COMMUNITY WILDFIRE PROTECTION PLAN
MISSOULA COUNTY, MONTANA

FEBRUARY 2018, Update

Signature Page

ATTEST:

Clerk and Recorder

BOARD OF COUNTY COMMISSIONERS
MISSOULA COUNTY

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Nicole Rowley, Commissioner — 5/24/2018 Date

About the Community Planning Assistance for Wildfire Program

The Community Planning Assistance for Wildfire (CPAW) program works with communities to reduce wildfire risks through improved land use planning. It is supported through grants from the U.S. Forest Service, the LOR Foundation, and other private foundations. It is a program of Headwaters Economics and Wildfire Planning International.

Author Contact Information

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Acknowledgments

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❖ List of Acronyms

BCC – Board of County Commissioners (Missoula County)
BLM – Bureau of Land Management (U.S.)
CAPS – Community and Planning Services (Missoula County)
CSKT – Confederated Salish and Kootenai Tribes
CSWG – Cohesive Strategy Working Group
CWPP – Community Wildfire Protection Plan
FAC – Fire Adapted Communities
HIZ – Home Ignition Zone
HFRA – Healthy Forest Restoration Act
IBHS – Insurance Institute for Business and Home Safety

LNF- Lolo National Forest
MCFPA – Missoula County Fire Protection Association
MT DNRC – Montana Department of Natural Resources & Conservation
MT FWP – Montana Fish, Wildlife & Parks
NIST – National Institute of Standards and Technology
NWS- National Weather Service
OEM – Office of Emergency Management (Missoula County)
PDM – Pre-Disaster Mitigation Plan
USFS – United States Forest Service
WUI – Wildland-Urban Interface

Executive Summary

❖ Introduction

In 2017, Montana experienced hundreds of wildfires that collectively burned more than one million acres across the state. Major fires in or near Missoula County—including the Lolo Peak Fire, Sapphire Complex, and Rice Ridge Fire—served as a powerful reminder of fire's role on the landscape. These fires also brought a host of challenges to local communities: residents experienced weeks of poor air quality and evacuations; first responders were on the front lines of protecting property and other community values at risk; and land managers will be dealing with the long-term effects of post-fire landscape restoration for decades. Although wildfire has shaped the region's landscapes for millennia, the 2017 wildfire season underscored the importance of planning, collaboration, and action to address future incidents.

The Lolo Peak Fire burns near the city of Missoula during the summer of 2017. ***Credit: Larry Abramson***

Community Wildfire Protection Plan As a Tool for Risk Reduction

While the wildfire season unfolded, Missoula County had also begun an update to its Community Wildfire Protection Plan (CWPP)—a community-based plan that identifies local wildfire risk, what is at risk, and actions the community must take to address its wildfire risk.

Missoula County adopted its first CWPP in 2005, which was initiated by the Missoula County Office of Emergency Services and incorporated input from numerous stakeholders. Since that time, many changes have occurred across the county, including new housing and roads, fires on the landscape, and forest fuel treatments near communities. These changes affect the way a community plans for fire and prompted the need for revisions.

This CWPP builds on the expertise and information contained in the 2005 CWPP, and provides important updates, including:

- Refined definition of the wildland-urban interface (WUI) for Missoula County;
- An updated risk and hazard assessment;
- New action table and maintenance plan;
- Refreshed content to align with national policy and strategies.

Updated information in this CWPP was gathered through engagement with a multidisciplinary stakeholder group and public comment process.

CWPP Minimum Requirements

CWPPs have been in practice across the country since 2003, when the Healthy Forests Restoration Act (HFRA)[1] was signed into law and gave statutory incentives for the United States Forest Service (USFS) and the Bureau of Land Management (BLM) to consider the priorities of local communities that developed and implemented forest management and hazardous fuel reduction projects.

HFRA requires that CWPPs must meet three minimum requirements:

1. Show collaboration between local and state agencies, in consultation with federal agencies and other interested parties;
2. Identify and prioritize fuel treatments to reduce hazardous fuel areas;
3. Recommend strategies to reduce the ignitability of structures.

Many CWPPs also cover a range of other relevant topics, such as public education and outreach activities, potential mitigation resources, and other local community information. Unlike codes or ordinances, CWPPs are not legally-binding documents. However, given future uncertainties such as national budgets and changing climatic conditions, CWPPs are an effective local tool to help communities plan for unknowns and increase wildfire resilience.

LEARN MORE: WHY DOES MY COMMUNITY NEED A CWPP?

CWPPs are the primary mechanism that communities use to identify local priorities for wildfire risk reduction and resilience. These plans serve as the "glue" that brings together multiple sources of information, activities, and interests into one document.

CWPPs have many economic, social, and environmental benefits, including:

- Reducing the direct and indirect social, economic, and environmental costs of wildfire;
- Coordinating wildfire risk reduction with other community values and priorities;
- Influencing where federal agencies (USFS, BLM) prioritize fuel treatments;
- Bringing together diverse interests to tackle local wildfire challenges and opportunities;
- Identifying potential resources and funding for mitigation activities;
- Increasing community awareness and engagement in risk reduction.

