires Start

Fire occurs whenever combustible fuel in the presence of oxygen at an extremely high temperature becomes gas. Flames are the visual indicator of the heated gas. Fire can also occur from lower-temperature sources. Over time, combustible materials such as smoldering embers can reach their ignition temperature.

The Fire Triangle

The fire triangle is a simple way of understanding the elements of fire. The sides of the triangle represent the interdependent ingredients needed for fire: heat, fuel and oxygen.



1



Heat

A heat source is responsible for the initial ignition of fire, and is also needed to maintain the fire and enable it to spread. Heat allows fire to spread by drying out and preheating nearby fuel and warming surrounding air.

2

Fuel

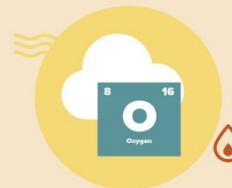
Fuel is any kind of combustible material. It's characterized by its moisture content, size, shape, quantity and the arrangement in which it is spread over the landscape. The moisture content determines how easily it will burn.



3

Oxygen

Air contains about 21 percent oxygen, and most fires require at least 16 percent oxygen content to burn. Oxygen supports the chemical processes that occur during fire. When fuel burns, it reacts with oxygen from the surrounding air, releasing heat and generating combustion products (gases, smoke, embers, etc.). This process is known as oxidation.

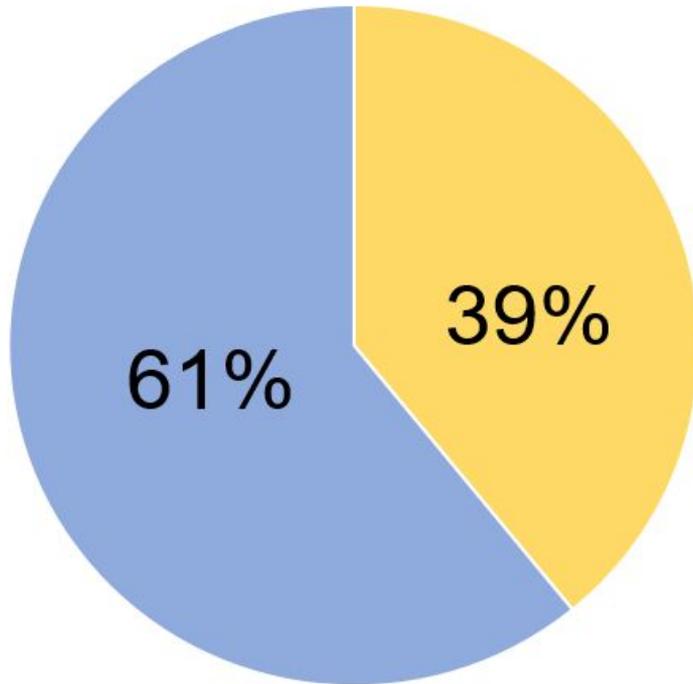


Read: [Elements of Fire](#)

