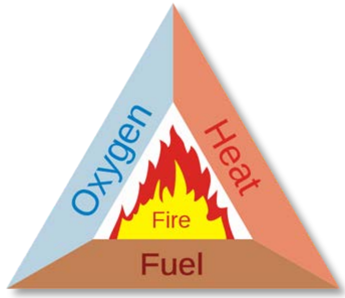
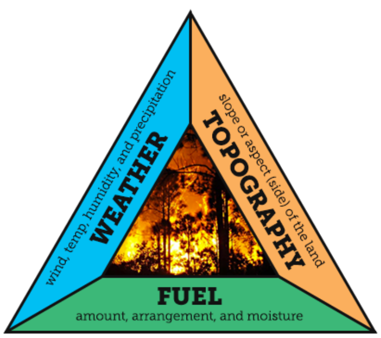
3.1 Risk Assessment: Wildfire

Description



A wildfire is any non-structure, other than prescribed, fire that occurs in the wildland. Wildfires occur when all of the necessary elements of a fire triangle come together in a wooded or grassy area. As seen in the figure to the right (fire ignition triangle), oxygen (air), heat and fuel all need to be present for a fire to start. Oxygen is needed to start and sustain combustion. Air supply can be increased by windy conditions. Air supporting a fire must be at least 16-percent oxygen; the air that surrounds humans contains about 21-percent oxygen. Heat is needed to raise fuel temperatures to their ignition point and to ignite fuels. Common sources of heat are lightning and human activities. Fuel is needed to sustain and/or carry flames. Fuel is considered any material capable of burning and includes living vegetation, branches, needles, standing dead snags, leaves, etc. (National Park Service 2017). Once fuels are ignited, heat is transferred in three ways:



Fire Behavior Triangle

Conduction transfers heat from a warmer object to a cooler object until both temperatures are the same.
Radiation transfers heat through air by short energy waves (infrared rays), which preheat and dehydrate fuels to their ignition point.
Convection transfers heat through the movement of liquid or gas. Wildfires generate gases that rise in columns, usually accompanied by sparks, embers and burning twigs. These convective columns move downwind, ahead of the fire front, carrying embers that start spot fires (Idaho Firewise 2018).

There are many factors affecting how a wildfire burns, how fast it moves, and how difficult it is to control. Looking at the fire behavior triangle, these factors include: weather, topography, and fuels.

Weather includes wind, temperature, cloudiness, moisture, and air pressure. Warm temperatures and low humidity dry out vegetation and cause wildfires to burn quickly. Wind not only moves wildfires, it also supplies oxygen that can cause fires to grow. Wind also blows embers for miles, leading to the ignition of new spot fires. Rain and high humidity can slow down or extinguish fires, while storms can cause fire activity to increase or become unpredictable.

Topography describes the physical features of an area, including slope and aspect (the direction it faces). Wildfires burn more rapidly when moving upslope by preheating unburned fuels and making them more combustible. South and west facing slopes have drier fuels than north and east facing slopes.

Fuels are vegetation and structures with characteristics having a huge effect on wildfire behavior. Large, dense trees burn for hours and generate a lot of heat. Dried grasses, on the other hand, produce a flashy fire that burns quickly and does not generate much heat (Idaho Firewise 2018).

The hazard of wildfire is one that is significant not only in Idaho but in many areas of the United States. Wildfires can increase the probability of other natural disasters, specifically floods and mudflows. Wildfires, particular large-scale fires, can dramatically alter the terrain and ground conditions, making land already devastated by fire susceptible to floods. Lands impacted by wildfire increase the risk of flooding and mudflow in those areas impacted by wildfire. Normally, vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to absorb water; thus, creating conditions perfect for flash flooding and mudflows. Flood risk in these impacted areas remain significantly higher until vegetation is restored, which can take up to five years after a wildfire (FEMA 2013).

Flooding after a wildfire is often more severe, as debris and ash left from the fire can form mudflows. During and after a rain event, as water moves across charred and denuded ground, it can also pick up soil and sediment and carry it in a stream of floodwaters. These mudflows have the potential to cause significant damage to impacted areas. Areas directly affected by fires and those located below or downstream of burn areas are most at risk for flooding (FEMA 2013).

Figure 3.1.A. 2015 Soda Wildfire

Source: BLM 2015

Wildfires have a rapid forward rate of spread when burning through dense, uninterrupted fuels. They can move as fast as 6.7 miles per hour (mph) in forests and 14 mph in grass and range lands. Wildfires can advance tangential to the main front to form a flanking front, or burn in the opposite direction of the main front by *backing*. They may also spread by jumping or spotting, as winds and vertical convection columns carry firebrands (hot wood embers) and other burning materials through the air over roads, rivers, and other barriers that may otherwise act as firebreaks. Torching and fires in tree canopies encourage spotting, and dry ground fuels that surround a wildfire are especially vulnerable to ignition from firebrands. Spotting can create spot fires as hot embers and firebrands ignite fuels downwind from the fire. In Australian bushfires, spot fires are known to occur as far as 6 miles away from the fire front.

Large wildfires may affect air currents in their immediate vicinities by the stack effect: air rises as it is heated, and large wildfires create powerful updrafts that will draw in new, cooler air from surrounding areas in thermal columns. Great vertical differences in temperature and humidity encourage pyrocumulus clouds, strong winds, and fire whirls with the force of tornadoes at speeds of more than 80 kilometers per hour (50 mph). Rapid rates of spread, prolific crowning or spotting, the presence of fire whirls, and strong convection columns signify extreme conditions.

Wildfires can consume large areas of Idaho, destroying property and taking lives. When huge fires strike, there is often little that can be done to control them; forcing residents to evacuate. Dense smoke can fill the area for miles around the fire, impacting areas not directly affected by flames. The smoke from fires poses a direct threat to health impacts, especially for the young and elderly, as well as economic damages due to loss of tourist business. Wildfires also threaten the infrastructure of Idaho, as well as resources such as water, timber, wildlife habitat, and recreation (IOEM 2018).

Wildfires have resulted in significant disasters throughout Idaho's history. The summer fires of 2000 and 2007 were some of the most damaging fires on record in the State. The 1910 fire that struck northern Idaho and western Montana has been characterized as the largest in American history, taking 86 lives and burning three million acres. As the communities of Idaho expand into the wildland urban interface, more and more residents are exposed to wildfire impacts. There is no county in the State of Idaho without a significant wildland fire hazard (IOEM 2018).

Idaho Fire Threats

Idaho fire threats include:

Ground fires burn organic matter (topsoil, partially decayed leaves, etc.) in the soil beneath surface litter and are sustained by glowing combustion. This fuel type is especially susceptible to ignition through spotting. Ground fires typically burn by smoldering and can burn slowly for days to months. Ground fires lead to ladder fires which consume the material between low-level vegetation and tree canopies such as small trees, downed logs, and vines. Kudzu, Old World climbing fern, and other invasive plants that scale trees may also encourage ladder fires.

Crawling or surface fires are fueled by low-lying vegetation such as leaf and timber litter, debris, grass, and low-lying shrubbery.

Crown, canopy, or aerial fires burn suspended material at the canopy level, such as tall trees, vines, and mosses. The ignition of a crown fire, termed crowning, is dependent on the density of the suspended material, canopy height, canopy continuity, and sufficient surface and ladder fires in order to reach the tree crowns (Idaho State HMP 2013).

Underground/subterranean fires burn combustible materials lying beneath the surface including peat, roots, rotten buried logs, and other woody fuels. Peat fires burning in peatlands tend to produce long-lasting, smoky, underground blazes. They burn a smaller area than fast-moving surface fires, but can burn up to 10 times more fuel mass per acre (Working on Fire 2018).

Factors Affecting Wildfire Risk

As stated above, there are three principal factors have a direct impact on the behavior of wildfires: topography, fuel, and weather.

Topography can have a powerful influence on wildfire behavior. The movement of air over the terrain tends to direct a fire's course. Gulches and canyons can funnel air and act as a chimney, intensifying fire behavior and inducing faster rates of spread. Similarly, saddles on ridge tops tend to offer lower resistance to the passage of air and will draw fires. Solar heating of drier, south facing slopes produces upslope thermal winds that can complicate behavior.

Source: Idaho Firewise website

Slope is an important factor. If the percentage of uphill slope doubles, the rate at which a wildfire spreads will likely double. On steep slopes, fuels on the uphill side of the fire are closer to the source of heat. Radiation preheats and dries the fuel, thus intensifying fire behavior. Terrain can also inhibit wildfires: fire travels down slope much more slowly than it does upslope, and ridge tops often mark the end of a wildfire's rapid spread.

Fuels are classified by weight or volume (fuel loading) and by type. Fuel loading, often expressed in tons per acre, can be used to describe the amount of vegetative material available. If fuel loading doubles, the energy released also can be expected to double. Each fuel type is given a burn index, which is an estimate of the amount of potential energy that may be released, the effort required to contain a fire in a given fuel, and the expected flame length. Different fuels have different burn qualities. Some fuels burn more easily or release more energy than others. Grass, for instance, releases relatively little energy, but can sustain very high rates of spread.

Firefighters generally classify wildfire fuels into three types:

- **Ground Fuels**: This vegetation is close to or lying on the ground. Ground fuels include dead grass and leaves, needles, dead branches, twigs, and logs.
- **Surface Fuels**: These plants and trees are close to the ground but not actually lying on the ground. They are usually shrubs, grasses, low-hanging branches, and anything not located in the high branches of trees. They are also referred to as “ladder fuels”, because a fire can move from ground fuels to surface fuels, then onto crown fuels.

- **Crown Fuels**: Crown fuels are found only in the crowns or tops of trees. They do not touch the ground and are usually the high branches of trees. When a wildfire burns in the tops of the trees, it is called a crown fire.

Figure 3.1.B. Wildfire in Deadwood River

Source: IncíWeb 2017

Continuity of fuels is an important factor. Continuity is expressed in terms of both horizontal and vertical dimensions. Horizontal continuity is what can be seen from an aerial photograph and represents the distribution of fuels over the landscape. Vertical continuity links fuels at the ground surface with tree crowns via ladder fuels.

Another essential factor is fuel moisture. Like humidity, fuel moisture is expressed as a percentage of total saturation and varies with antecedent weather. Low fuel moistures indicate the probability of severe fires. Given the same weather conditions, moisture in fuels of different diameters changes at different rates. A 1,000-hour fuel, which has a 3 to 8 inch diameter, changes more slowly than a 1 or 10 hour fuel.

Weather is the most variable out of all the factors influencing wildfire behavior. Extreme weather leads to extreme events, and it is often a moderation of the weather that marks the end of a wildfire's growth and the beginning of successful containment. High temperatures and low humidity can produce very vigorous fire activity. The cooling and higher humidity brought by sunset can dramatically quiet fire behavior.

Fronts and thunderstorms can produce winds that are capable of radical and sudden changes in speed and direction, causing similar changes in fire activity. A fire’s rate of spread varies directly with wind velocity. Winds may play a dominant role in directing the course of a fire. The radical and devastating effect that wind can have on fire behavior is a primary safety concern for firefighters. The most damaging firestorms are usually marked by high winds.

Leading Causes of Fires in Idaho

All wildfires begin with an ignition source. The 2016 Idaho Department of Land's (IDL) Year-End Fire Report shows that human caused fires are increasingly becoming the primary fire start cause. In the 2011 report, there were an average of 376 wildland fires per year in the State (29 year average). Of these fires, 46% are human caused and the remaining 54% are initiated by lightning strikes. Table 3.1.C presents the summary of wildland fires, by cause, for 2016. This shows an increase from 48% to 72% human caused fires in the State.

NUMBER OF FIRES BY CAUSE WITH COSTS					
General Cause	**# of Fires**	**% of Fires**	**Cost**	**% of Cost**	**Cost/Fire**
Human-Caused					
Miscellaneous	39	32%	$394,581	7.8%	$10,117
Campfire	25	21%	$188,613	3.7%	$7,545
Debris Burning	20	17%	$142,059	2.8%	$7,103
Equipment Use	20	17%	$3,048,602	60.3%	$152,430
Arson	14	12%	$1,275,938	25.2%	$91,138
Smoking	3	2%	$5,208	0.1%	$1,736
Railroad	0	0%	$0	0.0%	$0
Children	0	0%	$0	0.0%	$0
Total Human	121	100%	$5,055,001	100%	$41,777
Human and Lightning					
Lightning	47	28%	$217,392	4%	$4,625
Human	121	72%	$5,055,001	96%	$41,777
Grand Total	168	100%	$5,272,394	100%	$31,383

Minor discrepancies exist due to rounding

Table 3.1.C. Idaho Fires by Cause / *Source: Fire in Idaho 2016*

Location, Extent, and Magnitude

Location

Wildfires can occur anywhere and at any time within the state. Idaho's climate and ecosystems vary greatly from one area of the state to another, but can be divided into two distinct ecosystems affected by fire: forests and rangelands. Additionally, with the significant population growth Idaho has seen since 1970, the wildland-urban interface area is of importance to the wildfire hazard and will only continue to affect the state. Wildfire is both a destructive hazard as well as a cleansing agent for forest health.

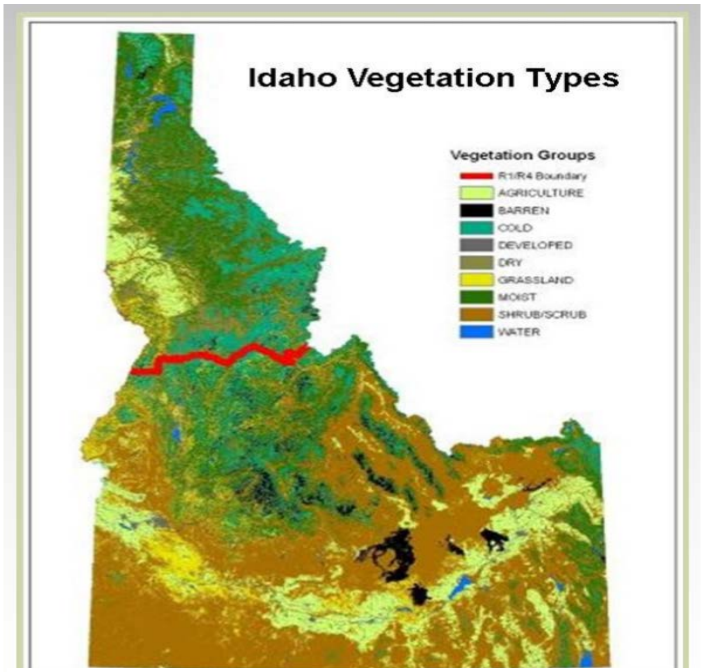


Table 3.1.D. Idaho Vegetation Types *Source: https://www.fs.fed.us/foresthealth/docs/fhh/ID_FHH_2014.pdf*

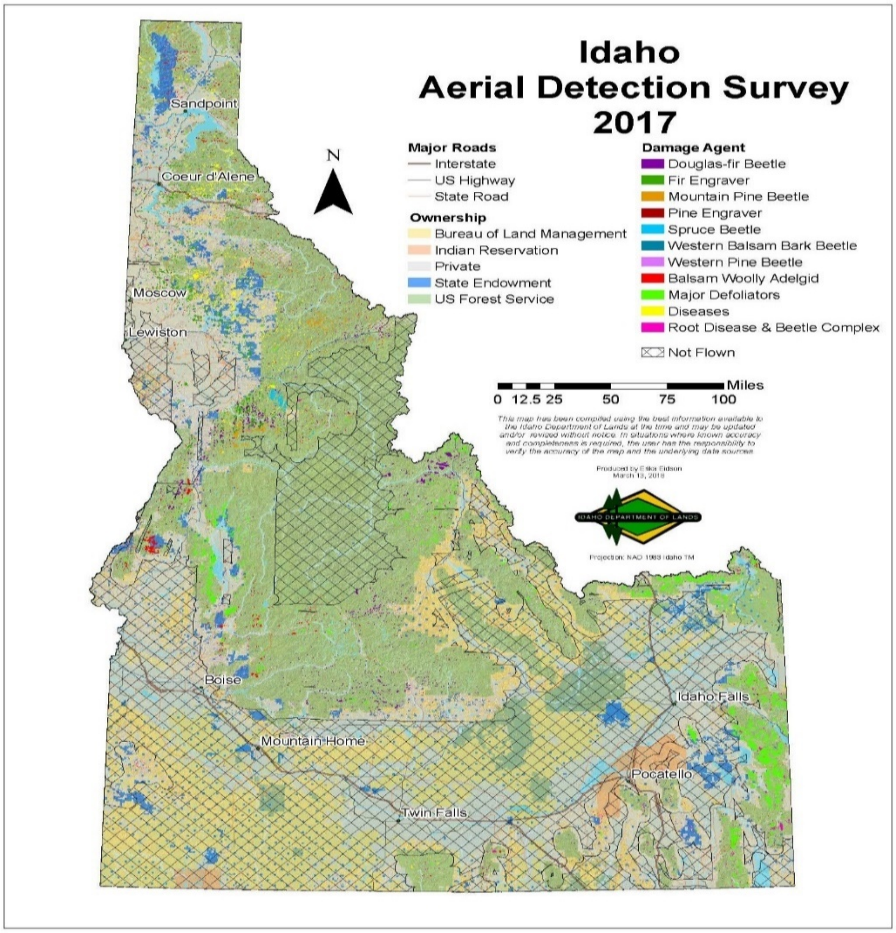
Idaho's Forests

More than 50 percent of Idaho is forested (Idaho Firewise 2018). Idaho has over 21 million acres of forest land, from the Canadian border in the north, to the Great Basin in the south. Elevations range from less than 1,000 feet along the Clearwater River valley to over 11,000 feet in the Sawtooth Range of southern Idaho. The mixed conifer forests in the Panhandle area can be moist forest types that include tree species found on the Pacific Coast such as western hemlock, Pacific yew, and western redcedar. Southern Idaho forests are generally drier, and ponderosa pine and Douglas-fir are most common. Lodgepole pine, Engelmann spruce, whitebark pine and subalpine fir occur at higher elevations or more northerly latitudes throughout the state. The majority of forest land in Idaho is owned by the Federal government (> 16 million acres), and of this, most is administered by the U.S. Forest Service. The state of Idaho owns just under 1.3 million acres, and private landowners own an additional 2.8 million acres. The various owners often have different management objectives (https://www.fs.fed.us/foresthealth/docs/fhh/ID_FHH_2014.pdf).

Forest Health

A forest is a dynamic system, continually changing in response to disturbances. Some disturbances help maintain native species and historic conditions and others threaten them. In urban forests or in campgrounds, agents of change, like disease, fire, insects and weather damage are often undesirable. They put facilities as well as visitors at some level of risk. However, in wilderness areas these same elements are considered desired components of a functioning ecosystem. It is the use or objective in managing the forest that determines how these agents of change are viewed as either desirable or undesirable (Idaho Forest Products Commission, 2018).

Table 3.1.E. Idaho Aerial Detection Survey 2017



Source: https://www.idl.idaho.gov/forestry/forest-health/id_ads_2017.pdf

Forest health plays a key role in fuels availability for wildfire. A total of 27.1 million acres were surveyed in Idaho in 2017, compared to 27.2 million acres in 2016. It is important to remember that trees attacked by bark beetles do not usually change color until the following year, so mortality observed in 2017 actually represents trees that were attacked in 2016. The 2017 Forest Health Highlights reported that aerial detection survey results yielded the following:

Bark Beetles. In 2017, mountain pine beetle caused mortality decreased slightly to 28,000 acres. Most of the mortality was in lodgepole pine, but approximately 900 acres of ponderosa pine were affected in 2017, continuing a downward trend from peak of 1.9 million acres in 2010. The decrease is due to host depletion, though large diameter lodgepole pine stands over 80 years old will remain susceptible to attack. Douglas-fire beetle cause mortality on over 49,000 acres in 2017 compared to approximately 30,000 acres in 2016. Fir engraver mortality increased to over 55,000 acres. Western pine beetle mortality decreased to approximately 4,000 acres but pine engraver mortality was recorded at a level similar to 2016. The Boise National Forest and the Boise Basin have been significantly impacted by the beetles. During periods of extended drought, pine trees become water-stressed and their defenses are reduced, giving the beetles an advantage. The beetles also exploit trees damaged in wildfires leading to increased tree mortality within the fire boundary and adjacent areas. The dying trees may increase fuel loads and the risk of fire. The fuel accumulation in pine stands varies, resulting in variability fire severity. As crown fires are a hazard to Idaho, fire danger may be increased while the dead needles are still on the trees. Once the needles fall off, the risk of crown fires is decreased. But when the trees die and fall down, the risk of fire may increase again. Research has shown that beetle-killed trees can hold 10 times less moisture than live trees. This means that they will ignite more quickly, burn more intensely, and carry embers farther than live trees.

Defoliators. Western spruce budworm is a major defoliator of Douglas-fir and grand fir in Idaho. Approximately 260,000 acres were affected in 2017 compared to over 740,000 acres in 2016. Most of the defoliation is in southern Idaho. Douglas-fir tussock moth populations increased in southern Idaho in 2017, and caused limited defoliation near Craters of the Moon National Monument and in the Sawtooth and Boise National Forests in 2017. Populations are expected to collapse in 2018. No defoliation is expected in northern Idaho in 2018.

Other Agents. Approximately 47,000 acres were affected by larch needle cast in 2017, compared to 4,000 acres in 2016. Mortality of subalpine fir, attributed to balsam, western balsam bark beetle and possible root disease decreased in 2017 to approximately 38,000 acres down from 56,000 acres recorded in 2016. (https://www.fs.fed.us/foresthealth/docs/fhh/ID_FHH_2017.pdf).

Idaho's forests are also significantly impacted by diseases, but not all diseases are easily detected from the air. With the exception of foliar diseases, most forest diseases are not well represented by aerial detection surveys. Root diseases are very common in northern Idaho, affecting over 8 million acres, with most mortality occurring in Douglas-fir, grand fir, and subalpine fir in northern Idaho. Dwarf mistletoes infect over 2.5 million acres of forest statewide. These parasites are especially damaging on western larch, Douglas-fir, lodgepole pine and ponderosa pine. White pine blister rust is widespread throughout the range of western white pine, whitebark and limber pines, affecting millions of trees, though an acreage estimate would be difficult to determine (https://www.fs.fed.us/foresthealth/docs/fhh/ID_FHH_2017.pdf).

Roughly 41 percent of Idaho is covered in forests. Over time, the trees in these forests grow thick and close together, along with other vegetation, both dead and alive. When this happens, the forest needs to be cleaned out to keep trees healthy. Wildfire helps forests to "clean themselves" by burning dead trees and other vegetation, along with the crowded plants and trees. Some wildfires burn all vegetation in a forest, but many of them burn in a "mosaic" pattern, which means that not all trees and vegetation are burnt. After a wildfire, new vegetation has room to grow. Trees can start to rejuvenate, and new trees sprout because they have access to sunlight. Tender grasses begin to grow, which attracts wildlife such as elk, deer, and antelope.

Forest Economics

Idaho has a productive forest industry, with 2017 revenues of wood and paper products totaling over $2.3 billion. An estimated 14,090 people were directly employed in the forest products industry in 2017, and an additional 22,173 people are employed in associated occupations. Most of Idaho's commercial forestland and larger production facilities are located north of the Salmon River. Forest products from Idaho's forests are sold throughout the world. Forest products industry jobs and worker income depend upon the harvesting of timber. During 2017 timber harvest volume in Idaho was estimated to be about

1.11 billion board feet (Scribner log scale), a decrease of about 18 percent from 2016, but a substantial increase from the recession induced level of 746 million board feet in 2009. Today each million board feet of timber harvested and processed in the state provides approximately 22 jobs (12 in the forest products industry plus 10 indirect or induced jobs in supporting industries), $2.02 billion in wages and salaries, and generates more than $3.77 billion in sales of goods and services. Since the mid 1990's, Idaho’s forest products industry has been sustained primarily by timber harvests from private and state lands. During 2017, private lands provided 65 percent of Idaho’s timber harvest volume, while state lands provided 20 percent. About 15 percent of the timber harvest volume came from U.S. National Forest System lands (http://www.idahoforests.org/docs/fast-facts/Idaho-forest-industry_2014-15_final.pdf).