❖ How to Read This Plan

This CWPP is intended for multiple audiences. While every reader is encouraged to read and use the entire plan, specific sections may be of higher interest and relevance. The following overview provides a quick guide to each section:

[1] https://www.fs.fed.us/emc/applit/includes/hfr2003.pdf

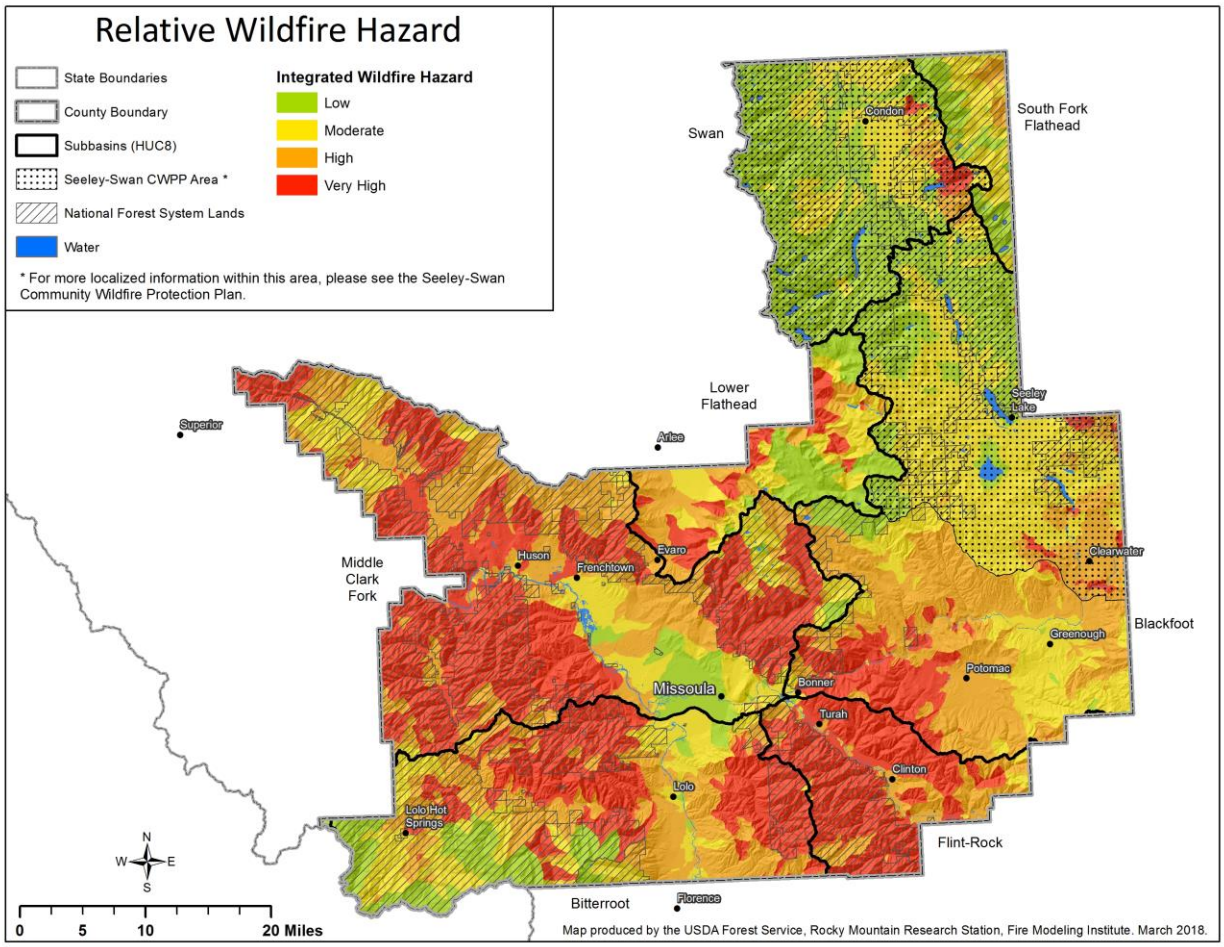
Part 1: Understanding the Local Environment

Part 1 provides an area description of the county with relevant data on topography and climate. It also describes the local environment and ecology, land ownership, and key demographic information. A primary focus of this section is on the fire environment and fire history in Missoula County. Finally, Part 1 also provides both a general definition and specific spatial delineation of the wildland urban interface in Missoula County.

Part 2: Risk Assessment

These components include the relative likelihood of occurrence and potential intensity of wildfire, which together are used to depict wildfire hazard across Missoula County. Part 2 provides a summary of information available to assess these risk components, including maps.

Figure 1. Relative Wildfire Hazard in Missoula County



Part 3: Taking a Cohesive Strategy Approach In Missoula County

Part 3 is organized into three subsections:

- Restoring and Maintaining Resilient Landscapes in Missoula County
- Promoting a Fire Adapted Missoula County
- Increasing Wildfire Response Throughout Missoula County

These subsections align with the National Cohesive Wildland Fire Management Strategy—a multi-phased effort engaging partners from federal, state, local, and tribal governments, non-governmental organizations, and public stakeholders to examine how the nation can plan for its wildfire future. Each subsection also provides local context and information on each topic. In addition, each subsection contains a list of potential strategies to address relevant challenges and opportunities.