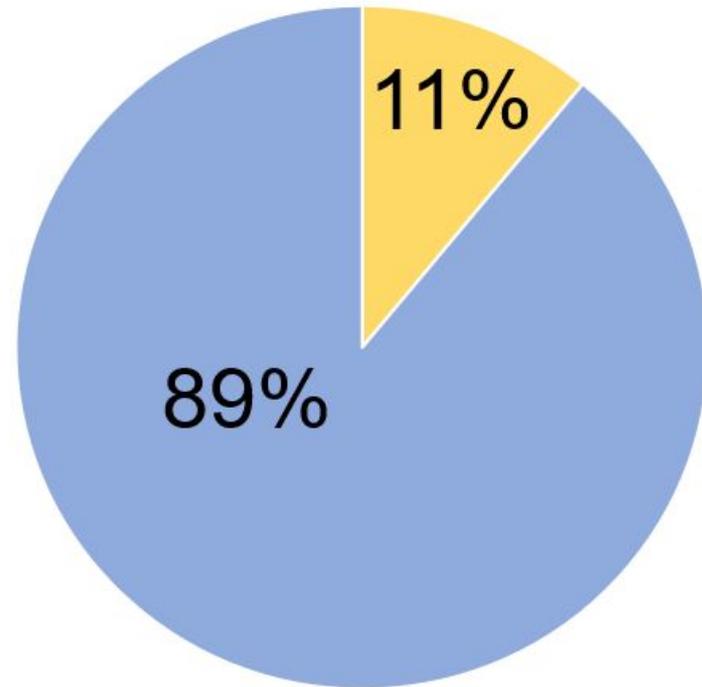
Jigsaw Station 2: How Wildfires Start

Lightning vs. Human Caused Wildfires (2001-2019)