Human Impact on Forest

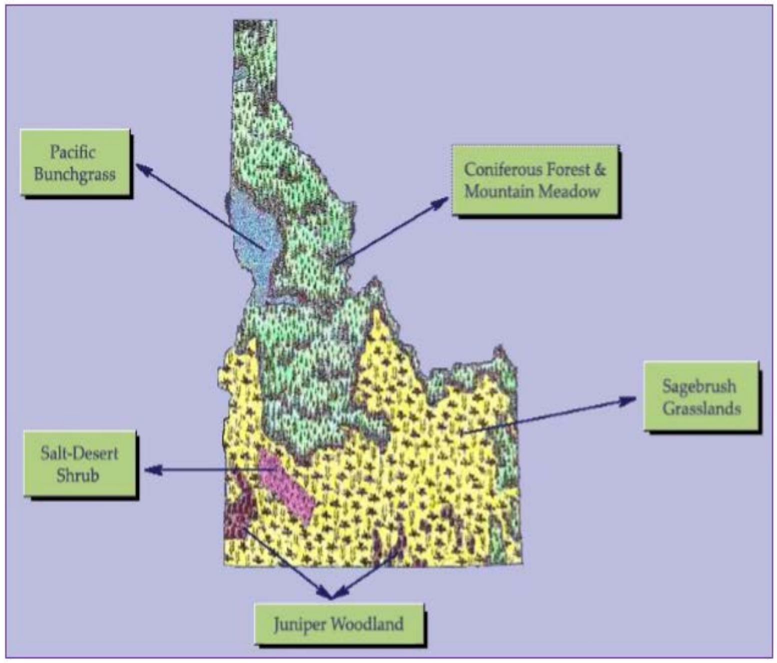
Another issue is the fire hazard and threat to life and personal property presented by abundant dead or dying trees. While urban areas throughout the Interior West have experienced population booms in the past decade, so have rural areas. Many people continue to seek rural locations with nearby recreational opportunities. While some counties are growing faster than others in Idaho, the state as a whole has been growing at an estimated rate of 18 percent per year since 1990. Much of the development that supports this influx of people is in, or adjacent to, forested lands. While some of that development is taking place near Idaho's larger population centers, there is also a substantial amount of new dispersed housing in rural counties. Valley County, in the central portion of the state, is a good example of the growth phenomenon. The county is estimated to be expanding at a rate of about 31 percent. Much of the land within the county's borders is both forested and government owned. About 20 percent of the land base are in private ownership and, therefore, potentially available for residential development. Nearly all of that development is in close proximity to the surrounding forest lands. The problem in terms of fire management is obvious. The probability of human-ignited fire is greater where there is more people, and there is an ever-increasing population in the wildland interface. More fire starts in conjunction with dense forests and hot or windy weather conditions, increases the possibility of fires capable of destroying homes and putting human lives at risk (http://www.idahoforests.org/health1.htm). WUI is further expanded upon in this chapter.

Idaho's Rangelands

Rangelands form the majority of the remaining land in the State that is not used for agriculture. Rangelands predominate in the Southwest, Central, and Southeast planning regions of Idaho.

Types of Rangeland in Idaho

Rangelands in Idaho include canyon grasslands, Palouse prairie, sagebrush-steppe, cold desert shrublands, juniper woodlands, aspen savannahs, mountain meadows, and streamside riparian communities. The geographic and climatic regimes of Idaho's rangelands are very diverse, creating many unique plant communities and habitats that are well adapted to these conditions. Low precipitation in these areas, often less than 10 inches per year, throughout most of Idaho creates plant communities, such as grasslands and shrublands, that can survive hot, dry summers (University of Idaho and Idaho Rangeland Commission, 2009).



Source: https://fishandgame.idaho.gov/sites/Wildlife/IDMasterNaturalist/DeerFlat/Curriculum%20Chapters/121Rangelands.pdf

Sagebrush Grasslands. This rangeland type is a mix of sagebrush and bunchgrass that dominates about 18.5 million acres in southern Idaho. These rangelands stretch across the plains, plateaus, and valleys south of the Salmon River. Lower elevations support stands of shorter and smaller shrubs compared to taller "savanna-like" stands at higher elevations. Precipitation generally ranges from 10 to 18 inches per year. Big sagebrush is the main type of sagebrush in Idaho. The shrub-grass mix provides good spring and fall grazing for livestock and wildlife. Sage grouse, pronghorn antelope, deer, and black-tailed jackrabbits call sagebrush grasslands home, and rely on this type of ecoregion for survival (University of Idaho and Idaho Rangeland Commission, 2009).

Juniper Woodlands. In southern Idaho, two kinds of small evergreen trees, Western juniper and Utah juniper, create a kind of "pygmy forest" covering about 1.6 million acres. Juniper woodlands usually occur on the rougher terrain and can be dense or open depending on soils and topography. These woodlands usually occur in scattered patches rather than solid stands. Annual precipitation in this area ranges from 12 to 30 inches per year. The juniper woodlands are important "watersheds" that yield water for agriculture and other human uses. The woodlands are also important winter range for wildlife, especially deer and songbirds. In addition, the juniper trees are often harvested for fence posts and other wood products. Western and Utah juniper are both common types of juniper found on these rangelands (University of Idaho and Idaho Rangeland Commission, 2009).

Salt-Desert Shrublands. In southern Idaho, dry deserts are created by salty soils and cold temperatures. Shrubs that are able to live in these salty soils dominate this "cold desert" covering 1.5 million acres. As the name suggests, soil salinity is a characteristic feature of this rangeland area. These shrublands get very little precipitation each year, usually 10 inches or less. Shrubs are generally better suited for these harsh conditions than grasses or forbs because of their deep root systems. Because these shrubs have high nutritive value in winter, salt deserts are excellent winter range for pronghorn antelope and are considered some of the world's best range for winter sheep grazing (University of Idaho and Idaho Rangeland Commission, 2009).

Pacific Bunchgrass. When settlers arrived in northern Idaho in the 1880's, they found mostly forest except for a few rolling prairies of bunchgrass that dominated about 1.2 million acres. These exploring farmers found the deep rich soils and moist climate of the Palouse and Camas prairies favorable for growing wheat and other crops. Precipitation in this area ranges from 12-30 inches per year. Today most of the prairies have been converted to farmland, and very little of the native bunchgrass remains. The existing canyon and foothill grasslands continue to provide high quality spring forage for sheep and cattle and good winter habitat for deer and quail. Predominant native grasses in the Pacific Bunchgrass region are bluebunch wheatgrass, Sandberg bluegrass, and Idaho fescue (University of Idaho and Idaho Rangeland Commission, 2009).

Fires are a natural disturbance that can have a positive or negative effect in the places where they occur. Fire naturally served a role in maintaining rangeland health, plant composition and diversity in many communities. Plants, animals, and insects in fire-adapted ecosystems have evolved mechanisms to tolerate or even benefit from fire. Adaptations include: long lived seeds that are activated by fire, quick germination and regrowth after fire, thick bark resilient to fire, and seed production activated by fire. For example, plants in the othus genus (a rangeland shrub) contain a waxy coating on the seed surface that is dependent on heat treatment from fire to break seed dormancy and promote germination. Antelope bitterbrush, rabbitbrush, and several other rangeland shrubs have adapted to sprout quickly after a fire, utilizing the increase of minerals and nutrients that are present in the ash. Grasses often come to dominate shrublands and woodlands after fire because the woody plants are removed and the grasses are better adapted to fire (University of Idaho and Idaho Rangeland Commission, 2009).

However, if fires are too frequent or intense, plant cover and organic matter at the soil surface can be reduced. Fire almost always results in a loss of nutrients through volatilization, oxidation, ash transport, and erosion. The potential damage to plants and amount of dead plant material that is converted to bioavailable nutrients depends on how hot the fire burned. Generally, low intensity burns increase plant productivity, while high intensity burns result in decreased productivity and plant diversity. A change of fire interval (i.e., the time between fires) or improper timing of fire during the season can deplete native plant communities of desirable perennial plants. Over time, repeated burning can result in severe impacts, including loss of perennial plants, an increase in frequency of weedy plants, increased erosion, and a change in nutrient cycling (University of Idaho and Idaho Rangeland Commission, 2009).

In Idaho and many other western states, land managers are concerned about cheatgrass invasion and its ability to shorten the interval between fire events. When cheatgrass goes dormant it creates a bed of fine fuels that are easily ignited and can burn rapidly and frequently across the landscape. Fine fuel created by cheatgrass recover and grow when wildfires occur every few years, which can happen on cheatgrass dominated rangelands.

Rangeland Economics

Rangelands also provide important habitat for domestic livestock, including cattle, sheep, goats, and horses. Most of the world's livestock live on rangelands and serve as a highly significant and necessary source of food and livelihood for people all over the globe. Ranching is an important endeavor that uses livestock to convert the nutritious and renewable grasses and other plants on rangelands into food, fiber, and other animal-based products for humans. Livestock production on rangeland is very important to supply meat for American and world populations. Rangelands are the primary source of our meat supply (University of Idaho and Idaho Rangeland Commission, 2009):

- Livestock grazing occurs on 65% of Idaho's total land area and in every county throughout the state.
- Range livestock production is one of Idaho's major agricultural activities in terms of land used and cash receipts.

The University Of Idaho College Of Natural Resources Policy Analysis Group completed an analysis of the financial performance of Idaho's Endowment Rangelands in March of 2016. This analysis used an income capitalization approach, land expectation value (LEV), to compare the value of endowment rangelands for livestock grazing over time and at different grazing lease rates. For the period FY 2011 to FY 2015, LEV at a 4% discount rate for Idaho's endowment rangelands averaged $41.4 million.

Table 3.1.F Summary Statistics and Financial Performance Indicators

Table 1. Summary statistics and financial performance indicators, Idaho endowment rangeland, FY 2011-2015

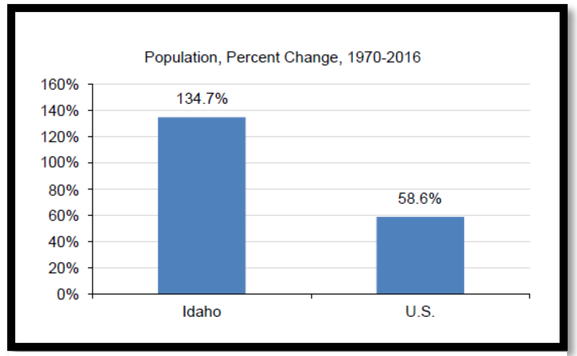
Statistics and Performance Indicators (2015 $)	FY2011	FY2012	FY2013	FY2014	FY2015	FY13-FY15 Average	FY11-FY15 Average
(a) Acres leased for grazing	1,765,301	1,765,301	1,789,596	1,785,843	1,793,615	1,789,685	1,779,931
(b) Animal unit months (AUMs) authorized	256,886	260,000	258,324	258,946	259,157	258,809	258,663
(c) Grazing fee, Idaho endowment land ($/AUM)	$5.13	$5.25	$6.36	$6.89	$6.77	$6.67	$6.08
(d) Cash income from grazing	$1,986,605	$1,409,895	$1,973,146	$2,170,499	$2,265,606	$2,136,417	$1,961,150
Nominal cash income from grazing (with bonus bid)	$1,878,863	$1,439,217	$1,932,652	$2,160,442	$2,265,606	$2,119,567	$1,935,356
Nominal direct income from bonus bids	$561,038	$74,217	$289,711	$376,304	$511,113	$392,376	$362,477
(e) Cash expenditures for management	$1,014,024	$1,306,061	$1,279,569	$1,391,850	$1,454,532	$1,375,317	$1,289,207
Nominal case expenditures for management	$959,029	$1,260,790	$1,253,309	$1,385,401	$1,454,532	$1,364,414	$1,262,612
(f) Net income	$972,581	$103,834	$693,577	$778,649	$811,074	$761,100	$671,943
Nominal net income	$919,834	$178,427	$679,343	$775,041	$811,074	$755,155	$672,744
(g) Net income per AUM	$3.79	$0.40	$2.68	$3.01	$3.13	$2.94	$2.60
(h) Net income per acre	$0.55	$0.06	$0.39	$0.44	$0.45	$0.43	$0.38
(i) Idaho private land grazing fee ($/AUM)	$15.86	$16.06	$15.82	$16.58	$17.00	$16.47	$16.26
Nominal Idaho private land grazing fee ($/AUM)	$15.00	$15.50	$15.50	$16.50	$17.00	$16.33	$15.90
(j) Fee adjustment factor, private to public	0.7	0.7	0.7	0.7	0.7	0.7	0.7
(k) Fair market value public land grazing fee ($/AUM)	$11.10	$11.24	$11.07	$11.61	$11.90	$11.53	$11.38
(l) Attainable net income from grazing[1]	$1,837,924	$1,616,859	$1,581,111	$1,613,477	$1,629,436	$1,608,008	$1,655,762
(m) Land expectation value (LEV) @ 4%[2]	$45,948,109	$40,421,475	$39,527,774	$40,336,932	$40,735,908	$40,200,205	$41,394,040
(n) LEV per acre @ 4%	$26.03	$22.90	$22.09	$22.59	$22.71	$22.46	$23.26
(o) Return on assets, grazing income (ROA_G)[3]		0.2%	1.7%	2.0%	2.0%	1.9%	1.7%
(p) Return on assets, land value (ROA_L)[4]		-12.0%	-2.2%	2.0%	1.0%	0.3%	2.1%
(q) Total return on assets (ROA_{G+L})		-11.8%	-0.5%	4.0%	3.0%	2.2%	3.8%
(r) Land expectation value (LEV) @ 6%[2]	$30,632,073	$26,947,650	$26,351,850	$26,891,288	$27,157,272	$26,800,136	$27,596,026
(s) LEV per acre @ 6%	$17.35	$15.27	$14.73	$15.06	$15.14	$14.97	$15.51
(t) Return on assets, grazing income (ROA_G)[3]		0.3%	2.6%	3.0%	3.0%	2.8%	2.5%
(u) Return on assets, land value (ROA_L)[4]		-12.0%	-2.2%	2.0%	1.0%	0.3%	2.1%
(v) Total return on assets (ROA_{G+L})		-11.7%	0.4%	5.0%	4.0%	3.1%	4.6%

[1] ((b) x (k)) - (e)
[2] (l) / "discount rate"
[3] ((f) / $(m)_{t-1}$ from previous year) x 100
[4] ((m) - $(m)_{t-1}$ for previous year) / ($(m)_{t-1}$ for previous year) x 100

Source:https://www.idl.idaho.gov/leasing/grazing/rate/pag-17-financial-performance-idaho-endowment-rangelands.pdf

Wildland-Urban Interface (WUI)

The WUI is the area where structures and other human development meet or intermingle with developed wildland. The character of the WUI ranges from urban areas adjoining wildlands to isolated ranches or cabins. In recent years, the expansion of the WUI has significant implications for wildfire management and impact. The WUI creates an environment in which fire can move easily between structural and vegetative fuels. The expansion of the WUI has increased the likelihood that wildfires will threaten structures and people (SILVIS Lab 2017). In Idaho, only 14-percent of the WUI is developed (University of Idaho 2016).



Source: *https://headwaterseconomics.org/tools/economic-*

When a fire occurs within the WUI, the job of firefighting becomes more complex. Since 1993, the number of structures in the WUI has nearly doubled. As the number of structures in the WUI continues to increase, concerns over public safety and the protection of improvements increases (IDL Year End Fire Report 2016). The population increase within the state can also mean that the WUI will continue to grow. According to the headwaters economics report, Idaho had a 135% population growth between 1970 and 2016. This greatly affects the WUI and increases the wildfire threat. In 2016, WUI fires were not as damaging as prior years. Fifty percent of IDL fires started in the WUI, burned 10 percent of the acreage, and accounted for 7 percent of the total cost of suppression. Of the WUI fires, 76 percent were human-caused.

WUI ACRES BURNED BY CAUSE WITH COSTS

General Cause	Acres Burned	% of Acreage	Total Cost	% of Cost	Cost/ Acre
Human-Caused					
Arson	74.0	51.0%	$64,293	23.9%	$869
Equipment Use	33.1	22.8%	$15,538	5.8%	$470
Debris Burning	30.5	21.0%	$71,189	26.4%	$2,334
Miscellaneous	5.4	3.7%	$87,462	32.5%	$16,348
Campfire	1.9	1.3%	$27,072	10.0%	$14,174
Smoking	0.2	0.1%	$3,938	1.5%	$19,692
Railroad	0.0	0.0%	$0	0.0%	$0
Children	0.0	0.0%	$0	0.0%	$0
Total Human	145	100%	$269,493	100%	$1,859
Human and Lightning					
Lightning	11.3	7%	$85,530	24%	$7,569
Human	145.0	93%	$269,493	76%	$1,859
Grand Total	156.3	100%	$355,023	100%	$2,272

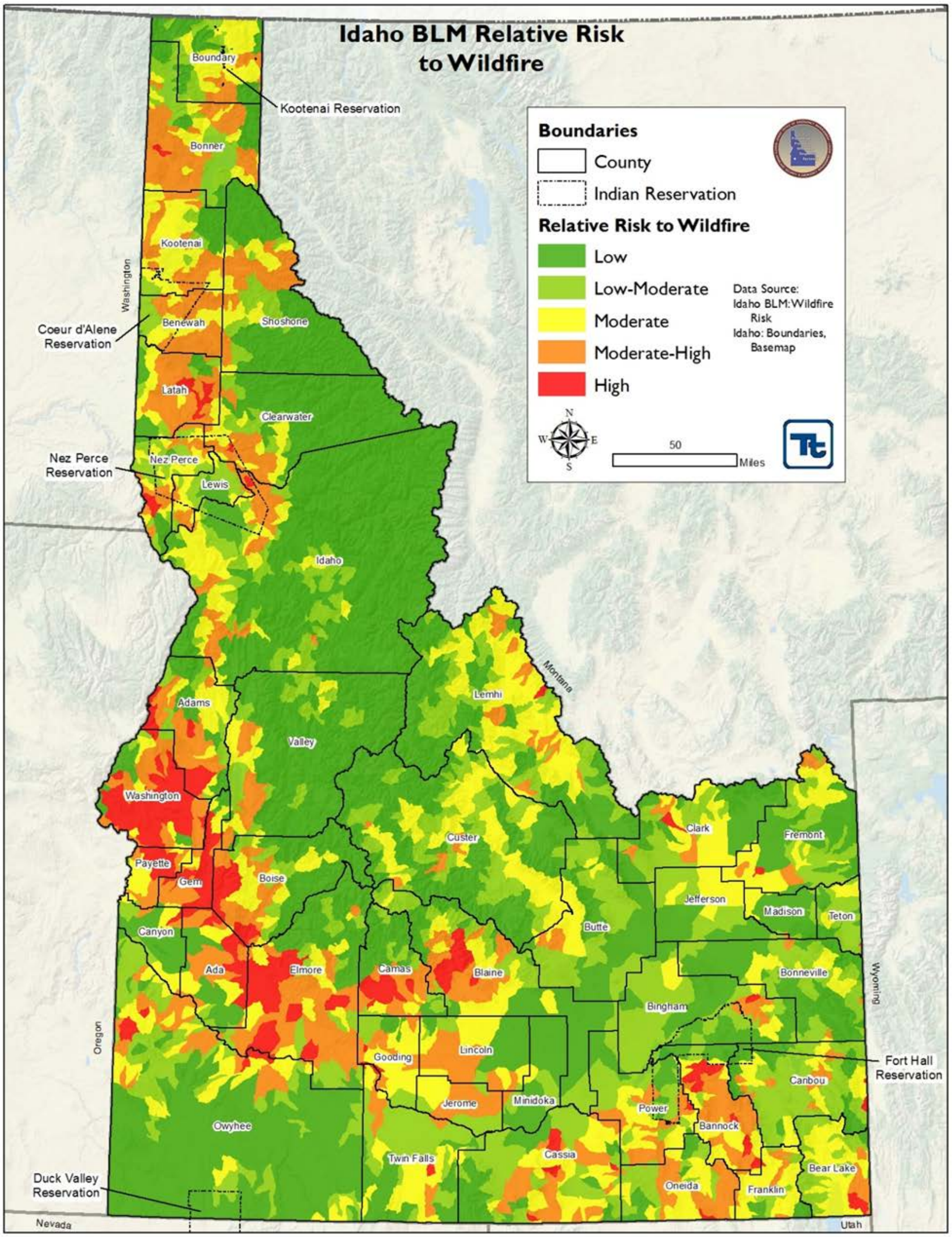
Minor discrepancies exist due to rounding

Figure 3.1.G. WUI Acres Burned

Source: https://www.idl.idaho.gov/fire/2016-year-end-fire-report.pdf

Figure 1.1.G depicts the locations of highest vulnerability based on WUI boundaries throughout the State. As seen in the figure, the southwestern portion of the State has the highest risk. This includes Washington, Payette, Gem, Boise, Ada, Elmore, Camas, and Blaine Counties. It is in the WUI that the protection of structures from wildland fires is most challenging and human-caused fire ignitions are most common.

Figure 1.1.H. WUI in Idaho



Extent

Land managers need to understand current and historical fire regimes (fire frequency and fire severity prior to significant human settlement) to be able to define ecologically appropriate goals and objectives for an area. This understanding must include knowledge of how historical fire regimes vary across the landscape. A forest is typically designated as one of five fire regime groups (FRG), depending on the forest's frequency and severity of burning. The regimes are classified based on average number of years between fires (fire frequency) and severity of the fire (amount of replacement) on the dominant overstory vegetation (Table 3.1.I) (National Wildfire Coordinating Group 2017).

Table 3.1.I. Fire Regime Groups and Descriptions

Group	Frequency	Severity	Severity Description
I	0 – 35 years	Low / mixed	Generally low-severity fires replacing less than 25% of the dominant overstory vegetation; can include mixed-severity fires that replace up to 75% of the overstory
II	0 – 35 years	Replacement	High-severity fires replacing greater than 75% of the dominant overstory vegetation
III	35 – 200 years	Mixed / low	Generally mixed-severity; can also include low-severity fires
IV	35 – 200 years	Replacement	High-severity fires
V	200+ years	Replacement / any severity	Generally replacement-severity; can include any severity type in this frequency range

Source: USGS 2008

Understanding how an ecosystem's processes and functions have changed provides a context for management sustainable ecosystems. Fire Regime Condition Classes (FRCC) are used to determine reference conditions and they categorize and describe vegetation composition and structure conditions that currently exist inside the FRG. FRCC is based on the coarse-scale national data and serve as generalized wildfire rankings. The classification is based on a relative measure describing the degree of departure from the historical fire regime. (National Wildfire Coordinating Group 2017). The ranking classes are low (FRCC 1), moderate (FRCC 2), and high (FRCC 3) based on vegetative departure. Low departure is considered to be within the historical range of variability, while moderate and high departures are outside.

This departure results in changes to one or more of the following ecological components:

- Vegetation characteristics (species composition, structural stages, stand age, canopy closure, and mosaic pattern);
- Fuel compositions;
- Fire frequency, severity, and pattern; and
- Other associated disturbances (for example insect and disease mortality, grazing, and drought).

Characteristic vegetation and fuel conditions are those that occurred within the historical, natural fire regime. Uncharacteristic conditions are those that did not occur within the historical fire regime, such as invasive species (for example, weeds, insects, and diseases), "high graded" forest composition and structure (for example, large trees removed in a frequent surface fire regime), or repeated annual grazing that reduces grassy fuels across relatively large areas to levels that will not carry a surface fire.

Determination of the amount of departure is based on comparison of a composite measure of fire regime attributes (Hann and Strohm 2003). Table .J displays the FRCC, their descriptions and their potential risks.

Table 3.1.J. Fire Regime Condition Classes

Fire Regime Condition Class	Description	Potential Risks
FRCC 1	Vegetation composition, structure, and fuels are similar to those of the natural regime and do not predispose the system to risk of loss of key ecosystem components. Wildland fires are characteristic of the natural fire regime behavior, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are within the natural range of variability.	• Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics. • Composition and structure of vegetation and fuels are similar to the natural (historical) regime. • Risk of loss of key ecosystem components (e.g. native species, large trees and soil) is low.
FRCC 2	Vegetation composition, structure, and fuels have moderate departure from the natural regime and predispose the system to risk of loss of key ecosystem components. Wildland fires are moderately uncharacteristic compared to the natural fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are outside the natural range of variability	• Fire behavior, effects, and other associated disturbances are moderately departed (more or less severe). • Composition and structure of vegetation and fuel are moderately altered. • Uncharacteristic conditions range from low to moderate. • Risk of loss of key ecosystem components is moderate.
FRCC 3	Vegetation composition, structure, and fuels have high departure from the natural regime and predispose the system to high risk of loss of key ecosystem components. Wildland fires are highly uncharacteristic compared to the natural fire regime behaviors, severity, and patterns. Disturbance agents, native species habitats, and hydrologic functions are substantially outside the natural range of variability.	• Fire behavior, effects, and other associated disturbances are highly departed (more or less severe). • Composition and structure of vegetation and fuel are highly altered. • Uncharacteristic conditions range from moderate to high. • Risk of loss of key ecosystem components is high.