Part 4: Putting the CWPP Into Action

Part 4 focuses on implementation. This section provides an action plan to guide stakeholder activities to ensure the CWPP process moves forward in tangible ways that reduce Missoula County's wildfire risk. This section includes guidance on future CWPP updates and an overview of stakeholders associated with this CWPP to promote understanding of roles and responsibilities.

Appendices

- **Appendix A: Primary Plans Related to CWPP Action Table** provides a list of wildfire and/or WUI-related actions from the Missoula County Growth Policy (2016), City of Missoula Growth Policy (2015), and Pre-Disaster Mitigation Plan for Missoula County and City (2017). This appendix serves as a quick reference to help readers see the linkages between this CWPP and other county and city plans.
- **Appendix B: Stakeholder and Public Engagement During CWPP Update** provides an overview of the CWPP update process that began in January 2017 and occurred over the course of sixteen months. During this update process, four separate CWPP drafts were shared with stakeholders for input, including the final draft which was provided to the public during an official public review and comment period.
- **Appendix C: 2005 Missoula County CWPP Fuel Treatment Project Status and Priorities** provides a summary of the fuel treatment status, critical egress areas, and fuel treatment priorities described in the 2005 Missoula County CWPP.
- **Appendix D: 2013 Seeley Swan Fire Plan** provides a localized calibrated CWPP for the northern portion of Missoula County and the communities of Seeley Lake and Condon.

❖ Relationship to Other Plans, Policies, and Regulations

This CWPP relates to many other local plans, policies, and regulations, which are referenced throughout the document. Generally, local plans, policies, and regulations informed the development of this CWPP in multiple ways, including:

- Drawing on existing information to inform sections of this CWPP;

- Supporting or building on relevant wildfire goals and policies previously adopted in other plans, and;
- Leveraging existing regulatory approaches (e.g., subdivision regulations) or exploring new mechanisms (e.g., zoning codes) to move applicable actions forward through this plan.

The most frequently referenced plans are identified below.

Pre-Disaster Mitigation Plan for Missoula County and the City of Missoula

The 2017 update to the Pre-Disaster Mitigation Plan for Missoula County and the City of Missoula provides a community profile, including information on critical facilities and infrastructure, population trends, housing stock, socioeconomic patterns, and land use and future development projections. Wildfire hazard was analyzed in terms of its wildfire history, risk, and vulnerability of the built environment. The Pre-Disaster Mitigation Plan's mitigation strategies include goals and objectives to reduce wildfire risk within the WUI and are further referenced throughout this CWPP.

Growth Policies and Regulations

The Missoula County Growth Policy is a comprehensive update to the 2005 Growth Policy and was adopted in June 2016. The updated policy identifies community challenges and priorities, including the growing wildland-urban interface, and gathers community information to guide planning decisions for the county's future growth. County goals and objectives relevant to this CWPP address development in hazardous areas, promoting resiliency, adapting to climate change, and conserving vital natural resources and environmental functions.

The City of Missoula's Growth Policy 2035 guides growth and development decisions in the City over the next 20 years. Similar to the county, the city's growth policy includes references to wildfire and the wildland-urban interface throughout the document. This includes a section on Wildland-Urban Interface Wildfire Risk Planning.

Other land use regulations, such as the Missoula County Zoning Resolution, the City of Missoula (Title 20) Zoning Ordinance, and Missoula County Subdivision Regulations, provide additional tools that may help future implementation of risk reduction actions discussed in this CWPP.

Locally-Adopted CWPPs

This plan also supports other local CWPPs. Because CWPPs can be effectively implemented at many different scales—neighborhood, fire district, town, city, and county—they can also "overlap" in their boundaries. Each different scale can help address unique concerns. For example, neighborhood CWPPs often contain more detail related to a residential area than a countywide CWPP. If multiple CWPPs exist, they can be designed to complement and strengthen the objectives of other CWPPs' jurisdictions and scales.

The Missoula County CWPP recognizes that the Seeley-Swan Fire Plan has been an effective local plan that addresses wildfire risk in the Seeley Lake and Condon communities-at-risk. Additional CWPPs may be adopted in the future by other fire districts or jurisdictions. The county encourages the development of local CWPPs that provide additional detail not included in this CWPP to further help communities plan for wildfire.

❖ Summary of CWPP Update

The value of a CWPP is in a three-step process of development, adoption, and implementation:

1. During development, stakeholders increase communication among agencies, organizations, and local community representatives to discuss and mutually agree on wildfire risk reduction goals and strategies.
2. The adopted plan provides an informative and action-oriented framework to guide a process of implementation.
3. Through ongoing and long-term actions, stakeholders work to achieve the goals set forth in the CWPP and make adjustments to improve actions, as necessary.