Rocky Mountain Region



California

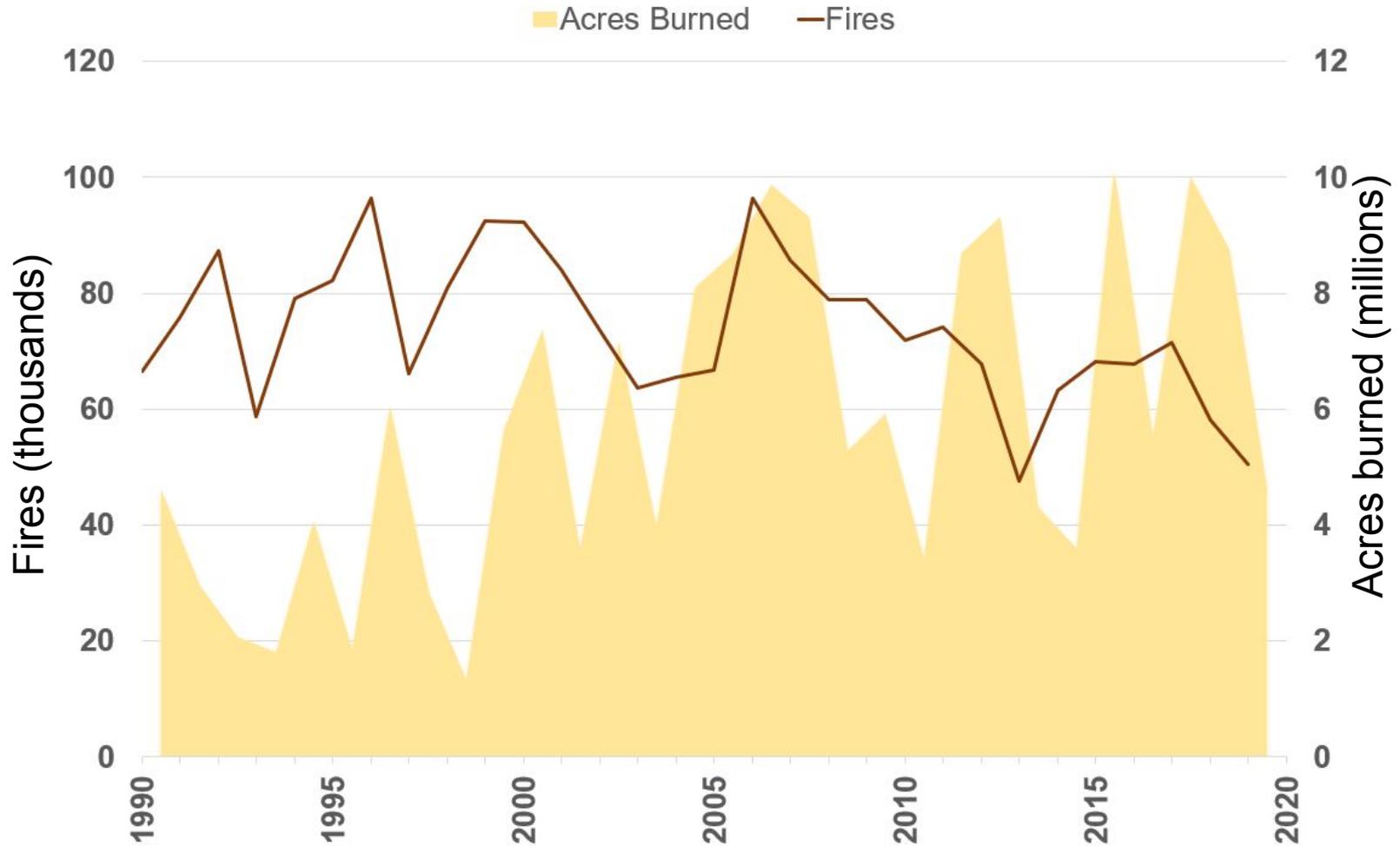


- Human-Caused Wildfires
- Lightning-Caused Wildfires

Data from: [National Interagency Fire Center \(NIFC\)](https://www.nifc.gov/)

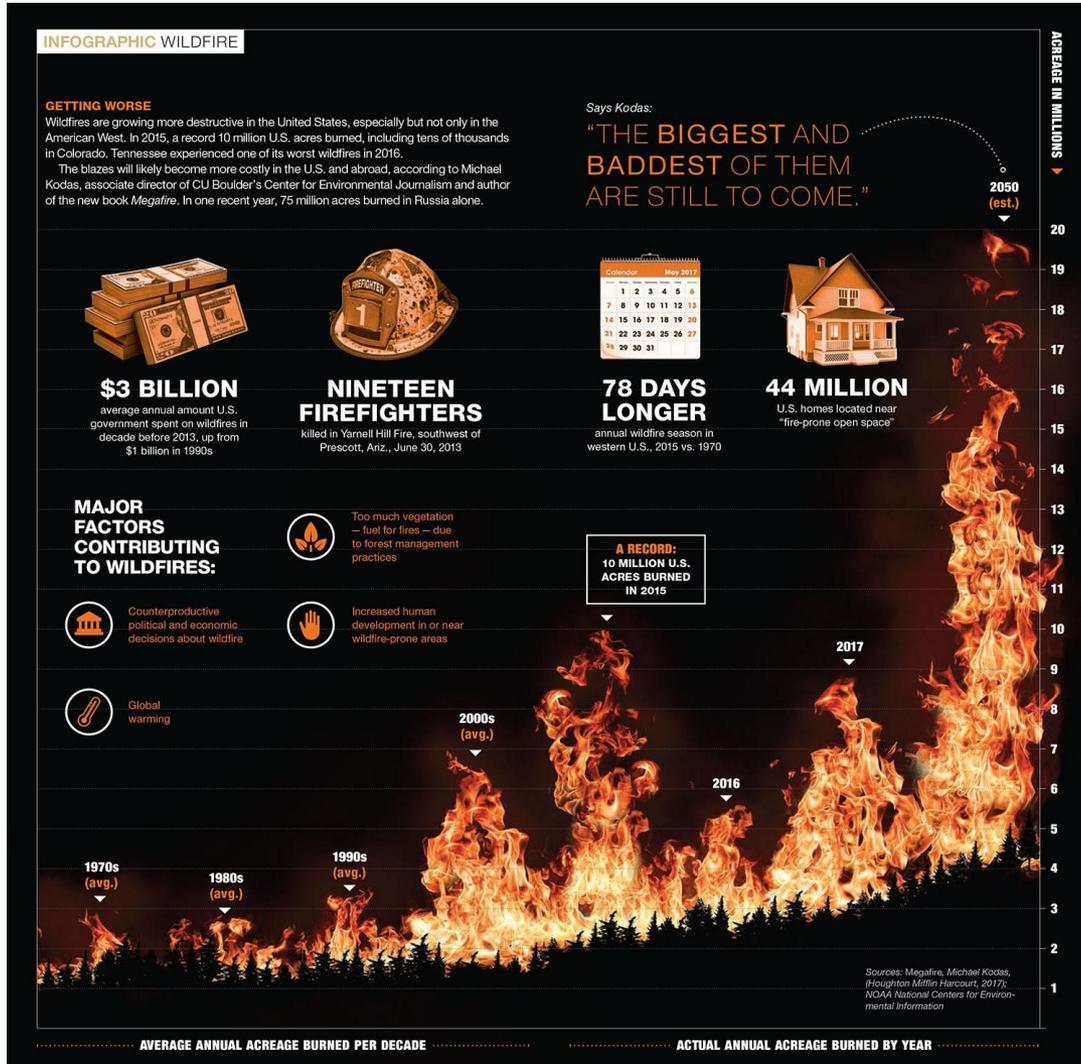
Jigsaw Station 3: National Wildfire Trends