Source: Hann and Strohm 2003

Table 3.1.K displays the Fire Regime Groups (FRG), by County, for all of Idaho. FRGs characterize the presumed historical fire regimes within landscapes based on interactions between vegetation dynamics, fire spread, fire effects, and spatial context. It categorizes simulated mean fire return intervals and fire severities into five fire regimes (LANDFIRE 2016). Each FRG has a fire return interval and includes:

- FRG I - ≤35 year fire return interval, low and mixed severity Data appears to be the same https://landfire.gov/DataDictionary/frg.pdf

FRG II - 35 year fire return interval, replacement severity
FRG III – 35-200 year fire return interval, low and mixed severity
FRG IV – 35-200 year fire return interval, replacement severity

FRG V - >200 year fire return interval, any severity

Table 1.1.K. Fire Regime Groups by County

County	Total Area	FRG I	% Total Area	FRG II	% Total Area	FRG III	% Total Area	FRG IV	% Total Area	FRG V	% Total Area
Ada County	1,059.8	32.8	3.1%	0.2	<1%	39.5	3.7%	960.0	90.6%	15.8	1.5%
Adams County	1,369.5	519.0	37.9%	7.3	<1%	424.1	31.0%	389.0	28.4%	19.5	1.4%
Bannock County	1,150.5	203.8	17.7%	0.0	0%	131.2	11.4%	777.6	67.6%	8.8	<1%
Bear Lake County	1,052.8	141.4	13.4%	0.7	<1%	192.9	18.3%	558.5	53.1%	83.8	8.0%
Benewah County	785.5	200.7	25.6%	18.2	2.3%	505.3	64.3%	42.3	5.4%	8.4	1.1%
Bingham County	2,122.2	16.8	<1%	0.0	<1%	137.4	6.5%	1,771.5	83.5%	63.9	3.0%
Blaine County	2,655.9	1,092.0	41.1%	0.1	<1%	441.3	16.6%	796.8	30.0%	11.0	<1%
Boise County	1,907.0	1,106.5	58.0%	118.7	6.2%	382.7	20.1%	268.6	14.1%	16.4	<1%
Bonner County	1,918.3	262.6	13.7%	14.6	<1%	1,221.0	63.7%	210.4	11.0%	20.7	1.1%
Bonneville County	1,904.8	2.2	<1%	0.3	<1%	323.4	17.0%	1,129.6	59.3%	321.7	16.9%
Boundary County	1,278.3	189.5	14.8%	7.8	<1%	684.3	53.5%	383.5	30.0%	0.4	<1%
Butte County	2,239.6	395.6	17.7%	1.2	<1%	660.1	29.5%	908.2	40.6%	61.1	2.7%
Camas County	1,076.7	549.3	51.0%	0.0	<1%	354.8	33.0%	161.8	15.0%	3.9	<1%
Canyon County	604.0	0.0	0%	0.0	0%	0.0	<1%	583.6	96.6%	2.2	<1%
Caribou County	1,806.0	105.2	5.8%	0.2	<1%	212.0	11.7%	1,189.7	65.9%	270.7	15.0%
Cassia County	2,578.5	132.0	5.1%	0.0	0%	447.2	17.3%	1,774.8	68.8%	208.5	8.1%
Clark County	1,768.2	329.2	18.6%	11.5	<1%	564.0	31.9%	696.6	39.4%	152.1	8.6%
Clearwater County	2,488.3	104.6	4.2%	13.4	<1%	1,838.5	73.9%	486.9	19.6%	17.8	<1%
Custer County	4,938.7	1,579.8	32.0%	12.2	<1%	2,278.0	46.1%	628.6	12.7%	247.7	5.0%
Elmore County	3,102.0	1,357.6	43.8%	6.0	<1%	343.6	11.1%	1,266.6	40.8%	92.2	3.0%
Franklin County	669.8	130.4	19.5%	0.4	<1%	105.8	15.8%	404.4	60.4%	22.1	3.3%
Fremont County	1,901.9	17.4	<1%	2.4	<1%	390.3	20.5%	978.7	51.5%	462.3	24.3%
Gem County	564.6	59.0	10.4%	3.6	<1%	77.5	13.7%	417.4	73.9%	1.9	<1%
Gooding County	734.9	0.8	<1%	0.0	0%	98.6	13.4%	630.5	85.8%	0.2	<1%
Idaho County	8,499.7	1,622.1	19.1%	271.1	3.1%	3,614.6	42.5%	2,885.9	34.0%	72.9	<1%
Jefferson County	1,106.7	1.6	<1%	0.0	0%	34.8	3.1%	1,004.6	90.8%	49.7	4.5%
Jerome County	601.9	1.5	<1%	0.0	0%	0.2	<1%	597.3	99.2%	0.0	<1%
Kootenai County	1,309.0	465.4	35.6%	40.8	3.1%	650.8	49.7%	45.3	3.5%	30.2	2.3%
Latah County	1,076.4	349.8	32.5%	116.3	10.8%	503.1	46.7%	98.2	9.1%	8.3	<1%
Lemhi County	4,572.1	1,893.9	41.4%	32.4	<1%	1,953.1	42.7%	446.0	9.8%	103.5	2.3%
Lewis County	480.4	343.5	71.5%	29.8	6.2%	52.0	10.8%	53.4	11.1%	0.4	<1%
Lincoln County	1,205.9	1.6	<1%	0.0	0%	18.9	1.6%	1,178.6	97.7%	0.0	<1%
Madison County	474.6	3.7	<1%	0.1	<1%	48.0	10.1%	394.8	83.1%	19.2	4.0%
Minidoka County	766.1	0.3	<1%	0.0	0%	0.1	<1%	648.7	84.7%	0.0	<1%

County	Total Area	FRG I	% Total Area	FRG II	% Total Area	FRG III	% Total Area	FRG IV	% Total Area	FRG V	% Total Area
Nez Perce County	855.1	384.1	44.9%	243.3	28.4%	34.9	4.1%	177.8	20.8%	1.4	<1%
Oneida County	1,203.1	61.3	5.1%	0.0	<1%	106.1	8.8%	994.1	82.6%	39.6	3.3%
Owyhee County	7,694.6	172.9	2.2%	658.0	8.6%	2,558.1	33.1%	3,729.9	48.5%	523.6	6.8%
Payette County	410.3	0.0	<1%	0.0	0%	1.0	<1%	405.4	98.8%	0.0	<1%
Power County	1,442.9	100.2	6.9%	0.0	0%	59.3	4.1%	1,179.6	81.7%	10.8	<1%
Shoshone County	2,642.4	203.4	7.7%	0.3	<1%	1,669.1	63.1%	762.1	28.8%	2.0	<1%
Teton County	451.1	5.3	1.2%	0.0	<1%	125.1	27.7%	236.8	52.5%	81.9	18.2%
Twin Falls County	1,928.0	40.4	2.1%	0.0	0%	231.2	12.0%	1,644.6	85.3%	0.6	<1%
Valley County	3,735.2	1,090.0	29.2%	60.9	1.6%	1,193.3	31.9%	1,228.9	32.9%	91.8	2.5%
Washington County	1,473.6	183.8	12.5%	27.4	1.9%	322.4	21.9%	913.3	62.0%	4.6	<1%
Idaho Total	**83,606.9**	**15,453.0**	**18.5%**	**1,699.1**	**2.0%**	**25,029.6**	**29.9%**	**36,041.1**	**43.1%**	**3,153.7**	**3.8%**

Source: LANDFIRE 2016

Impacts

Severity

Potential losses from wildfire includes human life, property, infrastructure, and natural resources; they can have considerable social and economic costs. These costs have risen substantially in recent years and can be particularly high in the WUI, where considerable resources are spent on the protection of homes and other structures. The most publicized costs associated with wildfire are those to fight, or suppress, large wildfires. Both federal and state expenditures related to wildfire have increased, spending on wildfire protection, prevention, and suppression. In addition to suppression costs, there are other costs associated with wildfires: costs of restoring burned areas, lost tax and business revenues, property damage and/or devaluation, and costs to human health and lives.
Smoke and air pollution from wildfires can be a health hazard, especially for sensitive populations including children, the elderly, and those with respiratory and cardiovascular diseases. Wildfire may also threaten the health and safety of those fighting the fires. First responders are exposed to the dangers from the initial incident and after-effects from smoke inhalation and heat stroke. In addition, wildfire can lead to ancillary impacts such as landslides in steep ravine areas and flooding caused by the impacts of silt in local watersheds.

Within the WUI, risks are associated with the probability that an area will burn, its severity, and the likely behavior of fire in the area. It was assumed that burn probability and fire behavior contribute equally to the risks to communities. Agriculture areas, rock, urban areas, and water are not assigned a burn probability or relative fire behavior. Communities with these cover classes are assumed to not be at risk from wildfire.

Fire severity provides a description of how fire intensity affected ecosystems, particularly following wildfires where direction information on fire intensity was absent and effects are variable within and between different ecosystems. It refers to the loss or decomposition of organic matter aboveground and belowground. Burn severity refers to the loss of organic matter in or on the soil surface. The following classifications can be used to estimate soil heating by vegetative and physical conditions. They also assist with determining the intensity of wildfire. Wildfire burn intensity is useful in preparing rehabilitation plans and planning other post-fire activities. The following indicators assist with determining the intensity of a wildfire.

Table 3.1.L. Wildfire Burn Severity Classification

General Statements	Indicators	Interpretations
Low Fire Severity (Type III)		
• primarily occur on rangeland • no sediment delivery • natural recovery likely	• duff and debris are partly burned • soil is a normal color • hydrophobicity is low to absent • standing trees may have some brown needles	• root crowns and surface roots will resprout quickly • infiltration and erosion potential are not significantly • changed
Medium Fire Severity (Type II)		
• primarily occur on steep, lightly timbered slopes • with grass • some sediment delivery	• duff is consumed • burned needles are still evident • ash is generally dark colored • hydrophobicity is low to medium on surface soil up to 1 inch deep • soil is brown to reddish-brown and up to 2 inches of soil is darkened from burning (below ash) • roots are alive below 1 inch • shrub stumps and small fuels are charred but present • standing trees are blackened but not charcoal	• root crowns will usually resprout • roots and rhizomes below 1 inch will resprout • most perennial grasses will resprout • vegetative recovery (non-tree), depending on • conditions, could be one to five years • soil erosion potential will increase due to the lack of ground cover and moderate hydrophobicity
High Fire Severity (Type I)		
• primarily occurs in unprotected drainages on steep, timbered, north or east slopes with dense forest canopy • sediment delivery likely • natural recovery limited	• duff consumed • uniformly gray or white ash (in severe cases ash is thin and white or light) • no shrub stumps or small fuels remain • hydrophobicity medium to high – up to 2 inches deep • 2 to 4 inches of soil is darkened (soil color often reddish orange) • roots burned 2 to 4 inches • soil physically affected (crusting, crystallization, agglomeration) • standing trees charcoal up to 1 inch deep	• soil productivity is significantly reduced • some roots and rhizomes will resprout but only those deep in soil • vegetative recovery (non-tree), depending on conditions, could be five to 10 years • soil erosion potential can be significantly increased

Source: University of Wyoming 2018

Warning Time

Wildfires are often caused by humans, intentionally or accidentally. There is no way to predict when one might break out. However, there are tools used to identify the possibility of fire weather in an area. Fire weather watches and red flag warnings are used to convey the possibility of severe fire weather to wildland fire agencies.

The National Weather Service (NWS) issues Fire Weather Watches and Red Flag Warnings to alert fire departments and residents of the onset, or possible onset, of critical weather and dry conditions that could lead to rapid or dramatic increases in wildfire activity. The watches, warnings, and evacuation notices are science-based predictions that are intended to provide adequate time for evacuation.

A fire weather watch is issued by the NWS when the potential for severe fire weather exists in the near future. A watch is used when there is a relatively low probability of occurrence and less chance of verifying. The fire danger rating is usually in the high to extreme category. It is normally issued 12 to 24 hours in advance of the expected onset of severe fire weather conditions and typically in conjunction with the routine narrative forecasts. The area affected, onset time, and a statement describing the conditions will be included in the forecast. A Red Flag Warning is issued by the NWS to indicate the imminent danger of severe fire weather and a relatively high probability of occurring. The fire danger is usually in the high to extreme category. A Red Flag Warning may or may not be preceded by a Fire Weather Watch. A Red Flag Warning will normally be issued for severe fire weather events less than 12 hours away from occurring. They are typically issued in conjunction with the routine narrative forecasts. The area affected, onset time, and a statement describing the conditions will be included in the forecast (NPS 2018).

Past Occurrence

The number of acres burned by wildfires in 2015 set a record for the U.S., and the 10 million acres that were consumed in 2016 is over four million acres more than the annual average over the previous 10 years. While the number of fires per year continues to fluctuate, there has been a downward trend since 2006. During that same time, however, the number of acres burned has done just the opposite, trending upward to the record setting year recorded in 2015. Fewer fires with more acres burned appears to be the trajectory of wildfires in the U.S. The obvious result is that larger fires, which are often more difficult to contain, can threaten larger numbers of properties (2016 Core Logic Wildfire Hazard Risk Report).

Idaho has experienced several large, long-lasting wildfires in recent years, which burned thousands of acres at a time. These fires are not always considered to be good for the forest, because they burn such a large amount of vegetation all at one time. Wildlife must find new areas to forage for food when thousands of acres have burned all at one time.

The 2013 Plan discussed specific wildfire events that occurred in Idaho through 2012. For this 2018 Plan update, wildfire events were summarized between January 1, 2012 and October 1, 2017. Table .1.M includes events discussed in the 2013 Plan and events that occurred between 2012 and 2017.

Table 3.1.M. Wildfires in Idaho, 2002 – 2016

Year	Total # of Wildfires	Total Acres Burned
2016	630	361,649
2015	1,324	804,094
2014	1,180	189,430
2013	1,471	722,204
2012	1,149	1,667,654
2011	1,094	384,103
2010	977	613,868
2009	1,142	22,681
2008	997	116,796
2007	1,473	1,980,552
2006	1,831	933,548
2005	1,154	442,391
2004	1,098	13,981
2003	1,834	313,546
2002	1,486	84,964
Average:	**1,256**	**576,764**

Source: NIFC 2017

Table 3.1.N. Wildfire Events in Idaho, 1910 – 2017

Date(s) of Event	Event Type	Counties Affected	Description
August 1910	1910 Fire		The following text was excerpted from an article written by Jim Kershner from the August 15, 2010, edition of the Spokesman-Review. Some came to call it The Big Blowup. Others called it the Big Burn. By any name, it was easily the biggest forest fire in the Inland Northwest's history – actually the biggest forest fire in U.S. history. A century ago, 3 million acres of North Idaho, Montana and Washington forest were turned to charcoal in two wind-whipped days. The towns of Taft, Haugan, DeBorgia in Montana, and Grand Forks and Falcon in Idaho, were destroyed. One-third of Wallace was obliterated. At least 85 people died. A forest the size of Connecticut was exploding in a fearsome whoosh – generating, with fire and oxygen, its own tornadoes and cyclones. One survivor called it "the sound of a thousand trains rushing over a thousand steel trestles." Another said it could be compared only to the "roar of Niagara Falls." The noise was a deafening combination of 60 mph gales, colossal fire-driven updrafts, and the clamor of hundreds of trees cracking, snapping and slamming against earth. One witness said it sounded like being in the midst of "heavy cannonading." 1910 began with a disastrously snowy winter and then turned into an ominously dry spring and summer. The first wildfires in the Northern Rockies flared up in the unheard-of month of April. The drought persisted into summer and by late June and early July crews already were patrolling the forest "reserves," as the national forests were then called, putting out dozens of spot fires. By late July and early August thousands of fires were smoldering deep in the mountains of Idaho, Montana and Washington.

Date(s) of Event	Event Type	Counties Affected	Description
			The smokiest areas of all were in the vast St. Joe River drainage and the more thickly settled Coeur d'Alene River drainage of North Idaho. The fires had three main sources. Lightning strikes (including hundreds on July 26 alone); people, mainly farmers, prospectors and loggers who were clearing land and burning slash; and railroads, including one of the most audacious and expensive rail lines ever built, the Chicago, Milwaukee, St. Paul and Pacific line (called The Milwaukee Road) completed a year earlier over the Bitterroots. "Locomotives threw sparks like a Roman candle chugging down the tracks," wrote Pyne. The forest rangers at Wallace acquired a small fleet of velocipedes, or "speeders," which were like bicycles that could be used on railway tracks. The rangers scooted along behind the trains and put out the fires alongside the tracks. By mid-August, thousands of firefighters — including thousands of Army troops — were out in the mountains. Most were already exhausted from cutting fire lines (essentially, trenches) for miles through wilderness. The rangers were only too aware that hundreds of small fires were still alive, creeping along through brush and smoldering in the duff. The rangers' biggest fear was that a big wind would whip all of these fires into flame simultaneously. On Aug. 20, 1910, that's exactly what happened. Fire crews deep in the forests noticed with apprehension that the wind was freshening from the southwest. By mid-day it was a full-blown gale on the mountain ridges — the dreaded "Palouser," named for the Palouse country to the southwest. The crews knew the winds boded ill, but it wasn't until that afternoon that they looked up to see a truly horrifying sight: Huge black clouds, like giant inky thunderheads, blotting out the sun. These were clouds of smoke, ash and cinders, carried high aloft by giant, roaring updrafts. It meant that those hundreds of small fires across the Clearwater, St. Joe, Coeur d'Alene and Bitterroot regions had flared, marched and in many cases, joined up together and created a massive chain reaction of fuel, flame and oxygen. It was a true firestorm, massive enough to create its own roaring vortexes. Witnesses estimated clouds of smoke and ash 2,000 feet in the air. Down on the ground, these winds and updrafts created crown fires that moved faster than a man could run – faster than a locomotive could steam, said some witnesses. Entire mountainsides of trees were blown down like matchsticks. The scale was immense. Telegraph operators sent out desperate messages describing the approach of a solid line of flame 30 miles wide, and that was no exaggeration. Today, you can drive Interstate 90 east from Wallace, Idaho to just short of St. Regis, Mont. — about 45 miles — and be within the old burn zone every mile of the way. And this was by no means the only burn zone in the Northern Rockies – just the biggest.
1960	Wildfire (DR-105)	Boise	Large fires burned in Hells Canyon and Idaho City areas
1967	Wildfire (DR-231)	Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, Nez	10 counties in Panhandle affected; 50,000 acres burned in nine hours

Date(s) of Event	Event Type	Counties Affected	Description
		Perce, and Shoshone	
July and August 1985	Wildfire	N/A	Two statewide declarations for wildfire events in July and August
1986	Wildfire	N/A	Statewide declaration
June and August 1987	Wildfire	Ada, Adams and Bannock	Three counties declared individually: Ada (June), Adams (August), and Bannock (August); Statewide declaration in August
1989	Wildfire	N/A	The worst fires since 1910 burn thousands of acres in south-central Idaho, partially destroying the town of Lowman and leading to State-wide declaration
1992	Wildfire	N/A	One life lost in the worst fire season in Idaho history to date; one of two Statewide declarations was for an unusual spring event (April)
1994	Wildfire	N/A	One life lost and one home lost; summer wildfires burn over 750,000 acres, resulting in a Statewide declaration
1999	Mule Butte Fire	Blaine	Mule Butte and BLM Aberdeen District – 138,915 acres in size
2000	Multiple Wildfire Events (DR-1341)	Ada, Bannock, Bingham, Blaine, Clearwater, Custer, Elmore, Idaho, Jerome, Lemhi, Lewis, Lincoln, Power, and Valley	During the fires of 2000, smoke from the fires became a constant companion to residents throughout the State, affecting the health, recreation, and daily life of many communities. Several times, the Idaho Department of Environmental Quality issued air quality advisories to several communities in Idaho because of "very unhealthy" or "hazardous" air quality concerns. The town of Salmon requested and received air purifiers for their residents. The recorded losses include 700 cattle on one ranch in Dietrich, Idaho. Within the State of Idaho, 109 structures were destroyed: 38 residences (homes, cabins, or trailers), 70 outbuildings, and one commercial building/business. A total of 9,568 structures were threatened: 6,061 primary residences, 1,635 outbuildings, and 1,872 commercial building/businesses. The town of Atlanta imported potable water because the town's water system was damaged. Emergency closures of Federal and State lands affected approximately 3 million acres. Over 2,000 miles of trails, over 80 miles of river, and almost all public airstrips were closed. Restrictions were placed on campfires, smoking, and the use of chainsaws and other equipment. These closures and restrictions had an enormous impact. Many businesses that depend on the region's tourism in the summer and fall seasons suffered economically. During the 26 days that the Salmon River in the Frank Church River of No Return Wilderness was closed to recreation, 4,000 outfitter floaters, 2,300 private floaters, and 140 commercial jet boaters who were scheduled to float the river were unable to take their trips. These lost trips resulted in a loss of personal income and employment for surrounding communities. The closures also affected the plans of about 600 hunters, who had booked guided hunts in the wilderness area, in addition to the large number of resident hunters depending upon big game for their winter food supply.
2000	Clear Creek Fire	Custer	Salmon-Challis National Forest – 216,961 acres in size
2000	Diamond Fire	Valley	Payette National Forest – 149,772 acres in size
2000	SCF Wilderness Fire	Custer	Salmon-Challis National Forest – 182,600 acres in size

Date(s) of Event	Event Type	Counties Affected	Description
2003	Cramer Complex Fire	Lemhi	Cramer Complex Fire, 13,845 acres, two lives lost
2005	Wildfire	Bonneville, Twin Falls	Wildland fire totals: 1,154 fires, 442,391 acres. Clover Complex, Twin Falls BLM District, 192,846 acres; East Idaho Complex, Idaho Falls BLM District, 192,450
2006	Wildfire		Wildland fire totals: 1,831 fires, 933,548 acres
2006	Crystal Fire	Bonneville	BLM Idaho Falls District – 220,042 acres in size
2007	Wildfire	N/A	Wildland fire totals: 1,473 fires, 1,980,552 acres. Cascade Fire complex, East Zone Complex, Castle Rock Complex
2007	East Zone Complex Fire (FM-2725)	Valley	Payette National Forest – 300,022 acres in size
2007	Murphy Complex Fire	Owyhee and Twin Falls	BLM Twin Falls District - 652,016 acres in size
2007	Rowland Fire	N/A	Idaho – 180,000 acres in size
2007	Cascade Complex Fire (FM-2726)	Boise	Boise National Forest – 302,376 acres in size
2007	Elk Mountain Fire	Twin Falls	BLM Twin Falls District – 160,000 acres in size
2007	Shower Bath Fire	Custer	Salmon-Challis National Forest – 122,600 acres in size
2007	Rattlesnake Fire	N/A	Idaho – 102,000 acres in size
2008	Wildfire	N/A	Wildland fire total: 997 fires, 116,796 acres
2009	Wildfire	N/A	Wildland fire total: 1,142 fires, 22,681 acres
2010	Wildfire	N/A	Wildland fire total through Sept 18: 908 fires, 608,821 acres, Hurd.
2010	Jefferson Fire	N/A	DOE National Laboratory – 109,727 acres in size
2010	Long Butte Fire	Twin Falls	BLM Twin Falls District - 306,113 acres in size
July 7-19, 2012	Kinyon Road Fire	Twin Falls	210,874 acres burned with costs of approximately $1.63 million; fire was caused by lightning
July 9-20, 2012	Jacks Fire	N/A	50,816 acres burned with costs of approximately $300,000; fire was caused by lightning
July 20 – November 5, 2012	Powell SBW Complex Fire	Idaho	67,711 acres burned with costs of approximately $4.8 million; fire was caused by lightning

Date(s) of Event	Event Type	Counties Affected	Description
July 27 – October 18, 2012	Halstead Fire	Custer	181,948 acres burned with costs of approximately $26.4 million; fire was caused by lightning
August 3 – October 18, 2012	Trinity Ridge Fire	Elmore	Trinity Ridge Fire, Fire Management Assistance Declaration, 146,832 acres burned; human caused; approximately $41.23 million in costs
August 5-13, 2012	Flat Top 2 Fire	Lincoln	140,954 acres burned with costs of approximately $600,000; fire was caused by lightning
August 8-23, 2012	Minidoka Complex Fire	Cassia	97,616 acres burned with costs of approximately $5.8 million; fire was caused by lightning
September 6 – November 6, 2012	Sheep Fire	Idaho	48,626 acres burned with costs of approximately $18 million; fire was human-caused
2012	Karney Fire (FM-5019)	Boise	Karney Fire, Fire Management Assistance Declaration, 440 acres, arson
2012	Multiple Wildfire Events	Boise, Idaho, Lemhi	According to the University of Idaho, 2012 was the “worst wildfire year in Idaho in well over a decade” with 1.7 million acres of mostly rural forests burned. Sixty-six homes were lost in a Pocatello wildland fire. The Idaho Bureau of Homeland Security reported 13 structures were lost in the Trinity Ridge Fire, and areas near Atlanta, Pine, and Featherville were evacuated. Homes and businesses were threatened and evacuations were issued for communities affected by the Halstead Fire in Custer County, the Karney Fire in Boise County, the McGuire Fire in Idaho County, and the Mustang Complex Fire in Lemhi County. The Governor requested and received two Fire Assistance Management Grants from FEMA to offset structure protection costs. In total, there were 1,149 wildfires in Idaho in 2012, which consumed 1,667,654 acres.
August 9-19, 2013	Pony Complex Fire	Elmore	149,384 acres burned with costs of approximately $4 million; fire was caused by lightning
August 9-31, 2013	Elk Complex Fire	Elmore	131,258 acres burned with costs of approximately $10.72 million; fire was caused by lightning
August 7 – September 2, 2013	Beaver Creek Fire (FM-5045)	Camas	The Beaver Creek wildfire began with a lightning strike on August 9th northwest of Hailey. Some evacuations of Deer Creek west of the Big Wood River were ordered on the 15th. The East Fork of the Wood River between Ketchum and Sun Valley was evacuated on the 16th. Up to 2,500 people were displaced. Highway 75 was intermittently closed. Rapid growth occurred from August 15th through August 21st as it grew from 44 thousand acres to 108 thousand acres helped by gusty winds and low humidity. As many as 1,721 personnel were assigned to fight the fire. The fire burned approximately 111,490 acres and destroyed one home, a bunkhouse and six other structures. Costs from the fire were approximately $26.5 million.
August 2-22, 2014	Big Cougar Fire	Nez Perce	65,227 acres burned with costs of approximately $4.5 million; fire was caused by lightning
August 10-23, 2015	Soda Fire	Ada	285,361 acres burned with costs of approximately $6.25 million
August 10 –	Clearwater / Municipal / Motorway	Clearwater, Idaho and Lewis	The Clearwater-Municipal Complex consists of a group of fires in Clearwater, Idaho and Lewis Counties in northern Idaho. The fires, started by lightning, have been burning since August 10th. On August 28th, the Clearwater-Municipal