This CWPP update provides essential updates to the county's first CWPP (developed in 2005) in response to changes that have taken place across the county, including new development, wildfires, and fuel treatments. Updated information includes a new science-based hazard assessment, an alignment of information with national planning priorities, and a balanced approach to actions. This update was collaboratively developed by many stakeholders representing different areas of expertise and perspectives. Upon adoption of this CWPP update, stakeholders—including the public—are ready to launch into the critical phase of implementation to ensure that Missoula County increases its capacity for resilient landscapes, fire adapted communities, and efficient response capabilities.

Part 1: Understanding the Local Environment

❖ Overview

Missoula County has diverse landscapes and communities that are shaped by a variety of influences—including geologic, weather, climate, fire, and development patterns. These influences play a role in how the county assesses and plans for future wildfire events. To better understand these influences, Part 1 provides general background information on relevant aspects of the county, such as annual precipitation and temperature ranges, topographic features, and key demographic information.

Smoke columns merge as fires in the Lolo National Forest burn (2017). ***Credit: Lolo National Forest***

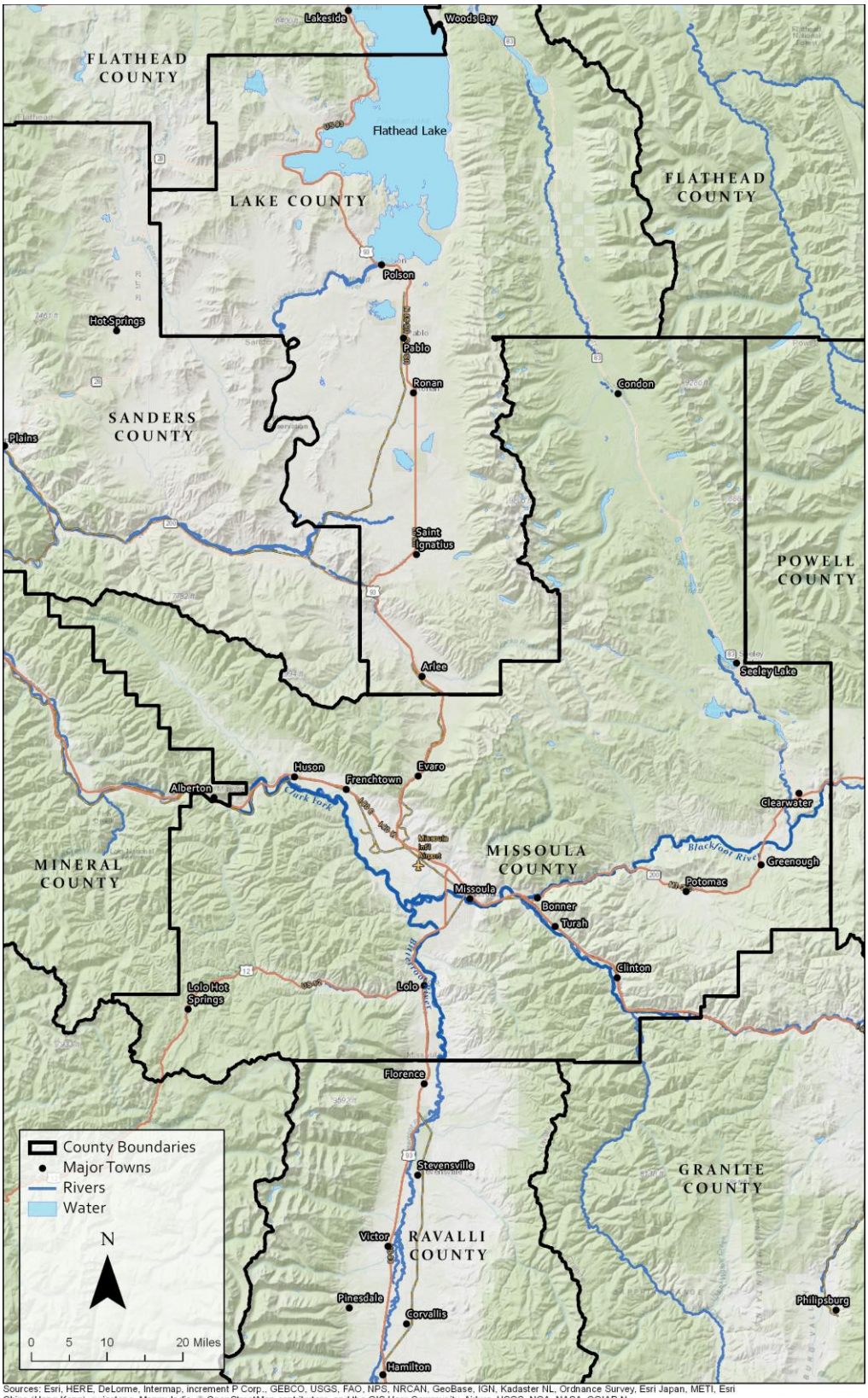
Part 1 also discusses a critical term, the wildland-urban interface (WUI, or "WOO-EE") to help readers understand this concept and how it applies to Missoula County. A countywide Wildfire Hazard Assessment shows where the WUI is located and current wildfire risk and hazard concerns. This information informs Parts 3 and 4 (including the CWPP Action Plan).