Annual Wildfires and Acres Burned (1990-2019)



Data from: [National Interagency Fire Center \(NIFC\)](https://www.nifc.gov/)

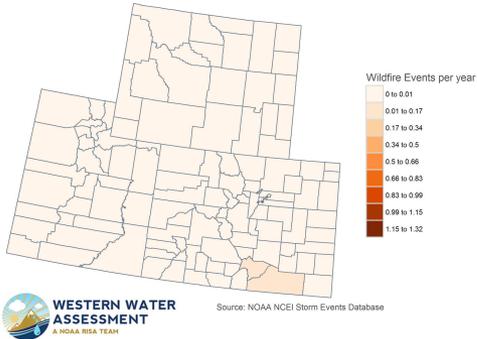
Jigsaw Station 3: National Wildfire Trends



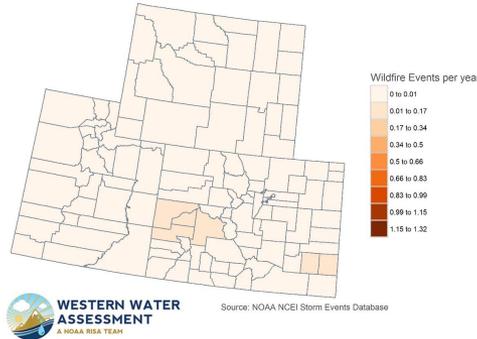
Infographic from: [Coloradan Alumni Magazine](http://coloradan.alumni.org)

Jigsaw Station 4: Location and Frequency of Wildfires in Colorado

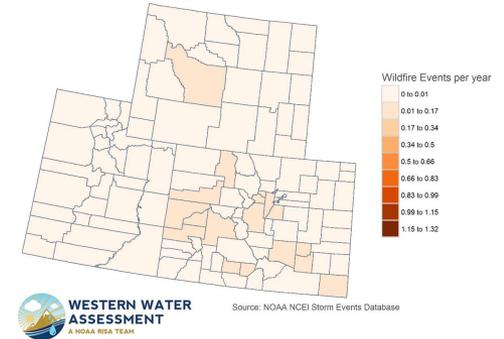
January Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



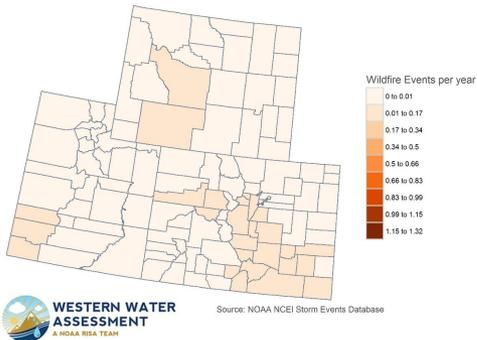
February Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



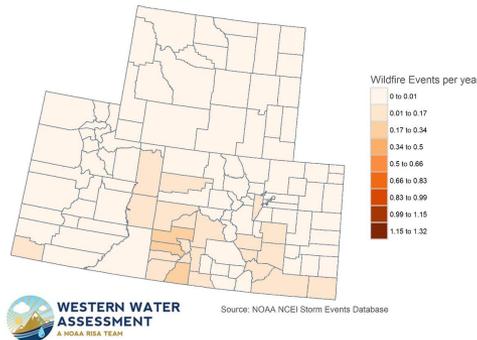
March Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