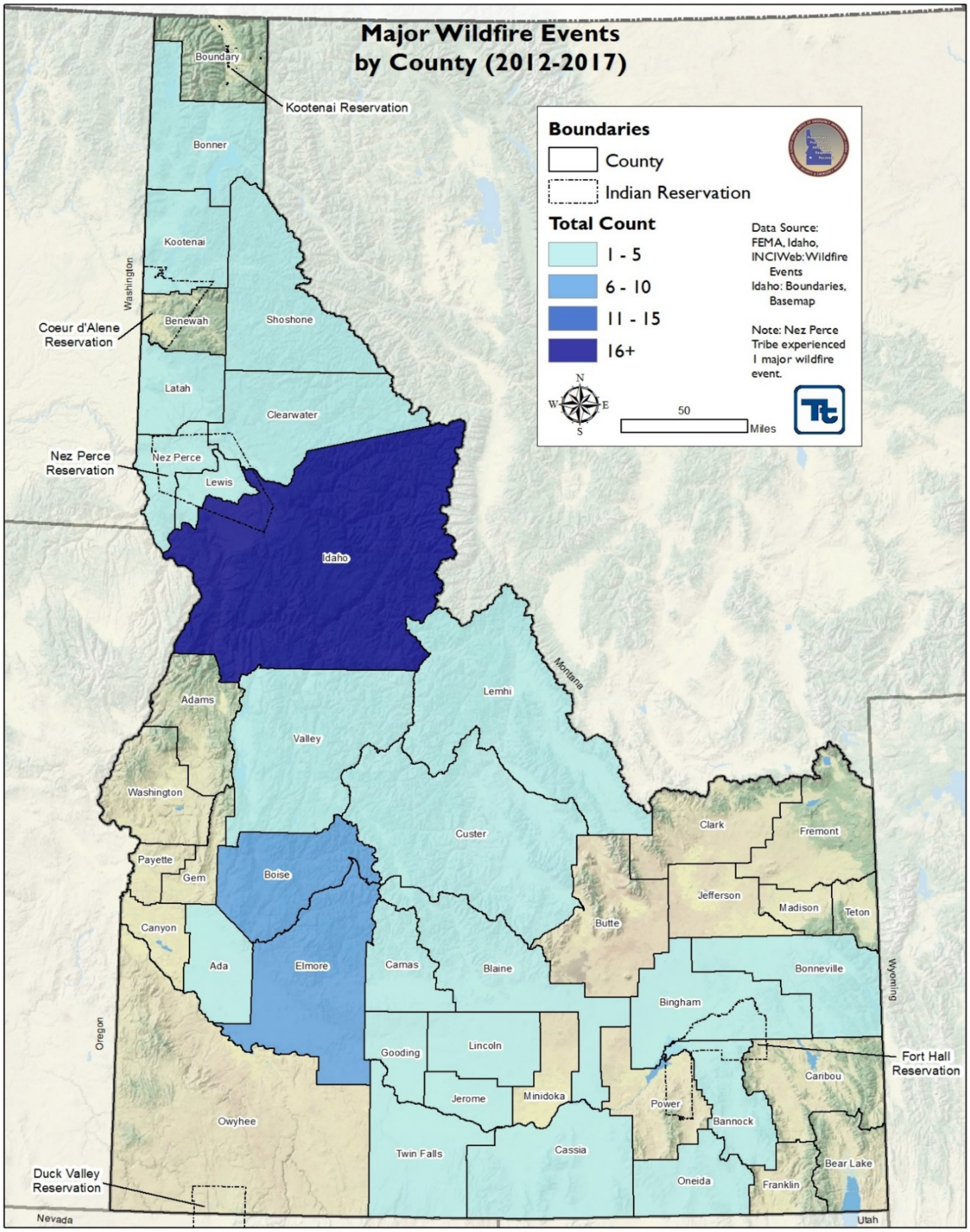
Date(s) of Event	Event Type	Counties Affected	Description
September 8, 2015	/ North Complex (FM-5099)		Complex was formed by merging the Clearwater Complex with the Municipal Complex. On August 14, 2015, FEMA issued a Fire Management Assistance (FM) declaration for the State of Idaho. In total, 82,243 acres burned with costs of approximately $41.5 million.
August 12 – November 5, 2015	Tepee Springs Fire (FM-5110)	Idaho	The Tepee Springs Fire began on August 12th after a lightning struck. The fire was fully contained by November 5th. On August 29, 2015, FEMA issued a Fire Management Assistance (FM) declaration for the State of Idaho. In total, 95,709 acres burned with costs of approximately $31.54 million
July 18 – October 27, 2016	Pioneer Fire	Boise	The Pioneer Fire was the largest fire on Forest Service lands in 2016. It burned a total of over 188,404 acres. More than 1,800 firefighters (local, state, federal and tribal) worked together to battle this fire. The costs of resources was estimated at $95.7 million.
August 21-31, 2016	Henry's Creek Fire (FM-5151)	Bonneville	The fire started on August 21st and was human-caused. The Henry's Creek Fire reached 100% containment at 10:00 p.m. on September 1, 2016. On August 25, 2016, FEMA issued a Fire Management Assistance (FM) declaration for the State of Idaho. In total, the fire burned 52,972 acres and cost approximately $4.32 million.
August 2016	Rough Fire	Boise	This fire was caused by a lightning strike and impacted an area of 3,598 acres.
July 4, 2017	North Fork Hughes Fire	Bonner	As of September 18, 2017, the North Fork Hughes Fire is approximately 5,000 acres. It was started by lightning. The fire is located just north of Hughes Meadows across the Washington State line and may be visible from the Priest Lake area. The fire is backing to the south near Hughes Meadows and backing towards the Sullivan Creek Road. Firefighters will continue to monitor and patrol the fire.
July 10, 2017	Hidden Fire	Boise	Lightning started the Hidden Fire on July 10th near Hidden Lake northeast of the Elk Summit Guard Station and in the Selway Bitterroot Wilderness. The fire burned an area of 12,261 acres.
July 14, 2017	Mink Peak Fire	Idaho	Located near Mink Peak in the Selway-Bitterroot Wilderness, the Mink Peak fire was lightning caused on July 14, 2017. It burned 817 acres.
July 14, 2017	Lone Pine Fire	Idaho	The Lone Pine fire started July 14 below Lone Pine Point, a very remote area in the Selway Bitterroot Wilderness. On or about August 30, the Lone Pine fire merged with both the Mink Peak fire and the Tony fire. It has burned an area of 15,237 acres. The fire is being managed for long-term resource benefit, using a point protection strategy.
July 14, 2017	Moose Creek 1 Fire	Idaho	The lightning-caused Moose Creek 1 fire started in the Selway Bitterroot Wilderness, immediately southeast of the historic Moose Creek Ranger Station. Originally three fires (Moose Creek 1, Moose Creek 2, and Moose Creek 3), they were merged together on July 20 as the Moose Creek 1 fire. The fire has also consumed the former Freeman fire. Structure protection measures are in place for various identified values at risk. As of September 15, 2017, the fire has burned 17,395 acres.
July 15 – August 3, 2017	Missouri Fire	Valley	This lightning-caused fire started on the Missouri Ridge on July 15 and was contained on August 3rd. It burned 1,277 acres.
July 24, 2017	Ibex Fire	Custer	The Ibex Fire began on July 24th, located 10 miles west of Challis. It was started by lightning. As of October 17th, the fire is being actively monitored and allowed to play its natural role while directing the fire away from identified values.
July 28, 2017	Goat Fire	Idaho	The Goat Fire was started by a lightning strike and is located in the Middle Fork of the Salmon River drainage. The fire burned 818 acres.

Date(s) of Event	Event Type	Counties Affected	Description
July 28, 2017	Highline Fire	Idaho	The majority of the Highline Fire is burning within fire scars from 2000. As of September 19th, it has burned an area of 84,619 acres.
August 1, 2017	Hanover Fire	Idaho	The Hanover Fire was caused by a lightning strike on August 1, 2017. Located south of Grangeville and northeast of Riggins. It burned an area of 26,500 acres.
August 1, 2017	Tappan Fire	Valley	The Tappan Fire was human-caused and located east of the Middle Fork of the Salmon River. It burned an area of 1,650 acres. As of September 21st, the fire is in monitor status under the direction of the North Zone Duty Officer.
August 2-6, 2017	Lava Flow Fire	Bingham	The Lava Flow fire was reported on August 2nd, approximately seven miles south of Atomic City. The fire started by lightning and burned in grass through the lava fields. The fire was contained on August 6th.
August 2, 2017	Buck Lake Fire	Idaho	The lightning-caused Buck Lake fire was detected August 2, 2017, in the Buck Lake Creek drainage in the Selway-Bitterroot Wilderness at 5 to 10 acres. Showing only minimal to moderate activity, the fire is now estimated at 4,655 acres as of September 14, 2017. This incident is being managed for long-term resource benefits and is being patrolled and monitored as it continues to perform its natural role across the landscape.
August 4-11, 2017	Powerline Fire	Bannock	The Powerline Fire was reported on August 4th, seven miles southeast of American Falls in the Arbon Valley area. The fire was human caused. The fire was contained on August 11th. It burned approximately 55,529 acres.
August 2017	Buck Fire	Shoshone	The Buck Fire is located on the St. Joe Ranger District, approximately 16 miles southeast of Avery. It burned steep terrain and heavy fuels along Buck Creek, south of FSR201. It burned an area of 2,386 acres.
August 2017	Patrol Ridge Fire	Idaho	Lightning caused the fire, burning 4.5 miles east of Windy Saddle on the Red River Ranger District. The fire moved north on the Moose Creek Ranger District in the Selway-Bitterroot Wilderness. The fire burned 1,175 acres.
August 13, 2017	Chute Creek Fire	Idaho	The lightning-caused Chute Creek fire was detected August 13 in the Selway-Bitterroot Wilderness 8 miles southeast of Elk Summit Guard Station and 2.5 miles west of Blodgett Lake. It burned an area of 5,107 acres.
August 14, 2017	Rattlesnake Point Fire	Idaho	The fire started on August 14th and was started by a lightning strike. It burned 4,843 acres.
August 23 – October 12, 2017	Bearskin Fire	Valley	The fire began on August 23rd as a result of a lightning strike. It is located 21 miles northeast of Lowman in Valley County. It was contained on October 2nd and controlled on October 11th. It burned an area of 30,251 acres. Most work on the Bearskin Fire was completed. Fire is now in monitor status.
August 27, 2017	Honeymoon Fire	Custer	The fire started on August 27th as a result of a lightning strike. As of October 17th, the fire has burned 1,860 acres and is being actively monitored and allowed to play its natural role with the wilderness while directing the fire away from identified values.
September 2-13, 2017	Strychnine Fire	Latah	The Strychnine Fire was located five miles northeast of Harvard. It burned an area of 1,010 acres.
September 3-11, 2017	Pronghorn Fire	Idaho	Lightning caused the fire, burning on the Red River Ranger District, 3.5 miles north-northeast of Red River Hot Springs on Matteson Ridge. The fire burned 78 acres.
September 8, 2017	Big Elk Fire	Idaho	The Big Elk fire started by lightning on September 8, 2017 just northeast of the Elk City township in the Big Elk Creek area on the Red River Ranger District of the Nez Perce-Clearwater National Forests. The fire quickly grew to 75 acres and fire crews immediately responded with all available resources including engines, smokejumpers, bulldozers, and a hotshot crew. It burned a total area of 80 acres.

Date(s) of Event	Event Type	Counties Affected	Description
September 24, 2017	West Bliss Fire	Gooding	198 acres burned
September 2017	Coolwater Complex Fires	Idaho	As of September 18, 2017, Andy's Hump Fire has burned on ridge tops and is now slowly backing down the upper slopes of the ridges, as well as progressing further along the ridges. There are continuous heavy fuels from the fire perimeter to values at risk in Lowell and the Selway River corridor downhill of the fire. The fuels are timber litter with a heavy down/dead component. There are patches and stringers of deciduous brush on the ridge and upper slopes that are slowing the fires spread. Glover Fire has had a few hot spots in it but has shown no movement recently. Old Man Fire has burned on a steep south slope with brush and timber stringers. The brush has been carrying fire as well as the timber fuels. The fire has been slowly side-sloping and then making an uphill run as it gets below unburned fuels. It has not burned across the ridge top on the north side but has the potential to do so and spread to a Management Action Point. Old Man Creek has held the fire to the south but could spot to the other side, which would continue fire progression toward Hwy 12. On September 9th, all three fires were combined into the Coolwater Complex, burning an area of 3,264 acres.

Sources: Idaho SHMP 2013; NOAA NCEI 2017; FEMA 2017; NIFC 2017; InciWeb 2017; WildCAD 2017
Note: For events from 2013 to 2017, this table includes only wildfire events that burned over 100 acres.
FEMA Federal Emergency Management Agency
FM Fire Management Assistance Declaration (FEMA)
S State Hazard Mitigation Plan
Hwy Highway
NCEI National Centers for Environmental Information
NIFC National Interagency Fire Center
NOAA National Oceanic and Atmospheric Administration
N/A Not Available

Figure 3.1.O. Major Wildfire Events in Idaho



FEMA Disaster Declarations

Between 1954 and 2017, FEMA included the State of Idaho in 18 wildfire-related major disaster (DR) or fire management assistance (FM) declarations. Generally, these disasters cover a wide region of the

State; therefore, they may have impacted many counties. However, not all counties were included in the disaster declarations as determined by FEMA (FEMA 2017; State of Idaho 2017).

Based on all sources researched, known wildfire events that have affected Idaho and were declared a state and/or FEMA disaster, are identified in 3.1.P. This table provides information on the disaster declarations for severe storms, including date of event, state disaster declaration, federal disaster declaration and disaster number, and counties affected. Figure .1.Q illustrates the number of FEMA-declared disasters by county.

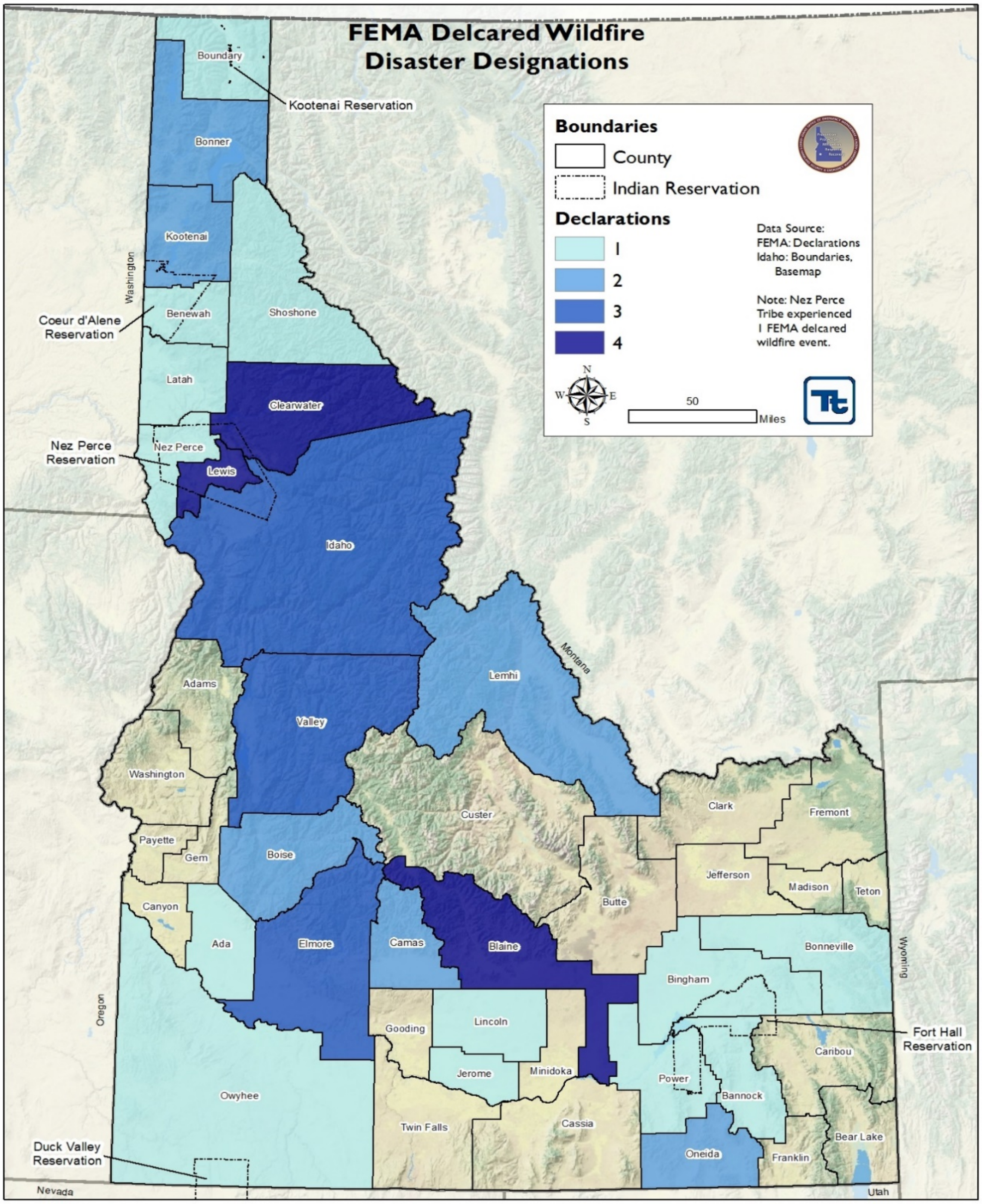
Table 3.1.P. Wildfire-Related State and Federal Declarations (1954 to 2017)

Year	Date	State	Federal	Counties Affected
1960	July 22, 1960		DR-105	
1967	August 30, 1967		DR-231	Benewah, Bonner, Boundary, Clearwater, Idaho, Kootenai, Latah, Lewis, Nez Perce, and Shoshone
1977	August 20, 1977 (Wilson's Creek Fire)		FM-2029	
1979	August 8, 1979 (20-Mile Fire)		FM-2038	
2000	September 1, 2000		DR-1341	Ada, Bannock, Bingham, Blaine, Clearwater, Custer, Elmore, Fort Hall Indian Reservation, Idaho, Jerome, Lemhi, Lewis, Lincoln, Power, Valley
2007	August 29, 2007 (Castle Rock Fire)		FM-2724	Blaine
	August 30, 2007 (Cascade Fire Complex)		FM-2726	Valley
	August 30, 2007 (East Zone Fire Complex)		FM-2725	Idaho, Valley
2010	August 26, 2010 (Hurd Fire)		DR-2853	Valley
2012	July 27, 2012 (Idaho Summer Wildfires)	ID-03-2012		Elmore
	August 3, 2012 (Trinity Ridge Fire)		FM-5006	Lemhi
	September 18, 2012 (Karney Fire)		FM-5019	
2013	August 12, 2013 (Elk Fire)	ID-01-2013	FM-5043	Blaine, Boise, Camas, Custer, Elmore, and Oneida
	August 15, 2013 (Beaver Creek Fire)	ID-01-2013	FM-5045	Blaine, Boise, Camas, Custer, Elmore, and Oneida
2015	July 5, 2015 (Cape Horn Fire)	ID-01-2015	FM-5088	Bonner, Kootenai
	August 10, 2015 (Clearwater Lawyer Branch Fire Complex)	ID-02-2015	FM-5099	Lewis, Clearwater, Owyhee
	August 14, 2015 (Municipal Fire)		FM-5105	Lewis
	August 29, 2015		FM-5110	Clearwater, Nez Perce Tribe

Year	Date	State	Federal	Counties Affected
	(Tepee Springs Fire)			
2016	August 21, 2016 (Henry's Creek Fire)	ID-02-2016	FM-5151	Bonneville

Source: Idaho SHMP 2013; FEMA 2017; State of Idaho 2017
Note: The date identified in the above table is the date of the disaster declaration

Figure 3.1.Q. FEMA Disaster Declarations in Idaho

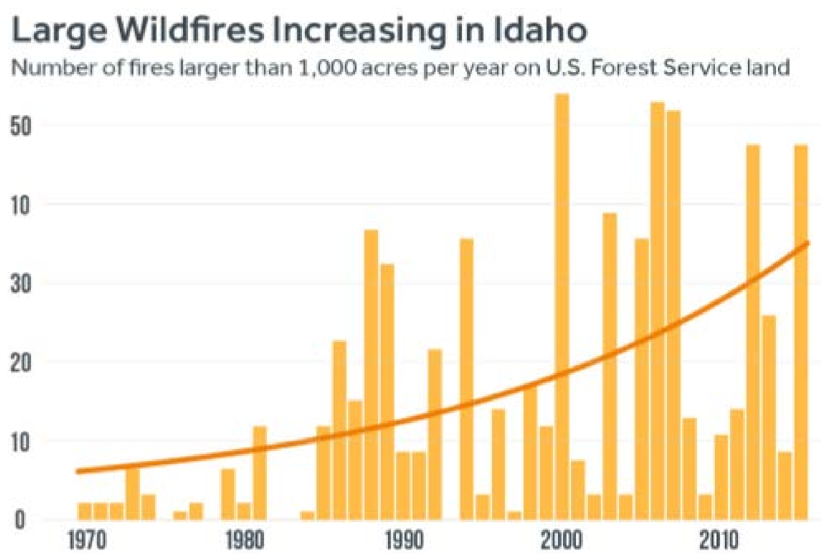


Future Occurrence

Since 2002, Idaho has experienced 18,840 wildfires, burning 8,651,461 acres. While the number of wildfires per year is relatively consistent, the number of acres burned can be highly variable. Considering factors affecting growth and forest health, the future occurrence of wildfire should not be expected to diminish from current trends.

The 2016 CoreLogic® Wildfire Hazard Risk Report provided the following conclusion that is applicable to both Idaho and the entire Western United States:

"There are a number of factors to consider when discussing future trends for wildfire activity. A combination of factors including fuel quantity and condition, firefighting response and homeowner preparation all interact to determine what the future will hold. In the case of fuels, the prolonged drought in many parts of the Western U.S. has exacerbated wildfire risk. Fuels that ignite more easily and burn more efficiently due to the dry conditions only serve to spread fires more quickly and across greater distances. Firefighting response has been responsible for preventing countless deaths and reducing property loss as much as is humanly possible with the resources available. However, the onslaught of multiple large fires burning concurrently stretches these resources dangerously thin. In the case of homeowner preparedness, the desire and ability of the individual property owner to remove and reduce risk factors in and around their homes is an increasingly effective solution to minimize the threat of wildfire".



Source: NOAA, USFS, Climate Central Report 2016
http://assets.climatecentral.org/pdfs/westernwildfires2016vfinal.pdf

Forest health can also determine fuel abundance, as well as thunderstorms generating lightning and human caused starts. More information on future occurrence, forest health, and climatic change can be found in the Climate Change Impacts section.

Table 3.1.R. Wildfires in Idaho, 2002 – 2016

Year	Total # of Wildfires	Total Acres Burned
2016	630	361,649
2015	1,324	804,094
2014	1,180	189,430
2013	1,471	722,204
2012	1,149	1,667,654
2011	1,094	384,103
2010	977	613,868
2009	1,142	22,681
.2008	997	116,796
2007	1,473	1,980,552
2006	1,831	933,548
2005	1,154	442,391
2004	1,098	13,981
2003	1,834	313,546
2002	1,486	84,964
Average:	**1,256**	**576,764**

Source: NIFC 2017

Relationships to Other Hazards

Secondary Impacts

Wildfires can also impact human health miles from the actual fires. The National Climate Assessment describes these human health impacts from wildfires by pointing out that exposure to smoke can lead to a wide range of respiratory and cardiovascular issues resulting in increased hospitalizations, ER visits, and even deaths. A Climate Central analysis found that in several western U.S. cities, the worst air quality days of the year were usually days when wildfires were burning in the region.

Wildfires can generate a range of secondary effects, which in some cases may cause more widespread and prolonged damage than the fire itself. Fires can cause direct economic losses in the reduction of harvestable timber and indirect economic losses in reduced tourism. Wildfires do influence a large number of other hazards, mainly due to the dramatic and long-term changes that such events apply to the landscape. Flooding hazards increase wherever a wildfire occurs. The loss of vegetation increases runoff, thereby increasing the threat of flood. Sediment from wildfires also has the possibility to block stream channels and waterways, which would result in localized flooding. The loss of vegetation also enhances the conditions needed to initiate landslides and avalanches. By removing vegetative cover, wildfires can contribute to mudslides, landslides, and floods. According to the National Commission on Wildfire Disasters, the 1992 Foothills Fire near Boise was so hot that not only was the vegetation removed, but the soils were ". . . so heat damaged that they resist water penetration and cause flash runoff and erosion, as well as some that slide off steep slopes like dry sugar" (MacLeary, 1993). Burned, standing timber is more vulnerable to high winds and even unburned areas neighboring burn zones would experience new wind patterns that those trees are not prepared to handle. Drought conditions could be influenced in areas where burns have occurred, as there may be less vegetation and soil to retain moisture. According to a 1991 case study, winds gusting to 62 mph (100 km/h) downed power lines, resulting in 92 separate wildland fires in Washington (The National Wildland/Urban Interface Fire Protection Initiative, 1992). Earthquakes also have the potential to cause wildfires through the tumbling of electrical services or home to wildland ignition.

Additionally, wildfires may lead to long term power outages. Transmission lines that pass through areas prone to wildfires are at a higher risk of outages. Dense smoke from wildfires can “trip” a transmission line circuit, causing it to go out of service. Outages can also result from emergency line de-rating or shut-downs during a nearby fire to prevent thermal damage to the lines. Wooden utility poles can burn, downing power lines and leading to outages.

From a human-caused perspective, wildfires could damage energy transmission and communication infrastructure. This could result in energy shortages or cyber disruptions. As wildfires can produce extremely large and impacting events, a worst case event could be a driving cause for civil disturbances. Facilities that store radiological materials may also be impacted should they be located in an area affected by wildfire.