❖ Area Description of Missoula County

Location

Missoula County is located within western Montana and is surrounded by Mineral, Sanders, Lake, Flathead, Powell, Granite, and Ravalli counties. It shares its southwestern border with the State of Idaho (Figure 2).

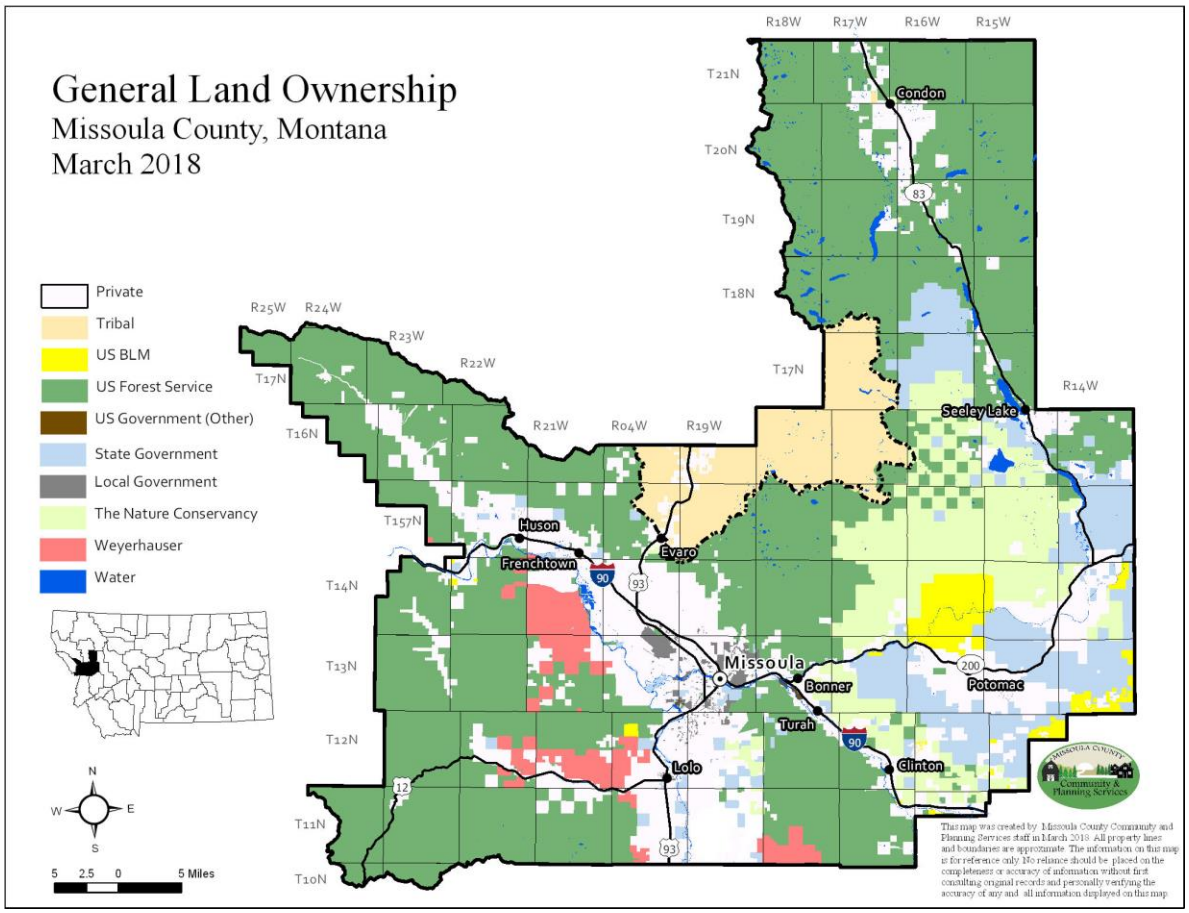
Figure 2. Missoula County Location and Topography

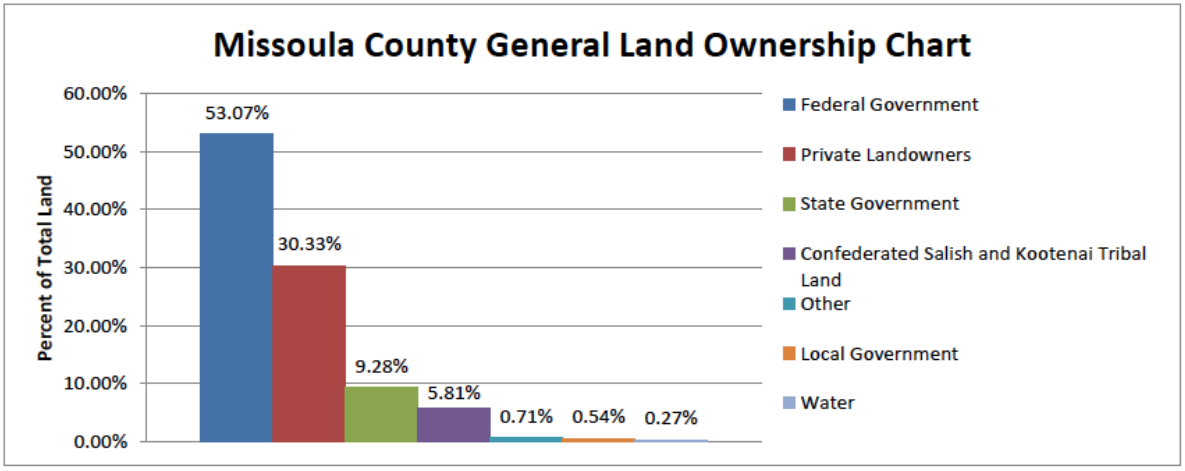


Local Land Ownership

Missoula County encompasses 1,673,517.72 acres (approximately 2,600 square miles) and ranks 25th for land area among Montana counties. The following Figure 3 displays land ownership of private, state, federal, and tribal entities across the county both spatially and by percentage.