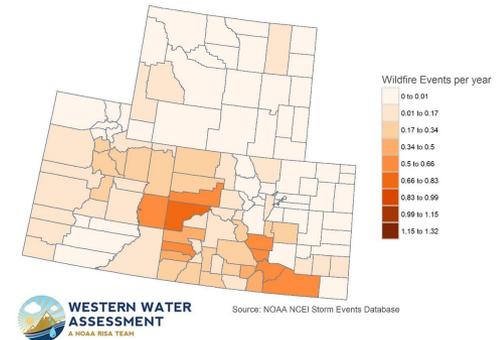
April Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



May Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



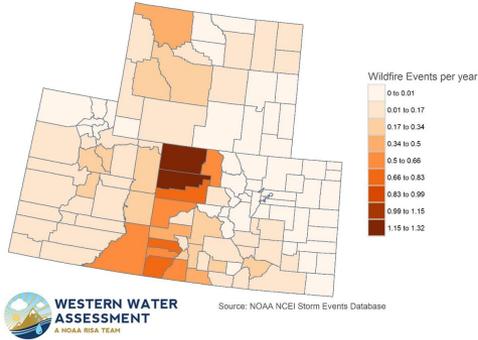
June Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



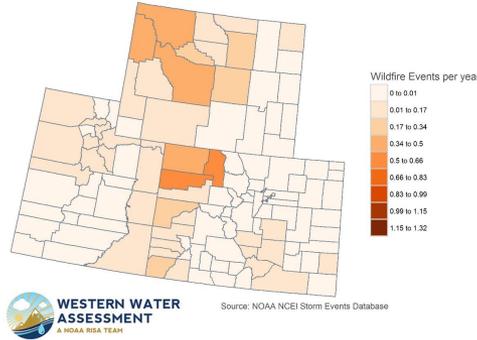
Explore: [Wildfire](#) maps (look at each month)

Jigsaw Station 4: Location and Frequency of Wildfires in Colorado

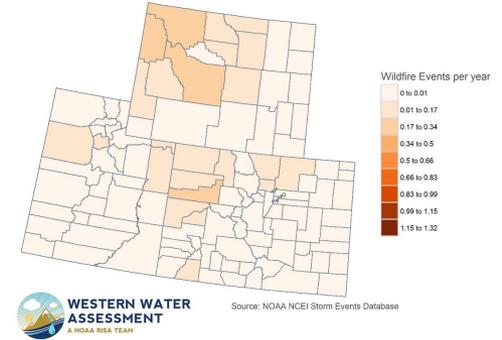
July Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



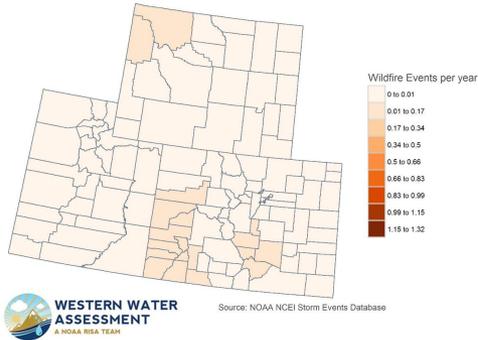
August Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



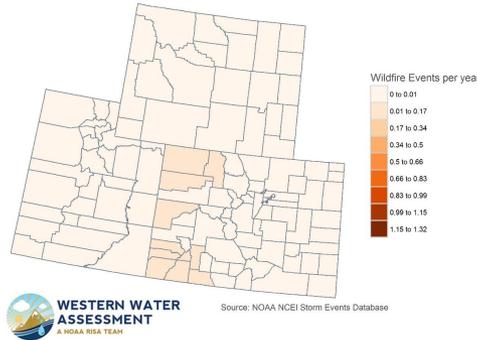
September Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