Environmental Impacts

Wildfire is a part of nature. It plays a key role in shaping ecosystems by serving as an agent of renewal and change. But fire can be deadly, destroying homes, wildlife habitat and timber, and polluting the air with emissions harmful to human health. Fire also releases carbon dioxide—a key greenhouse gas—into the atmosphere. Fire’s effect on the landscape may be long lasting. Fire effects are influenced by forest conditions before the fire and management action taken or not taken after the fire. Fire can shape ecosystem composition, structure and functions in multiple ways:

- By selecting fire adapted species and removing other, susceptible species
- By releasing nutrients from the biomass and improving nutrient cycling
- By affecting soil properties through changing soil microbial activities and water relations
- By creating heterogeneous mosaics, which in turn, can further influence fire behavior and ecological processes
- By damaging watersheds that serve as water supplies for urban areas
- By eliminating natural grazing areas.

Fire as a destructive force can rapidly consume large amounts of biomass and cause negative impacts such as post-fire soil erosion and water runoff, and air pollution; however, as a constructive force, fire is also responsible for maintaining the health and perpetuity of fire dependent ecosystems. Considering the unique ecological roles of fire in mediating and regulating ecosystems, fire should be incorporated as an integral component of ecosystems and management.

Wildfire can also bring opportunities for noxious weeds to grow on Idaho's rangelands. Nonnative species, including their seeds, eggs, spores, larvae or other biological material capable of propagation, that cause economic or environmental harm and are capable of spreading in the state are collectively known as invasive species. In Idaho, an invasive species is defined as a species that is (1) non-native to the state and (2) whose introduction causes or is likely to cause economic or environmental harm. Invasive species can be plants, animals, and other organisms. Human actions are the primary pathway (as opposed to natural shifts in the distribution of species). Nationally, the current environmental, economic, and health costs of invasive species were estimated as exceeding the costs of all other natural disasters combined.

Invasive species introduced into Idaho are affecting plant and animal communities on farms, ranches, parks, waters, forests, natural areas and in backyards. Human activity such as trade, travel and tourism have all increased substantially, escalating the speed and volume of species movement to unprecedented levels. Invasive species are often unintended hitchhikers on conveyances, animals and people. Still more nonnative species are deliberately introduced as pets, ornamental plants, crops, biofuels, food, for recreation, or other purposes. The majority of nonnative species brought into Idaho, including most of our sources of food and fiber, are not harmful; many are highly beneficial. Although invasive species, in most cases, primarily cause environmental damage and degradation, there are situations in which serious threats to public health, safety, and well-being can occur. For example, a widespread insect infestation, such as that of the Emerald Ash Borer, can create serious public safety threats (especially in densely populated urban areas such as the Treasure Valley) due to dead and dying trees being fire prone (because of their dry, brittle nature) or to partial/total collapse due to high winds or ice/snow accumulation. The falling trees or limbs can also cause property damage, block roads, bring down power lines, cause damage to public and private structures, and cause injuries or even death. Emerald Ash Borer has caused extensive damage to trees in other states, and those weakened trees have often collapsed and caused property damage, or required removal, at considerable expense.

Cheatgrass is one invasive weed that is widely distributed throughout the western U.S. It is not native, meaning that it was introduced from another continent. Because cheatgrass can grow in Idaho's climate and soils, it has spread rapidly throughout Idaho's rangelands. After fires burn on Idaho's rangelands, cheatgrass begins to grow before Idaho's native plants, because it sprouts in late fall, thus giving it a "head start" on native vegetation. When cheatgrass grows first, Idaho's native plants do not have soil and water to grow. Cheatgrass is also very flammable and grows in a continuous bed of grass, whereas Idaho's native grasses grow in clumps with separation between them. Because cheatgrass covers large areas, wildfire burns rapidly through it, creating larger, faster moving wildfires that are difficult to control.

Wildfires, particular large scale fires, can dramatically alter the terrain and ground conditions, making land already devastated by fire susceptible to floods. Normally, vegetation absorbs rainfall, reducing runoff. However, wildfires leave the ground charred, barren, and unable to absorb water; thus, creating conditions perfect for flash flooding and mudflows. Flood risk in these impacted areas remain significantly higher until vegetation is restored, which can take up to five years after a wildfire (FEMA 2013).

Areas directly affected by fires and those located below or downstream of burn areas are most at risk for flooding. Fire perimeters since the last SHMP (2013 to 2016) were intersected with the 1% flood boundary to determine the total area of floodplain that has been affected by wildfires in recent years. Overall, 16 square miles of floodplain were exposed to recent wildfires Statewide, with the greatest area located in Elmore County (4.8 square miles). The next two greatest areas exposed were in Bonneville County (2.7 square miles) and Lincoln County (1.9 square miles).

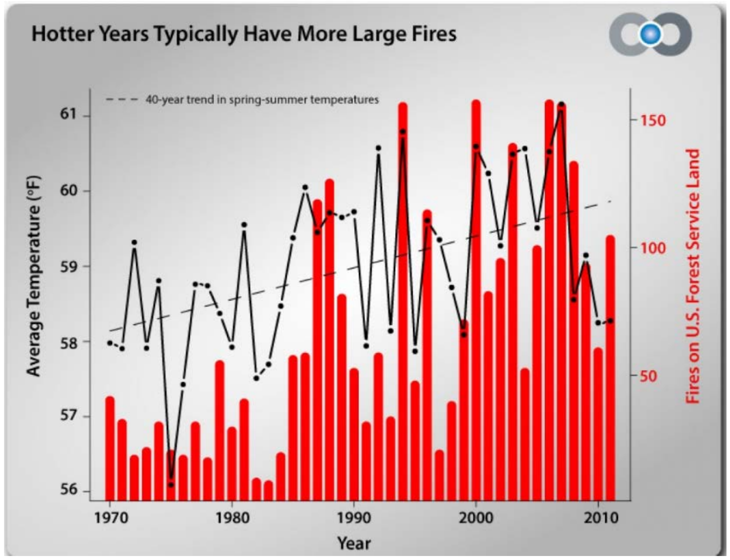
Positive Impacts

Beneficial fires occur when a fire ignites and burns slowly, burning mostly ground vegetation and a few trees. These fires help Idaho's ecosystems by cleaning out dead and/or crowded vegetation, but leaving the majority of large trees alive and able to repopulate the forest. Some trees rely on wildfire to repopulate the forest. Many of these trees drop "serotinous cones" from their branches. The seeds, sealed in the cone by resin, are stored for many years until they are exposed to intense heat that melts the resin covering the cone and allows the cone to open. The seeds are then able to germinate when conditions are optimum; in the ashes immediately after a forest fire. For example, the Lodgepole Pine trees in many of Idaho's forests drop serotinous cones on the forest floor. These trees are considered "fire dependent," because they need fire in order to spread their seeds (University of Idaho and Idaho Rangeland Commission, 2009).

Wildfire plays an important role in the health of Idaho's rangelands, just as it does in Idaho's forests. Juniper trees grow on Idaho's rangelands. They are also fire dependent. Without regular wildfires, juniper trees begin to grow in areas where sagebrush and grasses grow naturally. The juniper trees crowd out the sagebrush and grasses, causing habitat loss for sagebrush-dependent birds such as the sage grouse.

Climate Change Impacts

The climate of Idaho is changing. Records have shown that over the past 100 years, the State has seen an increase in temperature of one to two degrees (°F). In the coming years, it is predicted that streams will be warmer, wildfires will become more common, deserts may expand, and water may be less available for irrigation (USEPA 2016).



Source: NOAA, USFS, Climate Central Report 2012
http://www.climatecentral.org/news/report-the-age-of-western-wildfires-14873

Fire is determined by climate variability, local topography, and human intervention. Hot, dry spells create the highest fire risk. Increased temperatures may intensify wildfire danger by warming and drying out vegetation. When climate alters fuel loads and fuel moisture, this changes the ecosystem susceptibility to wildfires. Climate changes also may increase winds that spread fires. Faster fires are harder to contain, and thus are more likely to expand into residential neighborhoods.

Increasing Temperatures

In the past 40 years, rising spring and summer temperatures have increased the risk of wildfires in most parts of the West. Studies show that continued climate change is going to make wildfires much more common in the coming decades. Rising spring and summer temperatures across the West appear to be correlated to the increasing size and numbers of wildfires. The Climate Central analysis of historical climate data and climate projections examined how wildfire risk could change in the coming decades. The findings in Idaho revealed the conditions suitable for summer wildfires are projected to increase substantially in the relatively short period between now and 2050. The analysis relies on the Keetch-Byram Drought Index (KBDI), which is a measure of the dryness of the top 8 inches of the forest floor (the duff layer). The KBDI serves as a proxy for the dryness of forest fuels. It is one of a number of indicators of wildfire potential and the U.S. Forest Service uses it (among other tools) to predict fire danger. The scale runs from 0 to 800, where low numbers indicate that the fuel moisture is high (and less likely to burn) and high numbers represent more severe drought and higher likelihood of wildfires. The analysis found that the number of days with KBDI above 600 (a level at which the potential for wildfire is high) would increase significantly between now and 2050 in 10 of the western states if greenhouse gas emissions continue unabated (according to the high emission scenario RCP 8.5). The

KBDI projections are calculated from an ensemble of 29 climate models, downscaled across the U.S. (Climate Central Report 2016).

Earlier Spring and Longer Summers

Rising temperatures have secondary and tertiary effects on conditions which set the stage for increased wildfires. The frost-free season, defined as the stretch between the last 32°F reading in the spring and the first 32°F reading in the fall, has increased in length over the past 30 years, with both an earlier last frost in the spring and a later first frost in the fall. The average duration of the frost-free season is about 15 days longer across the U.S. than it was in the early 20th century. Climate change is contributing to an overall increase in the number of days without frost. The West has seen the most dramatic increases in the length of the frost-free season, with Boise adding about a month more to the frost-free season since 1970. The longer the time without a frost, the longer the growing season. While this may seem good — more time should lead to a larger crop yield — it could actually have detrimental effects on the crops we grow. Warmer weather helps pests survive longer which can wreak havoc on crops (Climate Central 2016 http://www.climatecentral.org/gallery/maps/frost-free-season-is-getting-longer-across-us).

This affects fuels in Idaho's forests with pests that can cause disease also living longer. In the spring and summer, hotter temperatures lead to drying of fire fuels – the duff and downed wood on the forest floor, and the standing trees. Drier fuels are more likely to ignite from lightning strikes and human activity. In Idaho's rangelands, where the climate is hotter and drier, those fires that do start are more likely to find ideal fire conditions over larger areas, leading to more area burning.

Reduced Snowpack

According to Climate Central's Meltdown analysis, an increasing percentage of winter precipitation is falling as rain rather than snow across much of the West. As a result, less water is stored in the West's mountain snowpack, and less water is available to keep fuels moist during the hotter and drier parts of fire season. In Idaho, 78 percent of weather stations at higher elevations (5,000 to 8,000 feet) reported a decreasing trend of snowfall (Climate Central Report 2016).

Earlier and warmer spring temperatures leads to earlier melting of the snowpack, causing a similar loss of water available during the hotter and drier times of the year. Earlier melting compounds the problem of less precipitation falling as snow. Research has found that years with higher wildfire frequency, especially in the Northern Rockies, were also years with low snowpack (Climate Central, 2016: Meltdown: Increasing Rain as a Percentage of Total Winter Precipitation. Princeton, NJ. http://assets.climatecentral.org/pdfs/Meltdown.pdf).

Increase in Wildfire Burn Season and Burn Acreage

On average, wildfires burn twice as much land area each year as they did 40 years ago. In the past decade, the average annual burn area on Forest Service land in the West has exceeded 2 million acres. Over the past 45 years, Idaho has seen a larger increase in the number of large fires and the area burned by them than any other western state. According to an analysis of large wildfires (larger than 1,000 acres) on U.S. Forest Service land in Idaho conducted by Climate Central in 2016:

Rank	State	More High Wildfire Potential Days
1	Arizona	34
2	California	24
3	New Mexico	23
4	Utah	23
5	Nevada	20
6	Washington	18
7	Oregon	17
8	Idaho	15
9	Wyoming	8
10	Montana	6

Source: Climate Central Report 2016 http://assets.climatecentral.org/pdfs/westernwildfires2016vfinal.pdf

- Over the last five years, Idaho has seen an average of 21 more large fires each year than it did in the 1970s, the largest increase among the western states, which is a 10-fold increase in its annual number of large wildfires.
- Idaho also ranks first in the increase in the area burned by large wildfires. 305,000 more acres burn in an average year now than did in the 1970s.

The burn season is two and a half months longer than 40 years ago. Across the West, the first wildfires of the year are starting earlier and the last fires of the year are starting later, making typical fire years 75 days longer now than they were 40 years ago. The number of days with high wildfire potential in Idaho is projected to quadruple between now and 2050, the third largest percentage increase among the western states (Climate Central 2016).

These climatological changes seem to also be pointing towards increased wildfire activity in the coming years. Idaho may see an increase in wildfire activity due to several factors: minimal snowpack, higher temperatures, and lower than average rainfall amounts across Idaho have contributed to drought conditions that will do little to reduce the threat for wildfires across the State.

Development Trend Impacts

An understanding of population and development trends can assist in planning for future development and ensuring that appropriate mitigation, planning, and preparedness measures are in place. The State considered the following factors to examine previous and potential conditions that may affect hazard vulnerability:

- Potential or projected development
- Projected changes in population
- Other identified conditions as relevant and appropriate

The U.S. EPA's Integrated Climate and Land-Use Scenarios (ICLUS) project generated projected population and land use projections for the United States through 2100. The project examined multiple scenarios taking into account various population growth and economic development parameters that have been used as the baseline for the Intergovernmental Panel on Climate Change's (IPCC) Special Report on emissions Scenarios (SRES). Population change took into account assumptions regarding fertility, mortality, and immigration, which was then used to drive the land use projections. The SRES provides two development scenarios: economic development (A) and environmentally driven development (B), where the A scenario will result in more sprawled development, and the B scenario will result in more compact developments close to the existing urban centers. Additionally, the model scenarios included parameters for global development (1) and regional development (2) (EPA, 2013). The model estimated projections for each decade from 2010 to 2100.

The ICLUS scenario 'A2' was selected to examine if changes in land use and housing density estimates from 2010 to 2020 are projected in the wildfire hazard area. The 2010 data was used as a baseline to determine if any changes in development by 2020 may result in increases or decreases in the hazard area. The resulting housing density and land use categories are defined as follows: Urban, which equates to 0.25 acres/unit; Suburban, which equates to 0.25 to 2 acres/unit; Exurban, which equates to 2 to 40 acres/unit; Rural, which equates to 40 acres/unit; Commercial and Industrial.

Table 3.1.S lists the estimated land-use area (square miles) located in the identified wildfire hazard area for 2010 and projected area for 2020 by jurisdiction. Map 2.F. in Chapter 2 (State Profile) displays the projected population growth by 2026. Wildfires can occur statewide, so population growth statewide will expose additional people to a wildfire event.

The most significant changes in land use are seen in the exurban and rural categories. Overall, 26.7 square miles of exurban area is projected to be developed in the wildfire hazard area by 2020, with the greatest increase in Kootenai County. As for rural land, statewide there is a projected decline of approximately 31.5 square miles. This decline is the greatest in Kootenai County, where a reduction of 10.2 square miles of rural land is projected; this coincides with the increase in higher housing densities, which will place a greater number of people in the hazard area.

Table 3.1.S. Projected Change in 2010 to 2020 Development Located in the Wildfire Hazard Area (square miles)

Area	Urban (sq. miles)			Suburban (sq. miles)			Exurban (sq. miles)			Rural (sq. miles)			Commercial/ Industrial (sq. miles)		
	2010	2020	Change	2010	2020	Change	2010	2020	Change	2010	2020	Change	2010	2020	Change
Ada County	1.1	1.3	0.2	15.8	19.1	3.3	84.6	90.8	6.2	219.6	210	-9.6	6.7	6.7	0.0
Adams County	0	0	0	0.3	0.3	0	5.6	5.8	0.2	251.2	251	-0.2	0.1	0.1	0.0
Bannock County	0.6	0.6	0	5.5	5.6	0.1	27.9	29	1.1	333.9	332.7	-1.2	1.1	1.1	0.0
Bear Lake County	0	0	0	0	0	0	0	0	0	90.4	90.4	0	0	0	0.0
Benewah County	0	0	0	0.5	0.5	0	14.9	14.9	0	151.1	151	-0.1	0.1	0.1	0.0
Bingham County	0	0	0	0	0	0	0	0	0	67.3	67.3	0	0	0	0.0
Blaine County	0.3	0.3	0	4.2	4.7	0.5	31.9	33.5	1.6	204.5	202.6	-1.9	1.1	1.1	0.0
Boise County	0	0	0	0.9	0.9	0	30.7	31.9	1.2	246.7	245.4	-1.3	0	0	0.0
Bonner County	0	0	0	1.5	1.5	0	102.8	102.8	0	373.8	373.8	0	0.1	0.1	0.0
Bonneville County	0	0	0	0	0	0	0.1	0.1	0	6.9	6.9	0	0	0	0.0
Boundary County	0	0	0	0.1	0.1	0	12.4	12.4	0	70.6	70.6	0	0	0	0.0
Butte County	0	0	0	0	0	0	0	0	0	29	29	0	0	0	0.0
Camas County	0	0	0	0.2	0.2	0	1.8	1.8	0	289	289	0	0	0	0.0
Canyon County	0	0.1	0.1	0.9	1.1	0.2	20.7	23.3	2.6	23	20.2	-2.8	0.3	0.3	0.0
Caribou County	0	0	0	0	0	0	0	0	0	83	83	0	0	0	0.0
Cassia County	0	0	0	0	0	0	2.2	2.2	0	264.9	264.9	0	0	0	0.0
Clark County	0	0	0	0	0	0	0	0	0	51.9	51.9	0	0.3	0.3	0.0
Clearwater County	0	0	0	0.2	0.2	0	5	5	0	154.4	154.4	0	0	0	0.0
Coeur D'Alene Tribe	0	0	0	0.7	0.7	0	5.7	6.7	1	164.6	163.7	-0.9	1.1	1.1	0.0
Custer County	0	0	0	0	0	0	1.9	1.9	0	13.1	13.1	0	0	0	0.0
Duck Valley Tribe	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0
Elmore County	0.4	0.4	0	3.4	3.4	0	24.9	25.3	0.4	516.9	516.6	-0.3	4.2	4.2	0.0
Fort Hall Tribe	0	0	0	0	0	0	0	0	0	41.3	41.3	0	0	0	0.0
Franklin County	0	0	0	0.1	0.1	0	1	1	0	60.5	60.5	0	0	0	0.0

Area	Urban (sq. miles)			Suburban (sq. miles)			Exurban (sq. miles)			Rural (sq. miles)			Commercial/ Industrial (sq. miles)		
	2010	2020	Change	2010	2020	Change	2010	2020	Change	2010	2020	Change	2010	2020	Change
Fremont County	0	0	0	0	0	0	3.4	3.4	0	71.4	71.4	0	0	0	0.0
Gem County	0.1	0.1	0	1.7	1.7	0	42.8	42.8	0	252.2	252.2	0	0.6	0.6	0.0
Gooding County	0.1	0.1	0	0.8	0.8	0	10	10	0	57.3	57.3	0	0.1	0.1	0.0
Idaho County	0	0	0	0.3	0.3	0	6.1	6.1	0	197.9	197.9	0	0	0	0.0
Jefferson County	0	0	0	0	0	0	0	0	0	0.4	0.4	0	0	0	0.0
Jerome County	0	0	0	0.1	0.1	0	4.2	4.2	0	110.1	110.1	0	0	0	0.0
Kootenai County	0.2	0.2	0	3.8	4.2	0.4	66.6	76.4	9.8	199.6	189.4	-10.2	1.3	1.3	0.0
Kootenai Tribe	0	0	0	0	0	0	0.1	0.1	0	0.4	0.4	0	0	0	0.0
Latah County	0	0	0	0.9	0.9	0	12.9	12.9	0	470.2	470.2	0	0	0	0.0
Lemhi County	0	0	0	0.1	0.1	0	2.9	2.9	0	65.9	65.9	0	0	0	0.0
Lewis County	0	0	0	0	0	0	0	0	0	43.3	43.3	0	0	0	0.0
Lincoln County	0	0	0	0.4	0.5	0.1	3.1	4.4	1.3	120.9	119.6	-1.3	0	0	0.0
Madison County	0	0	0	0	0	0	0	0	0	0.2	0.2	0	0	0	0.0
Minidoka County	0	0	0	0	0	0	0	0	0	8.1	8.1	0	0	0	0.0
Nez Perce County	0	0	0	0	0	0	0.1	0.1	0	95.2	95.2	0	0	0	0.0
Nez Perce Tribe	0.1	0.1	0	1.4	1.4	0	20.4	20.4	0	245.5	245.5	0	0.4	0.4	0.0
Oneida County	0	0	0	0.4	0.4	0	2.3	2.6	0.3	210.2	210	-0.2	0	0	0.0
Owyhee County	0	0	0	0	0	0	3.7	3.7	0	162	162	0	0.1	0.1	0.0
Payette County	0.1	0.1	0	1.1	1.1	0	13.5	13.5	0	166.1	166.1	0	0.1	0.1	0.0
Power County	0	0	0	0	0	0	0.8	1	0.2	187.9	187.7	-0.2	0	0	0.0
Shoshone County	0.2	0.2	0	2.6	2.6	0	19.3	19.3	0	171.6	171.6	0	0.8	0.8	0.0
Teton County	0	0	0	0	0	0	0.2	0.2	0	0.1	0.1	0	0	0	0.0
Twin Falls County	0.2	0.2	0	3.1	3.1	0	10.3	10.3	0	75.5	75.5	0	1	1	0.0
Valley County	0	0	0	0.4	0.4	0	20.6	20.7	0.1	158.5	158.5	0	0.1	0.1	0.0
Washington County	0.1	0.1	0	1.3	1.3	0	13.8	14.7	0.9	699.4	698.5	-0.9	0.2	0.2	0.0

Area	Urban (sq. miles)			Suburban (sq. miles)			Exurban (sq. miles)			Rural (sq. miles)			Commercial/ Industrial (sq. miles)		
	2010	2020	Change	2010	2020	Change	2010	2020	Change	2010	2020	Change	2010	2020	Change
Idaho Total	3.4	3.7	0.3	52.9	57.6	4.7	631.2	657.9	26.7	7,477.80	7,446.30	-31.5	20.2	20.2	0.0

Source: EPA 2013, Idaho BLM 2007
Notes: Projected development includes changes in housing density and land use.

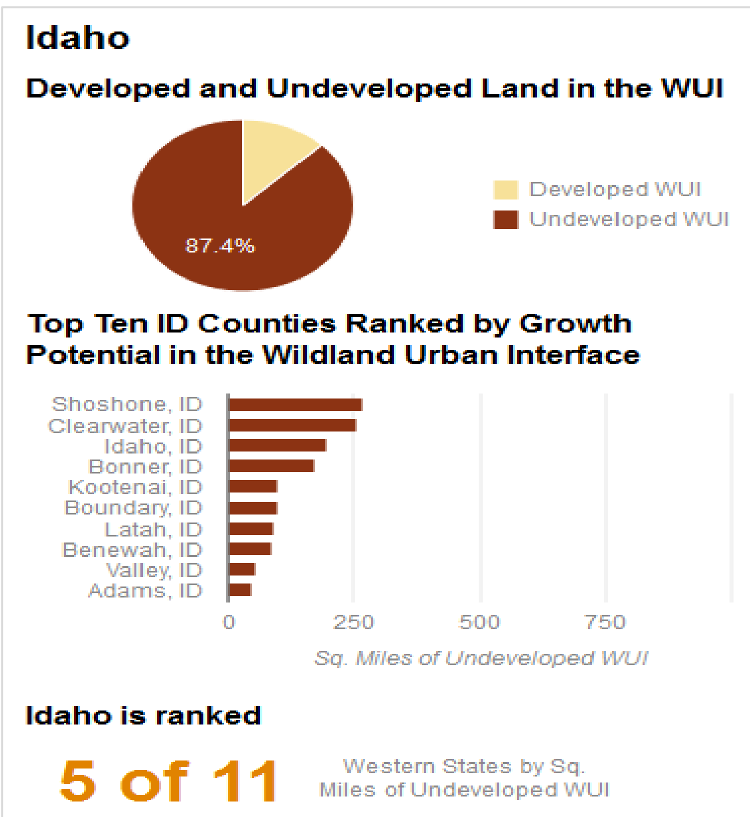


Figure 3.1.T: Idaho Development in WUI / *Source: www.headwatereconomics.org*

Numerous studies have been conducted with differing results in terms of number of buildings in the WUI. In addition, there are differing spatial definitions of the "WUI zone". But, all studies agree that the WUI is extensive and is rapidly expanding. For example, the 2016 Wildfire Hazard Risk Report by CoreLogic indicates that the State of Idaho has 41,230 residential properties potentially at risk in their 'Extreme Risk' zone that total an estimated $9.9 billion in replacement cost value. Figure 3.1.U shows the exponential increase in structures destroyed by fire over the past few decades from CoreLogic's 2012 study; an updated figure was not present in the most recent report. The trend shows a steady increase in the number of structures destroyed through the 1990's, and a massive increase between 2000 and 2008. As populations increase and developments expand into WUI zones, one could expect to continue to see this trend. According to a 2013 study by Headwater Economics, based on the large number of undeveloped private land in the WUI, future development trends will result in increased wildfire risk, especially to homes and personal property. The study estimates only 12.6 percent of available private land in the WUI is developed in Idaho, leaving a huge potential for growth in the remaining 87.4 percent of the acreage (see Figure 3.1.T). This ranks Idaho as the State with the 5th most undeveloped land in the WUI.