Figure 3. Missoula County Land Ownership (Map and Chart)





❖ Demographics

Missoula County is the second-most populous county within the state, behind Yellowstone County. The county seat and most populated city is Missoula, which is the only incorporated community in the county.

Table 1: Overview of Demographics In Missoula County, MT

Topic	Key Statistic	Notes
Population (2015)	114,181 residents	The county has added 18,003 residents since 2000.[a]
Forecast population (2035)	137,055 residents	Per Missoula County Growth Policy projections.[b]
Population density	43 persons/sq. mile	State average is 6.8 persons/ sq. mile. [b]
Median age	34.8 years	The median age has increased by 2.7% since 2010.[c] By 2035, the population over 65 is expected to comprise 20% of the county's total population.[b]
Total number of housing units	52,321	30,682 housing units are located within the City of Missoula.[b] Nearly 10% of all housing units are for seasonal, recreational, or occasional use.[d]
Median household income	$46,164	National median household income is $53,889.[c]
Workforce employment	59,103	Largest employment industries are management/professional, services, sales/office.[c]
Poverty rate	15.4%t[b]	Missoula County Growth Policy [b]

a. Headwaters Economics Economic Profile System (Socioeconomic Measures): U.S. Department of Commerce. 2016. Bureau of Economic Analysis, Regional Economic Accounts, Washington D.C. Table CA30.

b. Missoula County Growth Policy 2016 update.

c. Headwaters Economics Economic Profile System (Demographics): U.S. Department of Commerce. 2016. American Community Survey Office, Washington, D.C.

d. U.S. Census Bureau. 2010.

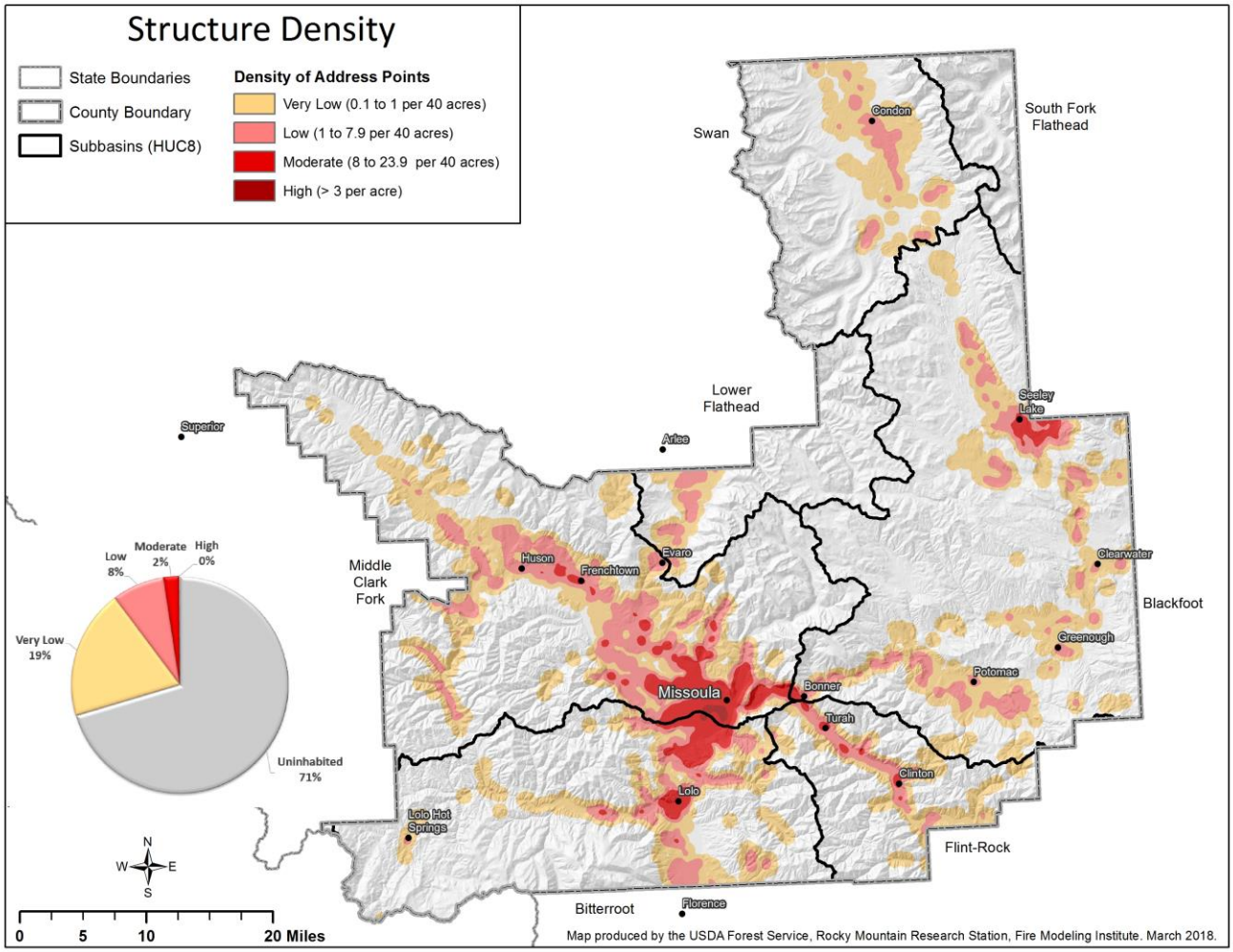
The Missoula County Growth Policy projects the county's population will reach 137,055 in 2035; county planning staff acknowledge that this projection may be conservative. While much of this growth is directed to the city limits, unincorporated areas in Missoula County anticipate an additional 6,300–7,400 new residents over the next 20 years.[2]