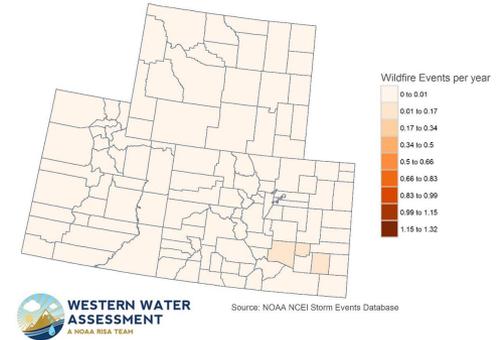
October Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



November Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



December Wildfire Events in Utah, Wyoming, and Colorado, 1996-2014



Explore: [Wildfire](#) maps (look at each month)

Jigsaw Station 5: Wildfire Risk in Colorado

Colorado's Wildland-Urban Interface

Uncontrolled wildland fire is particularly hazardous in the wildland-urban interface (WUI), areas where human development is close to, or within, natural terrain and flammable vegetation.

The wildland-urban interface, or WUI, is the area where structures and other human developments meet or intermingle with wildland vegetation. Wildfires in Colorado are a natural part of our ecosystems and help restore and maintain healthy forests.

During the past few decades, population in the interface has increased. Homes, businesses and subdivisions are being built on forested lands that have historically seen regular fires, and even need them to remain healthy. In order to preserve human life and property, firefighters have worked hard to suppress and control fires; this has had a negative effect on functioning ecosystems.

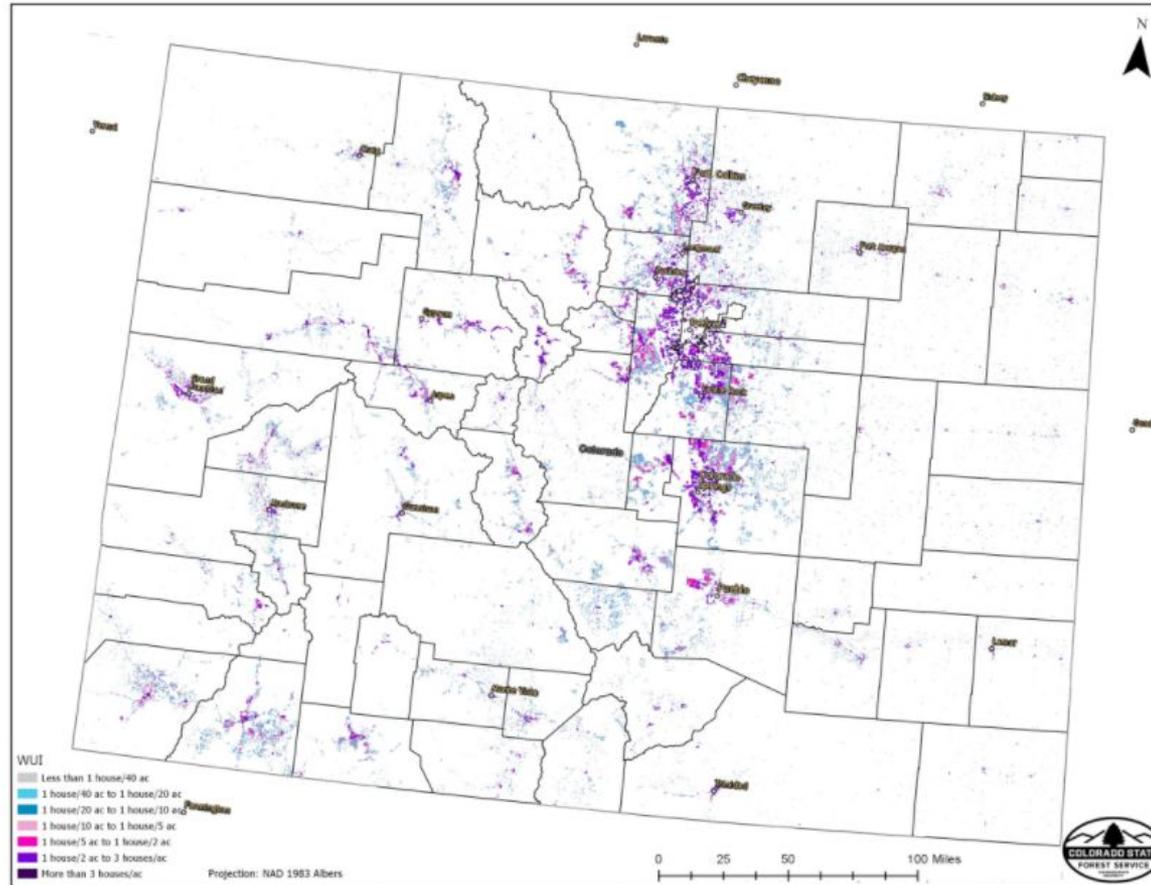
To help return forests to a more "natural" state, it is important that land managers and property owners work together. Buildings and the surrounding property should be adapted so that, when fires burn, firefighters can do their job safely to protect man-made structures while allowing fire to take its natural course in the ecosystem. Allowing natural fires to occur will help create a healthier forest and ultimately reduce the risks associated with large and unmanageable fires.