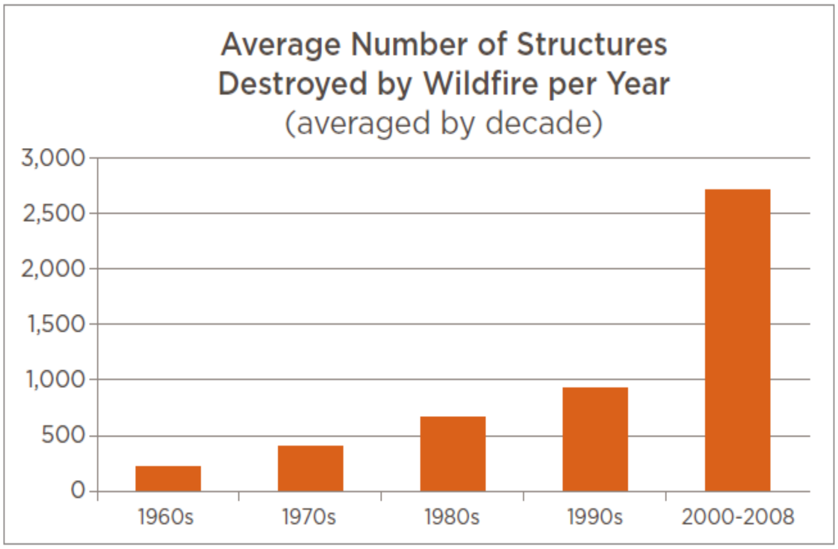


Figure 3.1.U.: U.S. Structures Destroyed by Wildfire / *Source: 2012 CoreLogic® Wildfire Hazard Risk Report (from Blue Ribbon Panel Report on WUI Fire, 2008)*

Northern Idaho has an exceptionally high potential risk. The current risk of wildfire (number of square miles of WUI with existing homes) and the potential risk (number of square miles of WUI that remains undeveloped) are both highest in the northern parts of the State. Both Shoshone and Clearwater counties have more than 250 square miles of undeveloped land that occur in the WUI (Figure 3.1.U). Combined, the 10 most northern counties in Idaho have more than 1,300 square miles of undeveloped, forested private land adjacent to fire-prone wildlands, where homes are likely to be built in the future.

A recent study from the University of Oregon's Institute for a Sustainable Environment conducted analysis of the economic impacts of large wildland fires in the western U.S. This study found that economies increase .9-1.5% in a community directly after a wildfire, but that these gains are short-lived and decreases are then seen a year and a half to two years following the event. This is interesting to note and is the inverse of those patterns seen for most other hazards, where communities generally experience a decrease in economy during a disaster event with economic growth seen during subsequent recovery.

Vulnerability Assessment and Loss Estimation

Statewide Analysis

A statewide wildfire analysis was conducted using best available data for the State of Idaho. This section discusses statewide vulnerability of areas susceptible to wildfires and potential losses to state assets (State-owned and leased buildings) and critical facilities. To assess the State's risk to the wildfire hazard, the Idaho BLM Relative Risk to Wildfire spatial layer was utilized. The wildfire hazard area was identified as the areas of 'Moderate-High' and 'High' risk as determined by the Idaho Bureau of Land. According to the Bureau of Land, the data was derived using the wildland urban interface, relative wildland fire risk, and relative wildland fire hazard (Idaho BLM 2007). The data examined the relationship between the potential for an area to burn, as well as the fire behavior that would be observed based on the land use.

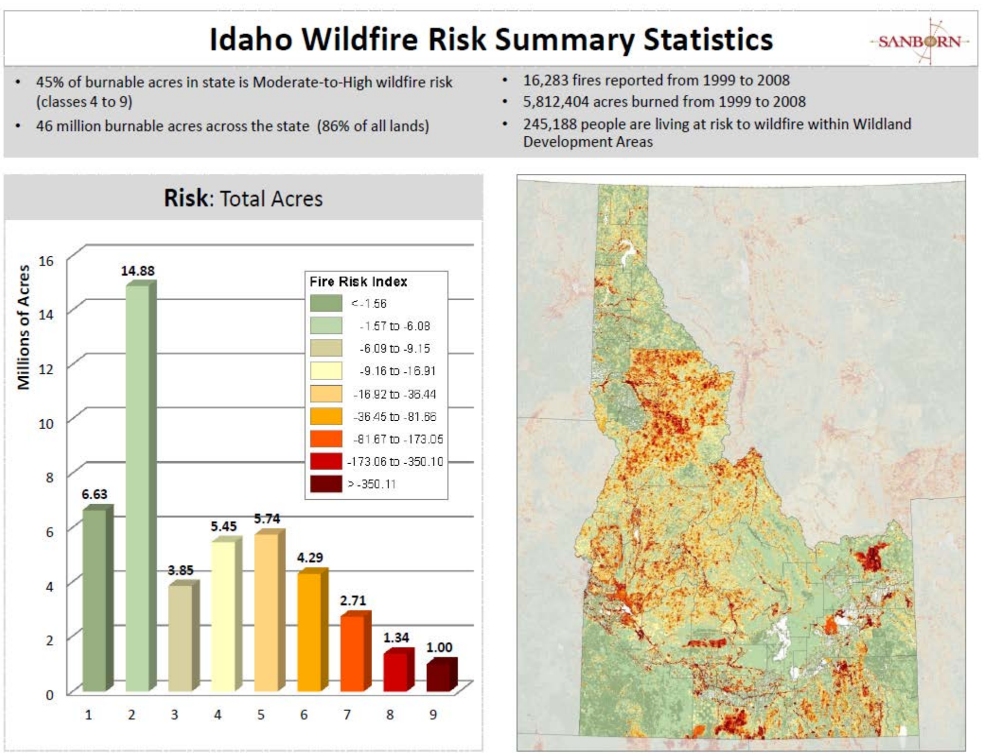
Wildfire risk is complicated. More than the other major hazards, wildfire risk has major consequences for both the natural and human environments. Also, there is no consensus on what constitutes the WUI. Different Federal agencies have different definitions of the WUI.
Similarly, wildfire losses are difficult to estimate. Losses are usually the result of several types of costs:

- **Direct Costs**: Wildfire costs are most easily measured when they have immediate and direct impacts. This category prominently includes Federal, State, and local suppression costs. These costs, in turn, can be broken down into expenditures for aviation, engines, firefighting crews, and agency personnel. In addition to suppression costs, other direct costs include private property losses (insured and uninsured), damage to utility lines, damage to recreation facilities, loss of timber resources, and aid to evacuated residents. Most of these costs are incurred during or immediately following the fire.
- **Rehabilitation Costs**: Immediate emergency rehabilitation costs are sometimes considered direct, since those costs are incurred in the days, weeks, and months following the fire and are clearly attributable to the wildfire event. The costs are shouldered by Federal, State, and local agencies and, again, the data are relatively accessible. Longer-term rehabilitation costs, however, are harder to measure, and ongoing rehabilitation expenses may not be clearly connected to the wildfire event. Watersheds damaged by fire, in particular, can take many years to recover and require significant restoration activities. Post-fire flooding events can create additional damage to the already scarred landscape, and subsequent impacts may include an increase in invasive species and erosion.
- **Indirect Costs**: Once the fire has been extinguished and rehabilitation efforts have begun, additional costs continue to accumulate. These costs have historically escaped accounting by land management agencies, and may extend years beyond the wildfire event. Indirect wildfire costs include lost tax revenues in a number of categories, such as sales and county taxes, as well as business revenue and property losses that accumulate over the longer term. For example,

properties that escape damage in the fire may still experience dramatic drops in value as the area recovers.

- **Special Costs**: Beyond the indirect costs associated with wildfire are longer-term costs, often called "special" costs. Putting a numerical value on human life is always a dubious effort, but some standardized numbers do exist for guidance. When a firefighter perishes in the line of duty, families receive a set sum for their loss; this number serves as a proxy for the cost of lost life. Loss of civilian life, ongoing health problems for the young, old, and those with weak respiratory or immune systems; and mental health needs also fall into this category but are rarely quantified. Additionally, there is an extensive loss of ecosystem services, some of which are inherently difficult to quantify—aesthetic and scenic beauty and wildlife existence values.

The USFS determined that over a 20-year period, suppression actions cost an average $582 per acre. According to the study *The True Cost of Wildfire in the Western U.S.,* by the Western Forestry Leadership Coalition, the true costs of wildfire are shown to be far greater than the costs usually reported to the public; total expenses range from 2 to 30 times the reported suppression costs. Estimates of total costs appear to be determined by a host of factors including fire severity, nearby population density, terrain, and the boundaries of the analysis itself. Based on the past average number of acres burned (597,644), the average annual losses in Idaho have been approximately $348 million.



The recent 2016 CoreLogic® Wildfire Hazard Risk Report, referenced previously, provided state by state estimates of residential properties potentially at risk to wildfire damages. Across western states, Idaho ranked 5th, for residential properties in both the Extreme and High risk categories. This equates to a total of 67,877 residences. This is an increase from the 2012 numbers of 9th and 8th in rankings and 10,633 residences, with 57,244 residences now at risk.

All structures contain an International Organization for Standardization (ISO) Fire Classification. Additional details are included below:

The ISO is an advisory organization that collects information and presents it to the public for insurance companies to use in order to determine rates for those that they insure. The ISO measures the amount of public fire assistance in each community across the United States and uses this information to classify each area on a numerical scale. The classifications offered by this rating schedule help the insurance companies develop policies, paperwork, language and premiums for those to whom that they provide service based on the classification of the ISO.

The PPC Program. The Public Protection Classification (PPC) Program is used to provide a score to every area across the United States based on their ability to provide public assistance in the case of a fire. The ISO evaluates each area's community-based programs in regards to their ability to answer fire calls efficiently and prevent resulting property loss. This rating helps communities throughout the United States to be aware of their ability to suppress fires and also helps insurance companies, as the higher the classification of a community, the lower the premiums will be in that area. In order to arrive at this classification the ISO evaluates water supply, fire departments and fire alarms.

Classes One through Three. Classes one through three are the highest classifications that a community can receive. A community will receive a class one ISO fire classification if they receive a score of 90 or above based on a 100 point scale after the ISO has evaluated all of the elements mentioned above concerning their ability to efficiently respond to fires. A community will receive a class two ISO fire classification if their score is between 80-89.99 and a class three ISO if 70-79.99. Fire insurance costs in these areas are typically lower due to the community's ability and resources to quickly respond to and suppress fires.

Classes Four through Six. A class four ISO fire classification is given to those communities that score between 60-69.99 on the 100 point scale, a class five ISO fire classification to those between 50-59.99 and a class six ISO classification to those 40-49.99. Fire insurance premiums in these areas are slightly higher than in areas with better ISO classifications, as the ISO has determined that there are some areas of improvement that need to be addressed in order to make the community more efficient at responding to and suppressing fires.

Classes Seven through Ten. A class seven ISO fire classification is issued to those communities who score between 30-39.99 on the 100 point scale, a class eight ISO classification to those communities between 20-29.99 and class nine to those between 10-9.99. The classification of ten is the worst possible ISO fire classification a community can receive, and is reserved for those who severely lack the ability to respond to fires. A class ten fire classification is issued to those communities that score less than 10 points on the 100 point scale. The premiums for fire insurance within these communities will be higher due to the increased probability of loss from fire.

Critical Infrastructure and State Facility Impacts

Major highways, railways, and power/communication transmission lines would be some of the State assets with the potential to be impacted by a wildfire event. State facilities that border or are located in the WUI would be the structures most vulnerable to the negative impacts arising from a wildfire.

For the purposes of this risk assessment, an asset is considered potentially vulnerable if it is located in an identified hazard area. To assess the vulnerability of the State owned and leased facilities, geographic information system (GIS) software was used to overlay the wildfire hazard area were overlaid with the assets. Tables 3.1.V and 3.1.W summarize the State owned and leased facilities located in the wildfire hazard area by County and Tribal Nation, and state agency, respectively. Table 3.1.V summarizes the total number of critical facilities located in the wildfire hazard area by County and Tribal National. Refer to Figure 3.1.W which illustrates the assets located within the wildfire hazard area in the State.

The spatial analysis indicates that Ada County has the greatest number of State owned and leased buildings located in the wildfire hazard area. The state agency with the greatest number of buildings exposed and potentially vulnerable to the wildfire hazard is the Department of Fish and Game. Statewide, an estimated 25-percent of the overall state building inventory is potentially vulnerable to the wildfire hazard (approximately $1.9 billion in replacement cost value). It is worth noting that 100% of the assets located in the following counties are located in the wildfire hazard area: Benewah County, Gem County, Lincoln County, Oneida County, and Shoshone County.

At the county level, Elmore County has the greatest number of critical facilities and greatest proportion of facilities located in the wildfire hazard area (359 facilities – 96.0%). Of the 3,796 critical facilities exposed, 2,348 are from the ICRMP critical facility inventory, which has the ISO Classification for each facility. The ISO measures the amount of public fire assistance in each community across the United States, and evaluates each areas' community based programs in regards to their ability to answer fire calls efficiently and prevent resulting property loss. Facilities with a classification of 7-10 are for the communities that severely lack the ability to effectively respond to fire. Of the total number of ISO classified facilities located in the hazard area, 712 received a score of 7-10, with Latah County containing the greatest number (89 facilities). Refer to Table 3.1.X for a summary of these results.

Table 3.1.V. Number of State-Owned and Leased Buildings Located in the Wildfire Hazard Area by Jurisdiction

Jurisdiction	State-Owned Buildings		State-Leased Buildings		Total Number of State-Owned and Leased Buildings	
	Number in the Wildfire Hazard Area	Value in the Wildfire Hazard Area	Number in the Wildfire Hazard Area	Value in the Wildfire Hazard Area	Total Number	Total Value
Ada County	180	$670,428,683	10	$75,682,223	589	$2,989,418,989
Adams County	2	$1,377,752	0	$0	3	$1,783,594
Bannock County	146	$1,019,376,654	1	$1,951,764	156	$1,103,616,221
Bear Lake County	0	$0	0	$0	5	$735,496
Benewah County	1	$2,749,464	0	$0	1	$2,749,464
Bingham County	0	$0	0	$0	90	$77,767,107
Blaine County	8	$3,592,142	0	$0	22	$5,902,697
Boise County	8	$1,633,996	0	$0	17	$2,887,850
Bonner County	25	$5,165,596	0	$0	64	$15,374,769
Bonneville County	0	$0	0	$0	55	$128,187,998
Boundary County	6	$304,623	0	$0	10	$2,921,183
Butte County	0	$0	0	$0	0	$0
Camas County	0	$0	0	$0	0	$0
Canyon County	0	$0	0	$0	217	$150,244,776
Caribou County	1	$33,114	0	$0	15	$2,277,825
Cassia County	0	$0	0	$0	28	$3,167,401
Clark County	0	$0	0	$0	2	$71,311
Clearwater County	0	$0	0	$0	6	$258,189
Coeur D'Alene Tribe	11	$3,334,023	0	$0	21	$8,410,014
Custer County	0	$0	0	$0	19	$2,331,691
Duck Valley Tribe	0	$0	0	$0	0	$0
Elmore County	32	$8,556,231	0	$0	33	$8,637,861
Fort Hall Tribe	0	$0	0	$0	1	$4,546,934
Franklin County	0	$0	0	$0	7	$2,244,517
Fremont County	52	$10,330,152	0	$0	191	$59,931,586
Gem County	8	$1,846,444	0	$0	8	$1,846,444
Gooding County	23	$36,381,147	0	$0	88	$49,454,311
Idaho County	0	$0	0	$0	27	$21,047,034
Jefferson County	0	$0	0	$0	50	$19,079,527
Jerome County	3	$372,580	3	$3,410,868	18	$13,471,464
Kootenai County	6	$9,221,400	0	$0	71	$83,386,890

Jurisdiction	State-Owned Buildings: Number in the Wildfire Hazard Area	State-Owned Buildings: Value in the Wildfire Hazard Area	State-Leased Buildings: Number in the Wildfire Hazard Area	State-Leased Buildings: Value in the Wildfire Hazard Area	Total Number of State-Owned and Leased Buildings: Total Number	Total Number of State-Owned and Leased Buildings: Total Value
Kootenai Tribe	0	$0	0	$0	0	$0
Latah County	37	$8,268,157	0	$0	390	$1,497,479,249
Lemhi County	0	$0	0	$0	48	$11,258,674
Lewis County	0	$0	0	$0	0	$0
Lincoln County	20	$11,258,939	0	$0	20	$11,258,939
Madison County	0	$0	0	$0	4	$3,514,980
Minidoka County	0	$0	0	$0	9	$6,314,545
Nez Perce County	1	$16,810	0	$0	135	$305,323,161
Nez Perce Tribe	61	$26,811,238	0	$0	62	$26,895,878
Oneida County	2	$832,428	0	$0	2	$832,428
Owyhee County	11	$2,522,208	0	$0	12	$2,639,778
Payette County	6	$3,379,492	0	$0	7	$3,405,151
Power County	0	$0	0	$0	33	$4,323,726
Shoshone County	8	$2,604,226	0	$0	8	$2,604,226
Teton County	0	$0	0	$0	27	$8,821,471
Twin Falls County	16	$14,222,991	0	$0	63	$86,924,836
Valley County	5	$1,021,825	0	$0	58	$9,575,027
Washington County	1	$268,727	0	$0	21	$2,024,672
Total	**680**	**$1,845,911,042**	**14**	**$81,044,855**	**2,713**	**$6,744,949,885**

Source: Idaho BLM 2007, Risk Management Technical Records
Value = Replacement cost value (structure and contents)

Wildfire Hazard Area by Agency

Agency	[State-Owned Buildings]: Number in the Wildfire Hazard Area	[State-Owned Buildings]: Value in the Wildfire Hazard Area	[State-Leased Buildings]: Number in the Wildfire Hazard Area	[State-Leased Buildings]: Value in the Wildfire Hazard Area	Total Number of State-Owned and Leased Buildings: Total Number	Total Number of State-Owned and Leased Buildings: Total Value
Administration - Department Of	0	$0	0	$0	16	$545,649,861
Blind Commission	0	$0	0	$0	1	$12,931,760
Board Of Pharmacy	0	$0	0	$0	1	$550,280
Boise State University	19	$10,901,469	0	$0	216	$1,478,845,528
Boise Veteran's Home	3	$35,009,037	0	$0	3	$35,009,037
Commission On The Arts	0	$0	1	$178,978	1	$178,978
Correctional Industries	4	$12,070,521	0	$0	4	$12,070,521

Agency	State-Owned Buildings		State-Leased Buildings		Total Number of State-Owned and Leased Buildings	
	Number in the Wildfire Hazard Area	Value in the Wildfire Hazard Area	Number in the Wildfire Hazard Area	Value in the Wildfire Hazard Area	Total Number	Total Value
Dairy Products Commission	0	$0	0	$0	1	$2,302,604
Deaf And Blind School	17	$35,062,732	0	$0	17	$35,062,732
Department Of Agriculture	8	$19,838,429	0	$0	8	$19,838,429
Department Of Corrections	80	$533,643,919	3	$200,921	111	$566,639,088
Department Of Fish And Game	113	$20,372,626	3	$3,410,868	503	$106,038,567
Department Of Juvenile Corrections	0	$0	0	$0	196	$58,581,570
Department Of Labor	0	$0	0	$0	9	$46,110,479
Department Of Lands	26	$7,418,545	0	$0	115	$56,967,411
Department Of Parks And Recreation	94	$24,643,056	0	$0	242	$50,186,766
Department Of Transportation	89	$39,319,328	0	$0	228	$160,342,438
Department Of Transportation-Aeronautics	2	$2,553,961	0	$0	3	$2,559,109
Department Of Water Resources	0	$0	0	$0	1	$160,000
Dept. Of Health & Welfare, Region I	0	$0	0	$0	1	$612,067
Dept. Of Health & Welfare, Region II	0	$0	0	$0	1	$1,842,609
Dept. Of Health & Welfare, Region V	2	$3,859,869	0	$0	2	$3,859,869
Dept. Of Health & Welfare, Region VI	0	$0	0	$0	3	$7,875,177
Eastern Idaho Technical College	0	$0	0	$0	8	$76,544,215
Historical Society	30	$40,363,830	0	$0	52	$61,850,665
Idaho Barley Commission	0	$0	0	$0	1	$10,506
Idaho Crop Improvement Association	0	$0	0	$0	5	$1,875,876
Idaho State University	107	$926,802,930	0	$0	118	$1,071,183,355
Idaho Wheat Commission	0	$0	0	$0	1	$888,285
IDHW - Bureau Of Laboratories	1	$19,366,868	0	$0	1	$19,366,868
IDHW - State Hospital North	14	$19,793,423	0	$0	14	$19,793,423

Agency	State-Owned Buildings		State-Leased Buildings		Total Number of State-Owned and Leased Buildings	
	Number in the Wildfire Hazard Area	Value in the Wildfire Hazard Area	Number in the Wildfire Hazard Area	Value in the Wildfire Hazard Area	Total Number	Total Value
IDHW - State Hospital South	0	$0	0	$0	14	$50,573,434
IDHW - Welfare Medicaid Operations	0	$0	0	$0	1	$113,141
IDHW Southwest Idaho Treatment Center	0	$0	0	$0	31	$65,257,596
ISP - Idaho State Police	1	$6,800,000	0	$0	15	$74,050,639
Lava Hot Springs Foundation	9	$13,043,015	1	$1,951,764	10	$14,994,779
Lewis-Clark State College	0	$0	0	$0	41	$228,497,894
Lewiston Veteran's Home	0	$0	0	$0	2	$12,096,807
Lottery Commission	0	$0	1	$10,769	2	$14,665
Military Division	12	$15,222,558	4	$373,540	70	$70,015,196
Pocatello Veteran's Home	4	$13,558,252	0	$0	4	$13,558,252
Public Employees Retirement System	0	$0	0	$0	2	$12,602,747
Public Health District 1 (Panhandle)	3	$4,066,623	0	$0	7	$17,949,011
Public Health District 2 (North Central)	2	$1,181,631	0	$0	5	$10,948,557
Public Health District 3 (Southwest)	4	$1,330,027	0	$0	5	$9,551,538
Public Health District 4 (Central)	1	$1,375,774	0	$0	3	$10,807,899
Public Health District 5 (South Central)	2	$2,104,759	0	$0	5	$8,898,081
Public Health District 6 (South Eastern)	2	$7,931,054	0	$0	3	$8,479,572
Public Health District 7 (Eastern)	0	$0	0	$0	9	$10,187,921
State Insurance Fund	0	$0	0	$0	2	$21,023,875
State Liquor Division	1	$14,451,435	0	$0	1	$14,451,435
University Of Idaho	30	$13,825,370	1	$74,918,015	590	$1,631,136,168
Veterans State Cemetery	0	$0	0	$0	8	$4,012,608
Total	**680**	**$1,845,911,042**	**14**	**$81,044,855**	**2,713**	**$6,744,949,885**

Source: Idaho BLM 2007, Risk Management Technical Records
Value = Replacement cost value (structure and contents)

Table 3.1.X. Number of Critical Facilities Located in the Wildfire Hazard Area by Jurisdiction

Jurisdiction	Total Number of Critical Facilities	Number of Critical Facilities in the Wildfire Hazard Area	Percent (%) of Total in the Wildfire Hazard Area
Ada County	1,078	306	28.4%
Adams County	96	54	56.3%
Bannock County	513	256	49.9%
Bear Lake County	152	7	4.6%
Benewah County	67	48	71.6%
Bingham County	334	1	<1%
Blaine County	320	202	63.1%
Boise County	157	121	77.1%
Bonner County	466	206	44.2%
Bonneville County	493	5	1.0%
Boundary County	206	38	18.4%
Butte County	80	0	0.0%
Camas County	41	30	73.1%
Canyon County	961	52	5.4%
Caribou County	220	15	6.8%
Cassia County	272	19	7.0%
Clark County	66	0	0.0%
Clearwater County	114	46	40.4%
Coeur D'Alene Tribe	126	70	55.6%
Custer County	122	0	0.0%
Duck Valley Tribe	1	0	0.0%
Elmore County	374	359	96.0%
Fort Hall Tribe	34	0	0.0%
Franklin County	207	16	7.7%
Fremont County	228	8	3.5%
Gem County	204	191	93.6%
Gooding County	216	62	28.7%
Idaho County	197	26	13.1%
Jefferson County	187	0	0.0%
Jerome County	236	52	22.0%
Kootenai County	758	266	35.1%
Kootenai Tribe	0	0	<1%
Latah County	366	205	56.0%
Lemhi County	182	47	25.8%
Lewis County	0	0	<1%
Lincoln County	129	88	68.2%
Madison County	173	0	0.0%
Minidoka County	196	0	0.0%
Nez Perce County	116	15	12.9%
Nez Perce Tribe	335	133	39.7%

Jurisdiction	Total Number of Critical Facilities	Number of Critical Facilities in the Wildfire Hazard Area	Percent (%) of Total in the Wildfire Hazard Area
Oneida County	111	76	68.5%
Owyhee County	252	31	12.3%
Payette County	267	55	20.6%
Power County	161	19	11.8%
Shoshone County	210	177	84.3%
Teton County	111	0	0.0%
Twin Falls County	761	141	18.5%
Valley County	314	124	39.5%
Washington County	241	229	95.0%
Idaho Total	**12,451**	**3,796**	**30.5%**

Source: Idaho BLM 2007, ICRMP, HSIP, IOEM, IDWR

Table 3.1.Y. Number of ISO Class 7-10 Facilities Located in the Wildfire Hazard Area by Jurisdiction

Jurisdiction	Number of ISO Class 7-10 Facilities Located in Hazard Area	Jurisdiction	Number of ISO Class 7-10 Facilities Located in Hazard Area
Ada County	7	Gem County	62
Adams County	2	Gooding County	2
Bannock County	13	Idaho County	4
Bear Lake County	1	Jerome County	13
Benewah County	16	Kootenai County	31
Blaine County	18	Latah County	89
Boise County	69	Lemhi County	19
Bonner County	58	Lewis County	0
Bonneville County	1	Lincoln County	7

Jurisdiction	Number of ISO Class 7-10 Facilities Located in Hazard Area	Jurisdiction	Number of ISO Class 7-10 Facilities Located in Hazard Area
Boundary County	17	Nez Perce County	15
Camas County	2	Oneida County	58
Canyon County	1	Owyhee County	1
Caribou County	3	Payette County	3
Cassia County	4	Power County	4
Clearwater County	27	Shoshone County	44
Elmore County	23	Twin Falls County	11
Franklin County	8	Valley County	45
Fremont County	1	Washington County	33
Gem County	62	**Idaho Total**	**712**

Source: Idaho BLM 2007, ICRMP

Table 3.1.Z lists the miles of canals that located in the wildfire hazard area by County and Tribal Nation. The Coeur d'Alene Tribe has the greatest proportion of canals exposed (99.4%), while Elmore County has the greatest total mileage of canals located in the hazard area (173.4 mi.).