[2] Missoula County, MT. Missoula County Growth Policy. 2016. p. 9-30.

Although Missoula County's population density is much higher than the state population density average, it's important to note that the county's population densities are unevenly distributed. The City of Missoula's approximate population density is 2,428 persons per square mile. This density is much higher than areas outside of the city, where the county's approximate population density is 17 persons per square mile.[3] Other populated areas of the county are primarily found along highway corridors, and include Clinton, Condon, Frenchtown, Lolo, and Seeley Lake.

Figure 4 illustrates the distribution of structure density patterns across the county (according to county address point data). This shows that populated areas occupy only approximately 29% of land area in the county, while 71% of land is uninhabited. While the map depicts structure density, it can also be interpreted as population density. Midpoint values of people per square mile in each class are roughly: very low = 13, low = 115, moderate = 1,638, high = 3,395.

Figure 4: Missoula County Structure Density Patterns



[3] Missoula County, MT. Missoula County Growth Policy. 2016. p. 9-1.

❖ Defining the Wildland-Urban Interface

Background

Until now, there has not been a single, unified definition of the WUI used consistently throughout the county. For example:

- The Missoula County Subdivision Regulations (February 15, 2016) define the WUI as "*The line, area or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels."*
- The 2005 Missoula County CWPP defines the WUI generally as "*The area where human development meets natural vegetation and the chance for catastrophic wildfire increases*," and specifically as a 1.5-mile buffer around mapped structures.

One single definition of the WUI is needed to minimize confusion and conflicts. This accepted definition of the WUI should provide a clear understanding of the scope and application to stakeholders and be consistent throughout the CWPP and all related documents.

The formal definition of WUI is rooted in the Federal Register and describes conditions under which vegetation and structures meet or intermix[4]. This definition uses levels of structure density or population density to subdivide WUI into *Interface* and *Intermix* categories. Interface refers to areas where structures directly abut wildland fuels, but there is a clear line of demarcation between developed and wildland areas. Intermix refers to areas where structures are scattered throughout a wildland area. While the Federal Register guidelines for structure density are helpful, the definitions are still fairly vague in terms of geographically defining WUI with a set of mappable criteria.

Missoula County CWPP WUI Definition

This 2018 Missoula County CWPP defines the concept of WUI as:

> ***Any area where the combination of human development and vegetation have a potential to result in negative impacts from wildfire on the community.***

For a specific geographic definition of WUI, this CWPP is generally adopting the approach used by the USDA Forest Service in mapping WUI for the conterminous U.S. from 2010 U.S. Census data.[10] Based on the Federal Register definitions, this approach combines structure density data and landcover data depicting wildland vegetation to map the categories of WUI. To increase the local relevancy of this effort, structure density was derived from county-level address point data, as opposed to structure density numbers at the Census Block polygon level used in the national mapping work. Also, to tie the mapped WUI to fire behavior modeling included in this CWPP, any areas mapped as having burnable wildland fuels for the purposes of modeling were considered to be wildland vegetation for the purposes of WUI.

An important difference between the WUI mapping criteria adopted here and what was used for WUI mapping nationally is the lower structure density threshold used to define WUI. In the Federal Register and the national WUI mapping, areas must have at least 6.18 structures per km^2

[4] Forest Service, USDA, 2001. Urban wildland interface communities within the vicinity of federal lands that are at high risk from wildfire. Thursday, January 4, 2001.Federal Register 66(3): 751-777.