Read: Colorado State Forest Service [Colorado's Wildland-Urban Interface](#)

Jigsaw Station 5: Wildfire Risk in Colorado

Colorado's Wildland Urban Interface – 2018

Pass your cursor over the map below to zoom in on an area.



Explore: Colorado State Forest Service [Colorado's Wildland-Urban Interface](https://colorado-state-forest-service.com/land-use/wildland-urban-interface)

Jigsaw Station 6: Wildfire Safety

Wildfire Weather Safety

[Weather.gov](#) > [Safety](#) > Wildfire Weather Safety

Safety
National Program

Wildland Fire
Safety

Watch VS. Warning

Preparedness

Get Set, Be Aware

Go Act Early



Raging wildfire. Photo: SciJinks, NOAA

Wildfire Resources

Wildfire Safety

NOAA Fire Weather

Air Quality Forecasts

Current Fire Information

Smokey Bear

American Red Cross

National Interagency Fire Center

Education and Outreach Materials

Links and Partners

NOAA's National Weather Service works in conjunction with federal and state wildland managers to protect lives and property in and around America's wildlands. This site will help you prepare, be aware and act early if a wildfire comes your way. A list of partners can be found on the [National Interagency Fire Center website](#). If you, or someone you know, have been a victim of a wildfire, please [share your story](#) so we can prevent others from becoming a victim. When you write, please note that NWS has permission to use your story and, if possible, let us know the town and state you were in and the year the event took place.

Share Your Story

Read: National Weather Service [Wildfire Weather Safety](#)

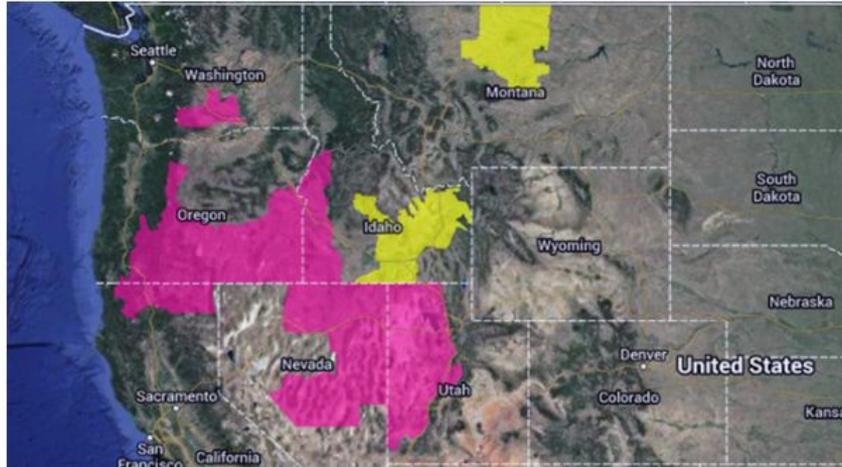
Jigsaw Station 6: Wildfire Safety

Understanding Wildfire Warnings, Watches and Behavior

[Weather.gov](#) > [Safety](#) > Understanding Wildfire Warnings, Watches and Behavior