Table 3.1.Z. Mileage of Canals Located in the Wildfire Hazard Area by Jurisdiction

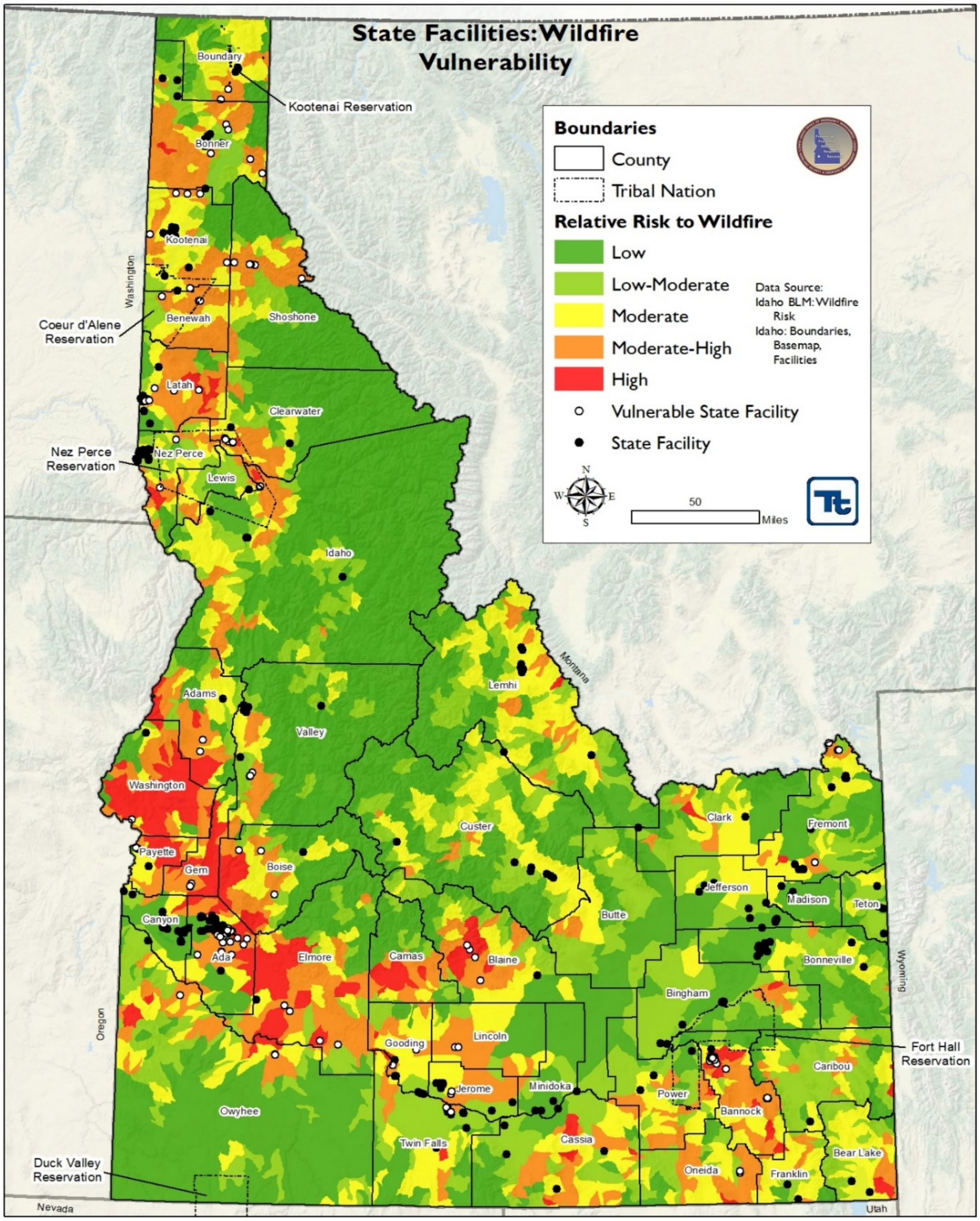
Jurisdiction	Total Canal Length (miles)	Length of Canal in the Wildfire Hazard Area (miles)	Percent (%) of Total
Ada County	422.0	166.6	39.5%
Adams County	28.7	10.9	37.9%
Bannock County	92.6	51.7	55.8%
Bear Lake County	198.7	18.7	9.4%
Benewah County	0.0	0.0	0.0%
Bingham County	455.6	2.4	<1%
Blaine County	114.5	62.7	54.8%
Boise County	10.6	4.6	43.3%
Bonner County	1.0	0.0	0.0%
Bonneville County	385.4	0.5	<1%
Boundary County	72.0	0.3	<1%
Butte County	166.9	5.5	3.3%
Camas County	4.9	4.2	85.2%
Canyon County	855.0	52.4	6.1%
Caribou County	168.2	6.3	3.7%
Cassia County	625.1	17.7	2.8%

Jurisdiction	Total Canal Length (miles)	Length of Canal in the Wildfire Hazard Area (miles)	Percent (%) of Total
Clark County	66.9	5.8	8.7%
Clearwater County	0.0	0.0	0.0%
Coeur D'Alene Tribe	5.3	5.3	99.4%
Custer County	115.9	0.0	0.0%
Duck Valley Tribe	21.0	0.0	0.0%
Elmore County	197.2	173.4	87.9%
Fort Hall Tribe	201.7	2.8	1.4%
Franklin County	214.2	8.4	3.9%
Fremont County	366.2	52.0	14.2%
Gem County	117.2	109.7	93.6%
Gooding County	383.1	83.5	21.8%
Idaho County	22.0	0.0	0.0%
Jefferson County	401.0	0.0	0.0%
Jerome County	431.5	125.0	29.0%
Kootenai County	26.0	16.2	62.5%
Kootenai Tribe	6.8	0.0	0.0%
Latah County	0.0	0.0	0.0%
Lemhi County	111.2	27.5	24.7%
Lewis County	0.0	0.0	0.0%
Lincoln County	220.8	157.6	71.4%
Madison County	165.8	0.0	0.0%
Minidoka County	252.6	0.0	0.0%
Nez Perce County	1.6	0.0	0.0%
Nez Perce Tribe	10.0	1.2	12.1%
Oneida County	39.8	26.5	66.5%
Owyhee County	349.6	82.6	23.6%
Payette County	230.2	150.7	65.5%
Power County	57.7	5.5	9.6%
Shoshone County	0.0	0.0	0.0%
Teton County	82.3	0.0	0.0%
Twin Falls County	500.4	52.4	10.5%
Valley County	59.4	28.2	47.5%
Washington County	55.5	49.2	88.7%
Idaho Total	**8,315.6**	**1,568.1**	**18.9%**

Source: Idaho BLM 2007, Risk Management Technical Records
Value = Replacement cost value (structure and contents)

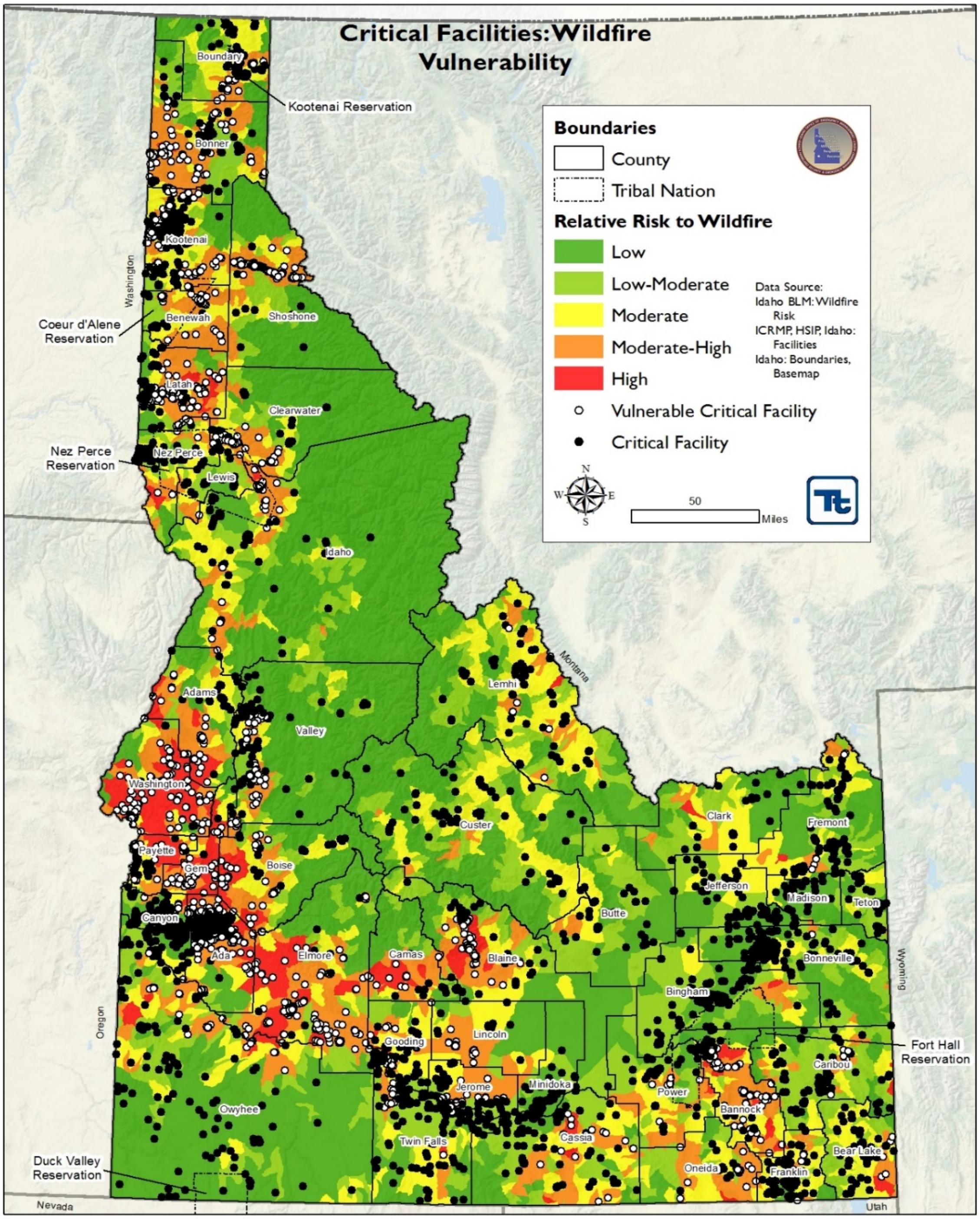
Major highways, railways, and power/communication transmission lines may also be impacted by a wildfire event. Most roads and railroads would not be damaged except in the worst case wildfire scenarios. Fires can create conditions that block or prevent access and can isolate residents and emergency service providers. Power lines are the most at risk to wildfire because most poles are made of wood and susceptible to burning. In the event of a wildfire, pipelines that provide a source of fuel could be ignited, leading to a catastrophic explosion. The wildfire hazard typically does not have a major direct impact on bridges, but it can create conditions in which bridges are obstructed or weakened.

Figure 3.1.AA. State Facilities: Wildfire Vulnerability



Note: State facility = State owned- or State-leased building. A vulnerable facility is a facility located in the identified hazard area.

Figure 3.1.BB. Critical Facilities: Wildfire Vulnerability



Note: A vulnerable facility is a facility located in the identified hazard area.

Hazard Mitigation Vulnerability Assessments

This section discusses the vulnerability of jurisdictions to areas susceptible to wildfire. It provides a summary of vulnerability and potential losses to population and buildings by county and Tribal Nation and discusses the jurisdictions most threatened by the wildfire hazard. A spatial exposure analysis was conducted using the Idaho BLM Relative Wildfire Risk data and the 2010 U.S. Census Block population data and default HAZUS-MH general building stock data. The HAZUS-MH v4.0 dasymetric census block data was utilized. Census locks with their centroid in the hazard area are reported. Refer to Appendix X for the IMHRP which summarizes overall wildfire risk by watershed.

IOEM directly participates in the Idaho Lands Resource Coordinating Council (ILRCC), which is described in Appendix D. The ILRCC is a multiagency (local, State and Federal) organization that is an advisory organization of Idaho Department of Lands (IDL). IDL has oversight and provides briefs to ILRCC on what is going on with CWPPs throughout the state. CWPPs were developed in collaboration with the State Fire Plan and have been integrated into some county Local All-Hazard Mitigation Plans, but in 2016 the direction on who plans were to be developed was determined by IDL. IOEM and IDL will continue to diligently work with counties to integrate CWPP into the County Hazard Plans as local jurisdictions desire.

Population

Table 3.1.CC displays the total population located in the wildfire hazard area. Both Elmore County and Gem County have more than 98% of their population located in the wildfire hazard area. Approximately 30% of the Ada County population is located in the wildfire hazard area. Overall, nearly 25% of the State's total population is located in the wildfire hazard area, and thus potentially vulnerable to the wildfire hazard.

While all people located in the wildfire hazard area are considered potentially vulnerable, populations considered most vulnerable include the elderly (persons over the age of 65) and individuals living below the United States Census poverty threshold. These socially vulnerable populations are most susceptible based on a number of factors including their physical and financial ability to react or respond during a hazard, the location and construction quality of their housing, and the ability to be self sustaining for prolonged periods of time after an incident because of limited ability to stockpile supplies. The population over 65 makes up 18.9% of the total population of Washington County located in the hazard area. Approximately 11.4% of Shoshone County's total population is the low income population located within the hazard area as well. Ada County has the greatest number of these socially vulnerable populations with nearly 14,000 people combined located in the hazard area. Chapter 2 (State Profile) summarizes the State's demographics by County.

Table 3.1.CC. U.S. Census 2010 Population Located in the Wildfire Hazard Area by Jurisdiction

Jurisdiction	Total Population	Population Located in the Wildfire Hazard Area	Percent (%) of Total Population	Population Over 65 Located in the Wildfire Hazard Area	Percent (%) of Total Population	Low Income Population Located in the Wildfire Hazard Area	Percent (%) of Total Population
Ada County	392,365	115,864	29.5%	10,317	2.6%	3,495	<1%
Adams County	3,976	2,347	59.0%	569	14.3%	315	7.9%
Bannock County	80,722	34,757	43.1%	4,104	5.1%	2,576	3.1%
Bear Lake County	5,986	40	<1%	7	<1%	12	<1%
Benewah County	4,743	4,408	92.9%	867	18.3%	509	10.7%
Bingham County	42,775	26	<1%	7	<1%	0	0.0%
Blaine County	21,376	18,344	85.8%	1,984	9.3%	778	3.6%
Boise County	7,028	5,756	81.9%	854	12.2%	453	6.4%
Bonner County	40,877	20,268	49.6%	3,437	8.4%	1,609	3.9%
Bonneville County	104,234	21	<1%	5	<1%	2	<1%
Boundary County	10,858	3,076	28.3%	455	4.2%	368	3.4%
Butte County	2,891	9	<1%	2	<1%	0	0.0%
Camas County	1,117	1,015	90.9%	147	13.1%	19	1.7%
Canyon County	188,923	8,563	4.5%	854	<1%	500	<1%
Caribou County	6,963	41	<1%	14	<1%	0	0.0%
Cassia County	22,952	1,006	4.4%	151	<1%	55	<1%
Clark County	982	75	7.6%	11	1.1%	6	<1%
Clearwater County	3,038	2,021	66.5%	480	15.8%	202	6.6%
Coeur D'Alene Tribe	6,765	3,734	55.2%	616	9.1%	369	5.5%
Custer County	4,368	53	1.2%	6	<1%	5	<1%
Duck Valley Tribe	356	0	0.0%	0	0.0%	0	0.0%
Elmore County	27,038	26,683	98.7%	2,686	9.9%	1,136	4.2%
Fort Hall Tribe	5,769	4	<1%	0	0.0%	0	0.0%
Franklin County	12,786	737	5.8%	82	<1%	52	<1%
Fremont County	13,242	1,212	9.2%	165	1.2%	90	<1%
Gem County	16,719	16,459	98.4%	3,066	18.3%	1,275	7.6%
Gooding County	15,464	5,669	36.7%	1,150	7.4%	568	3.7%
Idaho County	11,936	2,551	21.4%	679	5.7%	261	2.2%
Jefferson County	26,140	11	<1%	0	0.0%	0	0.0%
Jerome County	22,374	1,878	8.4%	270	1.2%	71	<1%
Kootenai County	136,271	28,956	21.2%	3,567	2.6%	1,760	1.3%

Kootenai Tribe	114	49	43.0%	11	9.6%	7	6.1%
Latah County	37,244	7,832	21.0%	1,259	3.4%	371	1.0%
Lemhi County	7,936	710	8.9%	174	2.2%	124	1.6%
Lewis County	36	16	44.4%	4	11.1%	1	2.8%
Lincoln County	5,208	3,757	72.1%	405	7.8%	178	3.4%
Madison County	37,536	0	0.0%	0	0.0%	0	0.0%
Minidoka County	20,069	21	<1%	1	0.0%	0	0.0%
Nez Perce County	34,664	600	1.7%	129	<1%	26	<1%
Nez Perce Tribe	18,440	9,737	52.8%	2,167	11.8%	987	5.4%
Oneida County	4,286	2,215	51.7%	405	9.4%	205	4.8%
Owyhee County	11,170	1,082	9.7%	168	1.5%	71	<1%
Payette County	22,623	8,159	36.1%	1,263	5.6%	381	1.7%
Power County	6,997	503	7.2%	63	<1%	18	<1%
Shoshone County	12,765	12,067	94.5%	2,385	18.7%	1,461	11.4%
Teton County	10,170	0	0.0%	0	0.0%	0	0.0%
Twin Falls County	77,230	21,352	27.6%	3,732	4.8%	1,128	1.5%
Valley County	9,862	3,421	34.7%	609	6.2%	180	1.8%
Washington County	10,198	9,480	93.0%	1,925	18.9%	1,090	10.7%
Idaho Total	**1,567,582**	**386,585**	**24.7%**	**51,252**	**3.3%**	**22,714**	**1.4%**

Source: US Census 2010, Idaho BLM 2007

General Building Stock

Similar to the analysis presented earlier, the general building stock data was overlaid with the wildfire hazard area to assess the vulnerability. Table 3.1.DD lists the number of buildings and total replacement cost (structure and contents) by county and Tribal Nation located in the hazard area. Overall, Ada County has the greatest building stock exposure to the wildfire hazard area. With 20,411 total buildings at an estimated $20.5 billion in replacement cost value, Ada County has nearly twice the number of buildings exposed as Bonner County (10,214); the County with the second highest number of buildings located in the wildfire hazard.

Table 3.1.DD. Estimated General Building Stock Located in the Wildfire Hazard Area

Jurisdiction	Total Number of Buildings	Total Replacement Cost Value	Number of Buildings Located in the Hazard Area	Percent (%) of Total Buildings	Value Located in the Wildfire Hazard Area	Percent (%) of Total Value
Ada County	94,345	$67,917,280,000	20,411	21.6%	$20,496,709,000	30.2%
Adams County	2,824	$768,231,000	1,535	54.4%	$429,814,000	55.9%
Bannock County	16,672	$12,223,383,000	7,555	45.3%	$5,103,178,000	41.7%
Bear Lake County	3,911	$1,196,118,000	37	<1%	$11,093,000	<1%
Benewah County	2,456	$698,652,000	2,314	94.2%	$668,182,000	95.6%
Bingham County	6,206	$5,405,079,000	3	<1%	$8,040,000	<1%
Blaine County	12,602	$5,476,705,000	10,056	79.8%	$4,107,862,000	75.0%
Boise County	5,475	$1,497,585,000	3,906	71.3%	$1,118,681,000	74.7%
Bonner County	24,133	$7,701,597,000	10,214	42.3%	$2,810,793,000	36.5%
Bonneville County	21,966	$18,775,427,000	7	<1%	$2,304,000	<1%
Boundary County	5,112	$1,556,926,000	1,159	22.7%	$286,858,000	18.4%
Butte County	1,127	$452,406,000	6	<1%	$1,334,000	<1%
Camas County	762	$247,126,000	689	90.4%	$213,395,000	86.4%
Canyon County	25,059	$24,048,014,000	2,388	9.5%	$1,059,907,000	4.4%
Caribou County	2,880	$1,176,048,000	31	1.1%	$7,262,000	<1%
Cassia County	1,389	$3,061,608,000	139	10.0%	$127,955,000	4.2%
Clark County	419	$124,419,000	16	3.8%	$9,366,000	7.5%
Clearwater County	2,028	$625,216,000	1,110	54.7%	$296,094,000	47.4%
Coeur D'Alene Tribe	3,651	$1,379,028,000	1,570	43.0%	$470,607,000	34.1%
Custer County	2,603	$987,374,000	41	1.6%	$10,606,000	1.1%
Duck Valley Tribe	52	$15,524,000	0	0.0%	$0	0.0%
Elmore County	954	$3,778,122,000	613	64.3%	$3,670,006,000	97.1%
Fort Hall Tribe	250	$596,710,000	1	<1%	$580,000	<1%
Franklin County	4,943	$1,742,513,000	298	6.0%	$91,190,000	5.2%
Fremont County	8,810	$2,807,781,000	819	9.3%	$225,647,000	8.0%
Gem County	7,294	$2,308,168,000	7,264	99.6%	$2,261,182,000	98.0%
Gooding County	907	$1,934,143,000	14	1.5%	$831,736,000	43.0%
Idaho County	4,252	$2,057,570,000	1,341	31.5%	$349,825,000	17.0%
Jefferson County	2,127	$3,163,139,000	2	<1%	$316,000	<1%
Jerome County	1,461	$2,620,168,000	274	18.8%	$254,616,000	9.7%
Kootenai County	50,322	$22,058,607,000	8,127	16.1%	$3,639,789,000	16.5%
Kootenai Tribe	50	$13,200,000	22	44.0%	$5,493,000	41.6%
Latah County	12,216	$5,264,747,000	3,611	29.6%	$1,076,027,000	20.4%

Lemhi County	4,833	$1,429,223,000	541	11.2%	$136,107,000	9.5%
Lewis County	34	$11,318,000	10	29.4%	$3,407,000	30.1%
Lincoln County	156	$629,652,000	99	63.5%	$458,144,000	72.8%
Madison County	4,371	$3,682,487,000	0	0.0%	$0	0.0%
Minidoka County	2,141	$2,594,005,000	0	0.0%	$3,779,000	<1%
Nez Perce County	14,271	$6,382,936,000	194	1.4%	$99,302,000	1.6%
Nez Perce Tribe	8,389	$2,580,646,000	4,909	58.5%	$1,435,604,000	55.6%
Oneida County	1,995	$684,026,000	1,091	54.7%	$364,693,000	53.3%
Owyhee County	1,140	$1,258,911,000	212	18.6%	$118,412,000	9.4%
Payette County	8,108	$2,900,679,000	2,935	36.2%	$1,013,432,000	34.9%
Power County	80	$1,011,694,000	19	23.8%	$74,793,000	7.4%
Shoshone County	7,056	$2,248,057,000	6,509	92.2%	$2,109,627,000	93.8%
Teton County	5,156	$1,793,082,000	1	<1%	$341,000	<1%
Twin Falls County	17,970	$11,430,233,000	6,413	35.7%	$3,821,814,000	33.4%
Valley County	11,335	$3,764,632,000	2,984	26.3%	$924,273,000	24.6%
Washington County	4,642	$1,615,788,000	4,283	92.3%	$1,464,414,000	90.6%
Idaho Total	**420,935**	**247,695,983,000**	**115,773**	**27.5%**	**$61,674,589,000**	**24.9%**

Source: HAZUS-MH v4.0, Idaho BLM 2007

Value = Replacement cost value (structure and contents)

In addition to threatening life and safety and destroying buildings and critical facilities, wildfire events can have major economic impacts on a community from the initial loss of structures and the subsequent loss of revenue from destroyed business and decrease in tourism. Wildfires can cost thousands of taxpayer dollars to suppress and control and involve hundreds of operating hours on fire apparatus and thousands of volunteer man hours from the volunteer firefighters. There are also many direct and indirect costs to local businesses that excuse volunteers from working to fight these fires.

Consequence Analysis Evaluation

On March 8, 2018, a Consequence Analysis Evaluation was conducted for three (3) hazard scenarios, aligning with hazards profiled in the State Hazard Mitigation Plan. The assessment was conducted by a diverse planning team comprised of subject matter experts from across the State. This effort mirrored a similar exercise that occurred during both the 2010 and 2013 State Hazard Mitigation Plan updates, which also analyzed the hazards of flood, earthquake, and wildfire.

The exercise is intended to provide another way to assess the State's vulnerability to its hazards and was conducted as a group exercise. Participants were asked to individually rank the following systems on a scale from 0 (no consequences) to 5 (most severe consequences), separately evaluating both the short-term (0-6 month) and long-term (6+ months) consequences of the scenario.

Systems Evaluated:

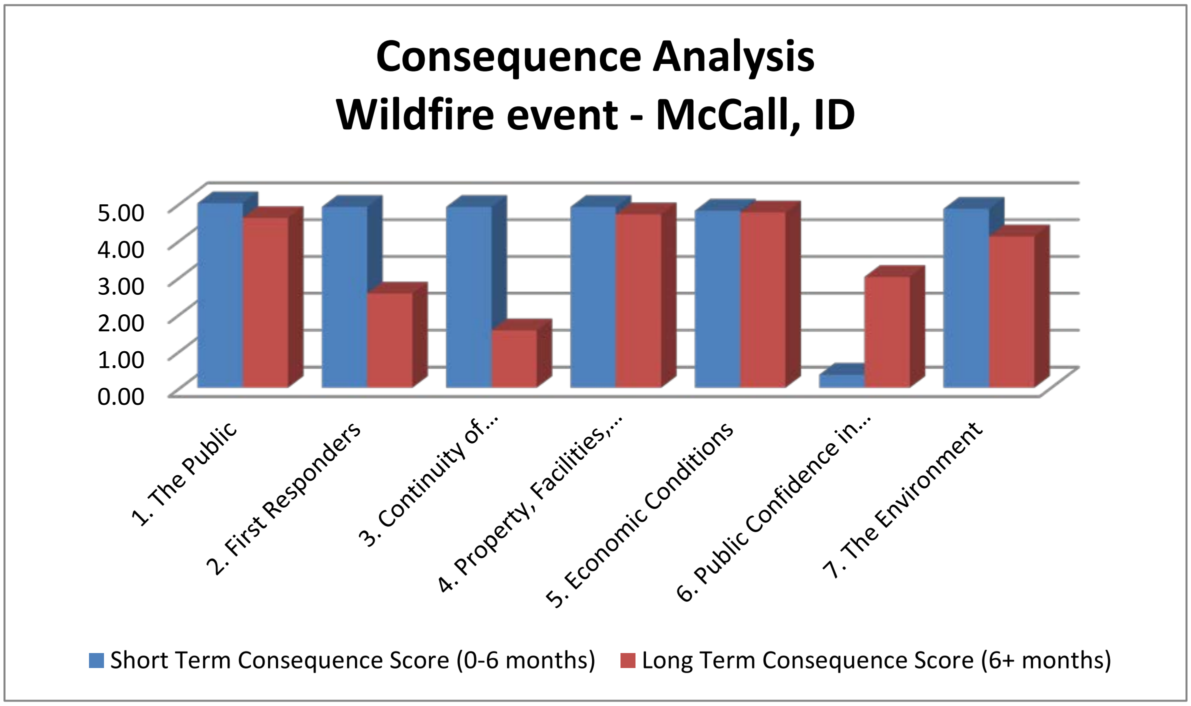
- The public

- First responders
- Continuity of operations
- Property, facilities, and infrastructure
- Economic conditions
- Public confidence in government

Scenario

August: A 1910-type wildfire event in McCall occurring in August.

Results



The chart above presents the results of the exercise. Looking at the short-term consequences of this wildfire event, exercise participants felt that the most severe consequences would be felt by nearly all of the systems reviewed, with the exception of public confidence in the government. From a long-term standpoint, the four systems suffering the most severe consequences include the public, the built environment, the economy, and the environment. Overall, what stands out is that the short-term impacts of a large wildfire are closely identical to the long-term effects, except that long-term consequences are improved for the operational and responder systems.

Some observations of the group to note included:

- The scenario in question is an extraordinarily massive and devastating disaster. All systems would be overwhelmed and would basically be starting from scratch.

- Federal assistance would be needed to attempt to recover from this wildfire. The sooner those resources would be made available, the better the consequences could be dealt with.
- The public, the built environment, the economy, and the environment would suffer severe consequences for an extended period of time.
- This type of hypothetical event would have a less catastrophic effect in any season other than summer and fall.
- The entire region would be dramatically affected from this event. The price of goods would skyrocket and tourism and jobs would relocate. This event could indirectly help other economies/locals.

Mitigation Rationale

Wildfires are one of the most frequently occurring hazards in the State; in terms of total costs, they are one of the costliest, year in and year out, even though many of these costs may be externalized. It is considered a major hazard. The focus of wildfire mitigation is on the WUI, where most existing and new development is occurring. A significant area of Idaho's WUI is undeveloped.

Recent studies on large-scale fires indicate that developed property in the WUI can be protected, even in intense firestorms. Thus, the application of correct mitigation techniques is critical.

General Mitigation Approaches

Wildfire experts generally agree that increased fire suppression efforts alone will not be successful in stopping the large, intense wildfires likely to occur in the next several decades. Such conflagrations as occurred in summer 2000 are generally impossible for firefighters to stop and are only extinguished by rainfall or depletion of the fuel load.

It is clear, therefore, that the elimination of wildfires is not the goal of WUI fire mitigation. As a practical matter, and as discussed above, it has been shown that the immediate suppression of all wildfires is not an effective long-term strategy. The goal is rather to eliminate or reduce the risks to human lives, property, and desired resource values.

The specific goal of this Plan is to eliminate or reduce those risks in the WUI. Mitigation of WUI fires generally takes the form of creating fire resistant landscapes and development, and eliminating possible ignition sources.

The National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) is a collaborative effort to identify, define, and address wildland fire management problems and opportunities for successful wildland fire management in the three regions of the United States: the Northeast, the Southeast, and the West. Phase I of the Cohesive Strategy outlined a three-phase process to address the three primary factors presenting the greatest challenges and opportunities to make a positive difference to wildland fire management across America: restoring and maintaining resilient landscapes, creating fire-adapted communities, and improving wildfire response.

There are many possible ways to mitigate effects of wildfires. Approaches include the following:

1. Continue programs to reduce fuel loads in critical areas including but not limited to: power corridors, area communication sites, watersheds serving communities, and local and regional transportation routes.
2. Publish maps identifying areas with a high probability of wildland fires.
3. Increase public awareness of the financial consequences of building homes in fire prone areas and of mitigation activities that can be taken (i.e., defensible space areas).
4. Improve land use planning and land use regulatory mechanisms for fire prone areas.
5. Add incentives for counties to sign firefighting cost share agreements.
6. Purchase or obtain easements on fire prone lands.
7. Establish mitigation actions in accordance with the National Cohesive Wildland Fire Management Strategy to restore and maintain landscapes, promote fire adapted communities, and encourage safe wildfire response.

Fire Adapted Communities

The National Wildfire Coordinating Group defines a fire adapted community as "A human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire." More fully, fire adapted communities are knowledgeable, engaged communities where actions of residents and agencies in relation to infrastructure, buildings, landscaping and the surrounding ecosystem lessen the need for extensive protection actions and enable the communities to safely accept fire as part of the surrounding landscape. Because every community is unique, the steps and strategies they take to improve their wildfire resilience will vary from place to place. (fireadaped.org). Fire adapted communities is not a program, rather it is a continual process with no defined endpoint. There is no entity that certifies that any given community is fire adapted and there is no checklist. This is because every community's fire adaptation journey is different, and because of the need for continual reevaluation and adjustment.

Under the umbrella of the larger Fire Adapted Communities strategy is the Firewise USA Program through the National Fire Protection Association. NFPA's Firewise USA® program teaches people how to adapt to living with wildfire and encourages neighbors to work together and take action now to prevent losses (NFPA, 2018).

Idaho Firewise (FW) has, in the last 5 years, formed a committee made up of individuals from the community, non-profit organizations, and federal, local, and state government agencies. The mission of Idaho FW is to coordinate, support, and promote statewide Wildland fire education to broaden the understanding of wildfire's role in ecosystems and encourage those who live in or visit Idaho to take responsibility in reducing the risk of loss from wildfire. The purpose of the Idaho Firewise Committee is to provide a coordinated, consistent, interagency, and consensus driven approach to Wildland fire education. Idaho Firewise seeks to establish and grow partnerships with private and public entities that have a stake in wildfire prevention and education. The Idaho Firewise Committee also seeks to facilitate information sharing across agencies and jurisdictional lines in an effort to develop a coordinated message.

Idaho Firewise has established an online clearing house of information regarding Firewise practices and fire ecology information through a web page specific to Idaho wildland fire resources and tools that can be used by government and citizens http://www.idahofirewise.org/. Idaho Firewise has set up a mechanism for receiving and reviewing grant proposals submitted by local Firewise communities and county agencies. Grants have been rewarded to several government and local organizations to forward the education and practices of building Firewise communities. Idaho Firewise reaches out to government and officials and the public through fire prevention workshops, Firewise specific workshops, and by hosting and funding community based meetings on being Firewise.

The Idaho Invasive Species Strategic Plan of 2012-2016 showcases the mitigation efforts of landowners in cooperating with state and federal partners. One example is in Hells Canyon where yellow Starthistle and invasive annual grasses have taken root following wildfires. Associated efforts such as the use of geographic information systems and Digital Aerial Ketch Mapping surveys help detect, inventory, map, and track the effects of wildfire and management activities. Weed control, prescribed burns, and rehabilitation are being coordinated in the grassland and forest community.

Community Wildfire Protection Plans

The Healthy Forests Restoration Act (HFRA) provided communities with a tremendous opportunity to influence where and how federal agencies implement fuel reduction projects on federal lands. A Community Wildfire Protection Plan (CWPP) is the most effective way to take advantage of this opportunity. Additionally, communities with Community Wildfire Protection Plans in place will be given priority for funding of hazardous fuels reduction projects under the HFRA.

Community Wildfire Protection Plans may address issues such as wildfire response, hazard mitigation, community preparedness, or structure protection or all of the above. The process of developing a CWPP can help a community clarify and refine its priorities for the protection of life, property, and critical infrastructure in the wildland urban interface. It also can lead community members through valuable discussions regarding management options and implications for the surrounding watershed. The language in the HFRA provides maximum flexibility for communities to determine the substance and detail of their plans and the procedures they use to develop them. All 44 counties in Idaho participate with a CWPP. The Idaho Department of Lands (IDL) is the state department which administers this program, and partners in planning with IOEM for comprehensive and integrated wildland fire mitigation.

Community Partnerships

With support from Governor Otter, the Idaho Legislature, and federal and State fire agencies, ranchers now have the avenues to form rangeland fire protection associations (RFPAs) - groups of ranchers professionally trained and legally allowed to utilize interagency fire suppression resources. Creation of the associations is a collaborative effort between local ranchers, the federal Bureau of Land Management (BLM), and the Idaho Department of Lands (IDL). RFPAs provide the following benefits (IDL, 2018):

- Take advantage of the quick initial attack the ranchers can provide;
- Satisfy the ranchers' interest to be active participants in protecting the forage needed for their livelihood;
- Satisfy fire managers' safety concerns by ensuring all firefighters are trained and have necessary equipment and communications;
- Support the IDL effort to provide a complete and coordinated approach to fire suppression in Idaho;
- Enhance efforts to protect sage grouse habitat to the benefit of all parties

Fire Suppression Response Committee

The Fire Suppression Response Committee was formulated to improve management and communication across all agencies for wildfire response in Idaho. The committee's guiding principles are to 1) Nurture cooperation between federal, state, local, tribal and private organizations with the State, 2) Provide leadership with the wildland fire response system in Idaho. To meet these guiding principles the committee provides a forum to advance the understanding of the complexities associated with managing wildland fire programs in the State and continue to improve the communication of wildland fire management issues and topics between the public, elected officials and the land management agencies. They are a forward thinking cohesive group that seeks new and creative solutions and opportunities to solve problems and enhance fire management activities across the state and across agency boundaries. They are governed by the interagency Fire Program Leaderships with membership from a broader interagency group representing agencies that engage in fire response in Idaho.

Fuels Reduction

The Idaho Lands Research Coordinating Council (ILRCC) facilitates strategic natural resource management across Idaho land ownerships and assists the state forester with implementing Idaho's

Forest Action Plan, a long-term coordinated strategy for reducing threats to Idaho's forests. The Idaho Forest Action Plan (FAP) is a long-term, coordinated strategy for reducing threats to Idaho's forests while increasing the social, economic and environmental benefits they provide (IDL, 2018). The ILRCC guides strategic actions such as sustainability, ecosystem health, and fuels reduction.

Mapping/Analysis/Planning

An accurate understanding of a hazard is the first step towards successful mitigation. To fully understand a hazard and the risk that it poses, the ability to accurately assess vulnerability is vital. After vulnerability is determined, it is then possible to assess potential losses if a state inventory of facilities and infrastructure is available.

For the 2018 Plan Update, the IMHRP evaluated the State's wildfire risk by calculating a risk score on a watershed basis. The risk analysis compiled a series of inputs that depict the wildfire hazard to communities and consequences of wildfire events: life and property. The Relative Risk to Communities and Ecosystems from Uncharacteristic Wildland Fire in Idaho (2009) data, displayed in Figure 3.1.EE, was used to develop the hazard components of the equation. Figure 3.1.FF summarizes the wildfire risk rank statewide as determined by each watersheds risk score.

Figure 3.1.EE. Statewide Wildfire Risk

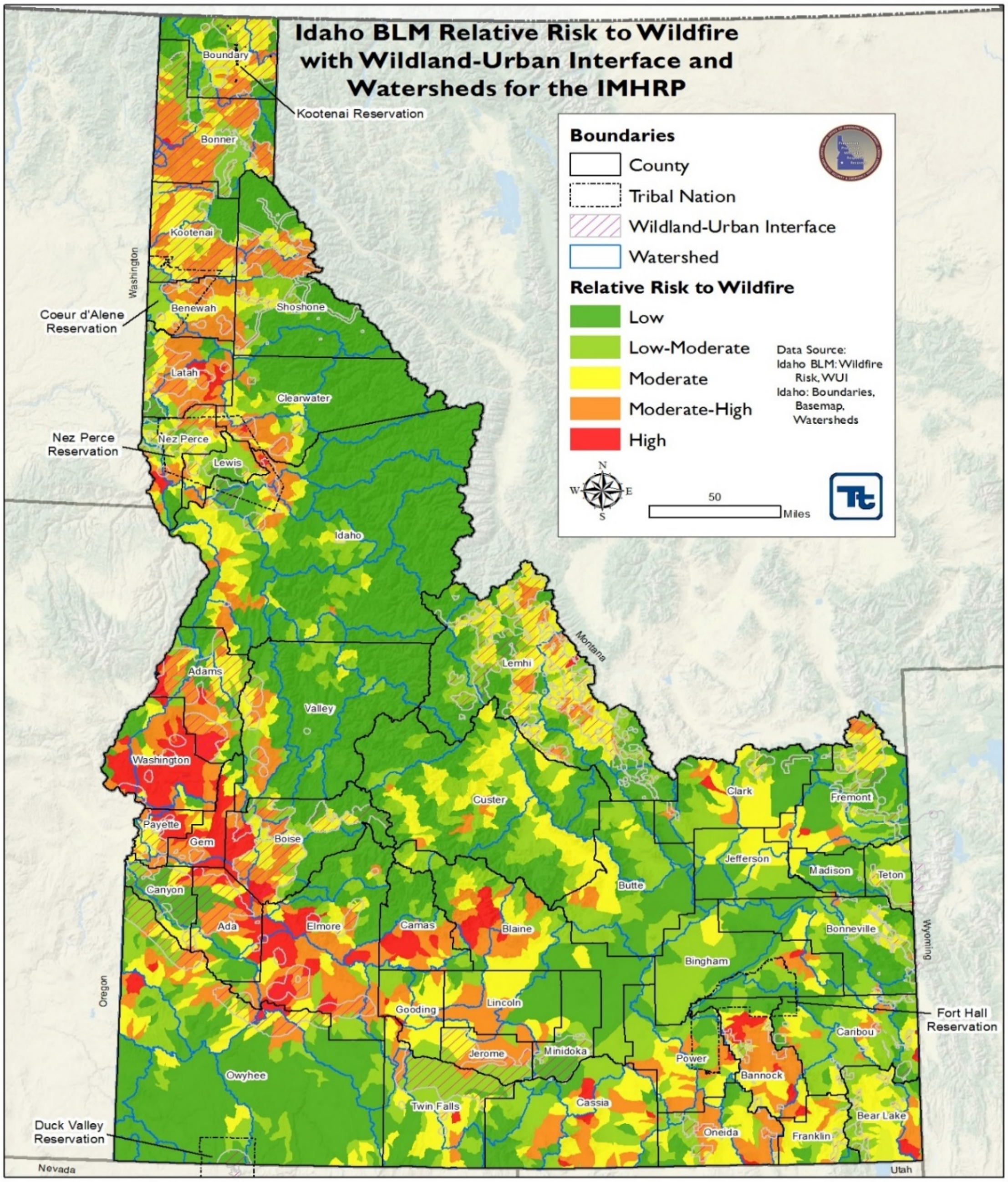


Figure 3.1.FF. Idaho Wildfire Risk by HUC-8 Watershed

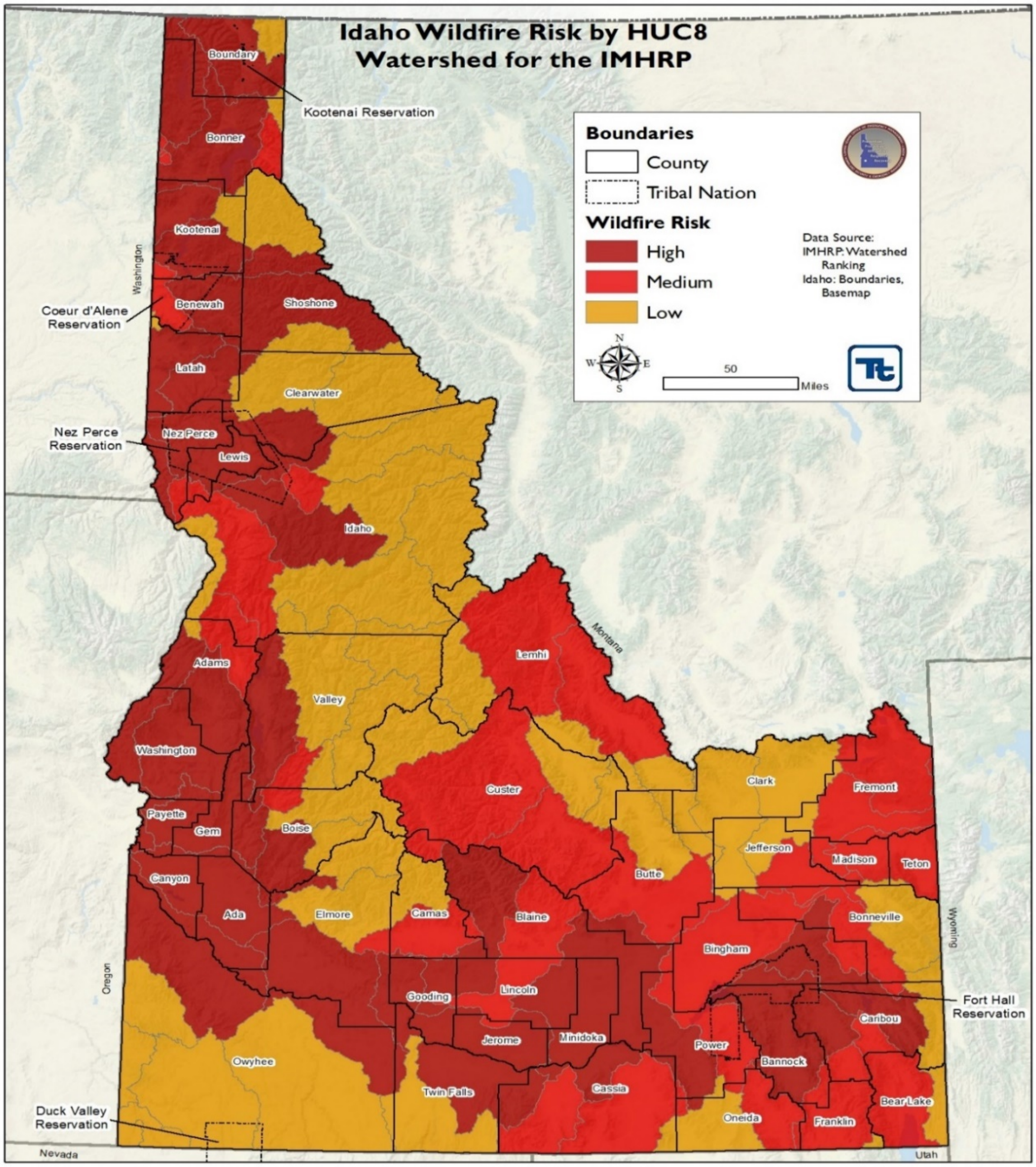


Table 3.1.GG summarizes the 'high' wildfire risk ranked watersheds in descending total risk order. In an effort to align the IMHRP and SHMP risk analyses, the counties and Tribal Nations that intersect the high-ranked watersheds are listed in Table 3.1.HH.

Table 3.1.GG. Watersheds with a 'High' Wildfire Risk Rank

HUC-8 Watershed	Wildfire Risk Rank	HUC-8 Watershed	Flood Risk Rank
Payette	1	Middle Snake-Payette	12
Lower Boise	2	St. Joe	13
Upper Spokane	3	Lower Snake-Asotin	14
Pend Oreille Lake	4	Lake Walcott	15
Coeur D'Alene Lake	5	Boise-Mores	16
Clearwater	6	Middle-Same-Succor	17
South Fork Coeur D'Alene	7	South Fork Clearwater	18
Weiser	8	Priest	19
C.J. Strike Reservoir	9	Big Wood	20
Upper Snake-Rock	10	Blackfoot	21
Palouse	11		

Source: IMHRP, 2015

Table 3.1.HH. Counties/Tribal Nations Located in the Top 5 High Wildfire Risk Ranked Watersheds

County/Tribal Nation	HUC-8 Watershed	Flood Risk Rank	County/Tribal Nation	HUC-8 Watershed	Flood Risk Rank
Ada County	Lower Boise	2	Gem County	Lower Boise	2
Adams County	Payette	1	Kootenai County	Pend Oreille Lake	4
Benewah County	Coeur d'Alene Lake	5	Kootenai County	Coeur d'Alene Lake	5
Boise County	Payette	1	Kootenai County	Upper Spokane	3
Boise County	Lower Boise	2	Payette County	Payette	1
Bonner County	Pend Oreille Lake	4	Payette County	Lower Boise	2
Boundary County	Pend Oreille Lake	4	Shoshone County	Pend Oreille Lake	4
Canyon County	Lower Boise	2	Shoshone County	Coeur d'Alene Lake	5
Coeur d'Alene Tribe	Coeur d'Alene Lake	5	Valley County	Payette	1
Elmore County	Lower Boise	2	Washington County	Payette	1
Gem County	Payette	1			

As demonstrated by the 2018 SHMP analysis, the jurisdictions with the greatest population, building stock, and critical facility exposure to the wildfire hazard are: Ada County, Bannock County, Elmore County, Kootenai County, and Twin Falls County.

Payette Watershed is the highest ranked watershed at risk for the wildfire hazard according to the IMHRP. Of the counties with the greatest percent population, building stock, and critical facilities in the wildfire hazard area, Gem County and Washington County are located in this watershed. Additional counties located in the Payette Watershed are Adams County, Boise County, Payette County, and Valley County.

The Lower Boise Watershed was ranked 2nd in terms of wildfire risk and contains Ada County and Elmore County, which as discussed above, are of the most wildfire vulnerable counties. Overall, the results of the 2018 SHMP risk analysis align with the IMHRP results with Payette and Lower Boise Watersheds being at greatest risk.

Of the most vulnerable counties, Ada County, Bannock County, Elmore County, and Kootenai County are projected to see a rise in population as estimated by the EPA's ICLUS project (Figure 3.1.HH above). Shoshone County, Kootenai County, and Benewah County are within Headwater Economics Top 10 counties, in descending order, and are of the most vulnerable counties as evidenced by the 2018 SHMP exposure analysis. Without adequate planning in these counties, future developments can be constructed within these at risk, undeveloped areas. Efforts can include ensuring any new developments in these areas meet or exceed requirements for fire safety, or ensuring that emergency services will be able to efficiently respond to the developments. The International Association of Wildland Fire published a WUI Fact Sheet, and in it, provided examples of WUI codes that may assist in the prevention and impact of wildfires, especially in rural areas:

- A code that regulates the layout of a structure may help avoid heat traps
- The establishment of a water supply on properties, which are more than a certain distance from a hydrant or existing natural water supply, can increase the value of the property.
- The requirement for a certain driveway width can allow access for more than fire department vehicles, as most companies have large vehicles for delivery purposes (IAWF, 2013).

The IAWF also advocates States adopt statewide building, fire, and WUI codes to keep development requirements uniform throughout the State. Overall, any new development in the wildfire hazard area will be potentially at risk to the hazard.

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