Safety
National Program

| | | | | |
|----------------------|-------------------|--------------|-------------------|--------------|
| Wildland Fire Safety | Watch VS. Warning | Preparedness | Get Set, Be Aware | Go Act Early |
|----------------------|-------------------|--------------|-------------------|--------------|



Wildfire Resources

| |
|----------------------------------|
| Wildfire Safety |
| NOAA Fire Weather |
| Air Quality Forecasts |
| Current Fire Information |
| Smokey Bear |
| American Red Cross |
| National Interagency Fire Center |
| Education and Outreach Materials |
| Links and Partners |

- **Red Flag Warning: Take Action.** Be extremely careful with open flames. NWS issues a Red Flag Warning, in conjunction with land management agencies, to alert land managers to an ongoing or imminent critical fire weather pattern. NWS issues a Red Flag Warning when fire conditions are ongoing or expected to occur shortly.
- **Fire Weather Watch: Be Prepared.** A Watch alerts land managers and the public that upcoming weather conditions could result in extensive wildland fire occurrence or extreme fire behavior. A watch means critical fire weather conditions are possible but not imminent or occurring.
- **Extreme Fire Behavior:** This alert implies a wildfire likely to rage out of control. It is often hard to predict these fires because such they behave erratically, sometimes dangerously. One or more of the following criteria must be met:
 - Moving fast: High rate of spread
 - Prolific crowning and/or spotting
 - Presence of fire whirls
 - Strong convection column

Read: National Weather Service [Wildfire Weather Safety](#)

Jigsaw Station 6: Wildfire Safety

Preparedness

[Weather.gov](#) > [Safety](#) > Preparedness

Safety
National Program

| | | | | |
|----------------------|-------------------|--------------|-------------------|--------------|
| Wildland Fire Safety | Watch VS. Warning | Preparedness | Get Set, Be Aware | Go Act Early |
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| Wildfire Resources |
|--|
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| Education and Outreach Materials |
| Links and Partners |

Take personal responsibility and prepare long before the threat of a wildland fire so your home is ready in case of a fire:

- Create [defensible space](#) by clearing brush away from your home.
- Use fire-resistant landscaping and harden your home with fire-safe construction measures.
- Put together a [basic emergency supply kit](#). Check emergency equipment, such as flashlights and generators.
- Plan escape routes and make sure all those residing within the home know the plan of action.
- [Learn more ways to protect yourself, your family and your property](#)
- Before an emergency happens, sit down with your family or close friends and decide how you will get in contact with each other, where you will go, and what you will do in an emergency. Keep a copy of this plan in your emergency supplies kit or another safe place where you can access it in the event of a disaster. Start at the [Ready.Gov emergency plan webpage](#).
- Review your insurance policies to ensure that you have adequate coverage for your home and personal property.
- Understand NWS forecast products, especially the meaning of [NWS watches and warnings](#).

Read: National Weather Service [Wildfire Weather Safety](#)

Part 3

Wildfire Expert Interview



[Wildfire Expert Video](#)

Waldo Canyon Wildfire Case Study Videos

- [Evacuating the Waldo Canyon Fire](#) (3:42)
- [The Waldo Canyon fire: Remembering it five years later](#) (1:51)
- [The Waldo Canyon fire, five years later: Colorado Springs rebuilds](#) (1:14)
- [The Waldo Canyon fire, five years later: Restoring the fire ravaged land](#) (2:16)

Local Wildfire News Story

Prompt: Create a local news story in a format of your choice (see options below), that summarizes important information for people in your community to prepare for and understand wildfire risk.

The format choices for the local wildfire news story include:

- Newspaper article with one picture and one graph or map (one page)
- Radio story (2-3 minutes in length)
- Video newscast (2-3 minutes in length)

Use the outline in your worksheet to compile information for your news story.