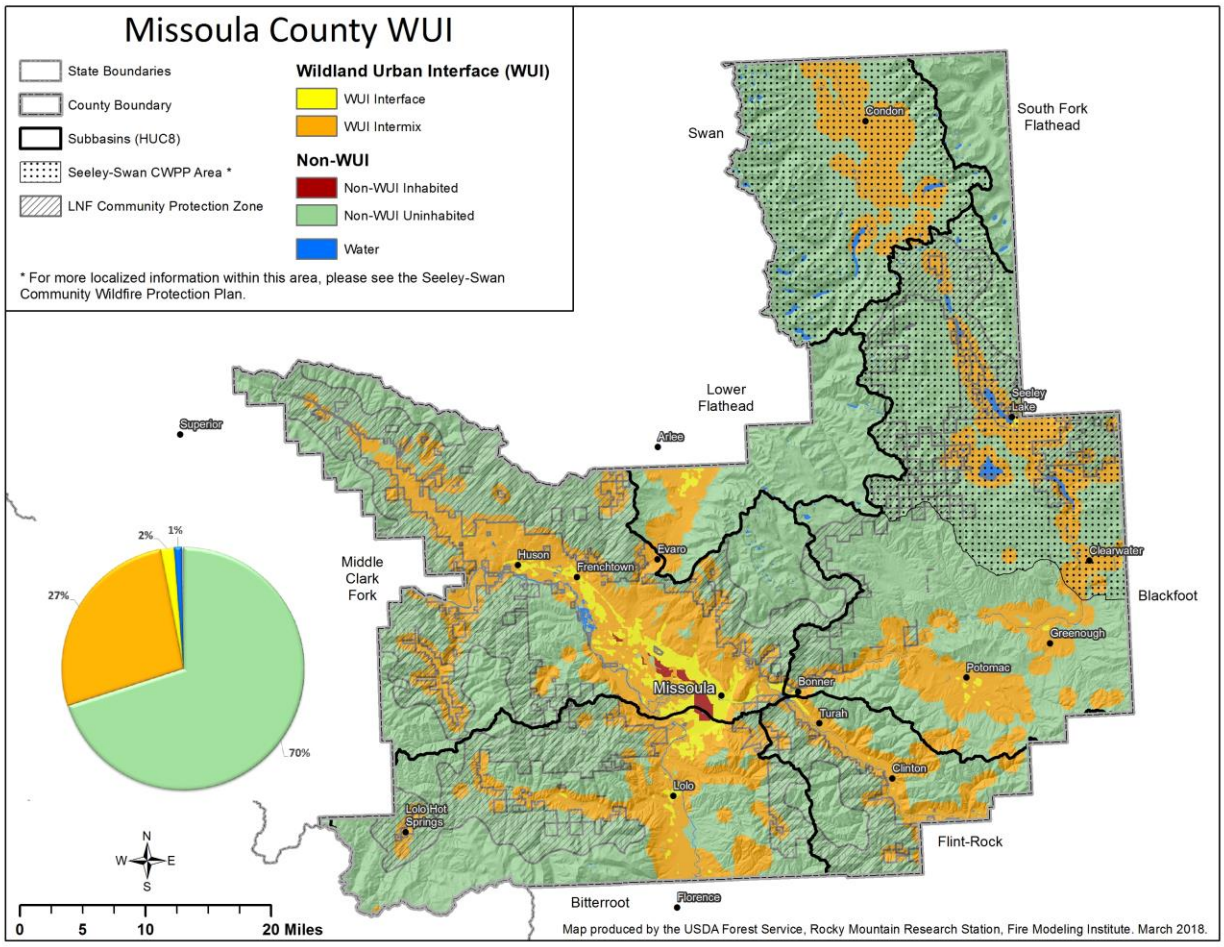
(1 per 40 acres) to be considered WUI. This leaves out sparsely populated areas with less than this density from the defined WUI area. As a conservative approximation of where future development could occur, and recognizing that fire protection efforts are often undertaken for any structure regardless of density, the decision was made to include any area with structure density greater than zero in the spatial definition of WUI for Missoula County.

The spatial criteria for mapping WUI in Missoula County in this CWPP are:

1. **WUI Intermix** = Areas with structure density > 0, and ≥ 50% cover of wildland vegetation within a 40-acre radius. These are places where structures and wildland vegetation are interspersed.
2. **WUI Interface** = Areas with structure density > 0, and < 50% cover of wildland vegetation within a 40-acre radius, located within 1.5 miles of a large, contiguous area of wildland vegetation (i.e., > 1,235 acres with ≥ 75% wildland vegetation). These are developed areas with less cover of natural vegetation, but within a distance where embers from wildfire in adjacent wildlands could cause wildfire impacts.
3. **Non-WUI Inhabited** = Areas with structure density > 0, and < 50% cover of wildland vegetation within a 40-acre radius, located further than 1.5 miles from a large, contiguous area of wildland vegetation. These are developed areas far enough from wildland vegetation that they have reduced likelihood of wildfire impacts.
4. **Non-WUI Uninhabited** = Areas with structure density = 0. These are areas with burnable fuels and no development.

A map of WUI for Missoula County based on these criteria is shown in Figure 5.

Figure 5. The Wildland Urban-Interface (WUI) in Missoula County



Clearly defining the WUI through a general definition, supported by a map that is spatially delineated into WUI categories and cross-referenced with the risk assessments, will provide a community-scale reference regarding potential wildfire exposure. This will aid in implementing future land use policies or regulations that require a tiered application.

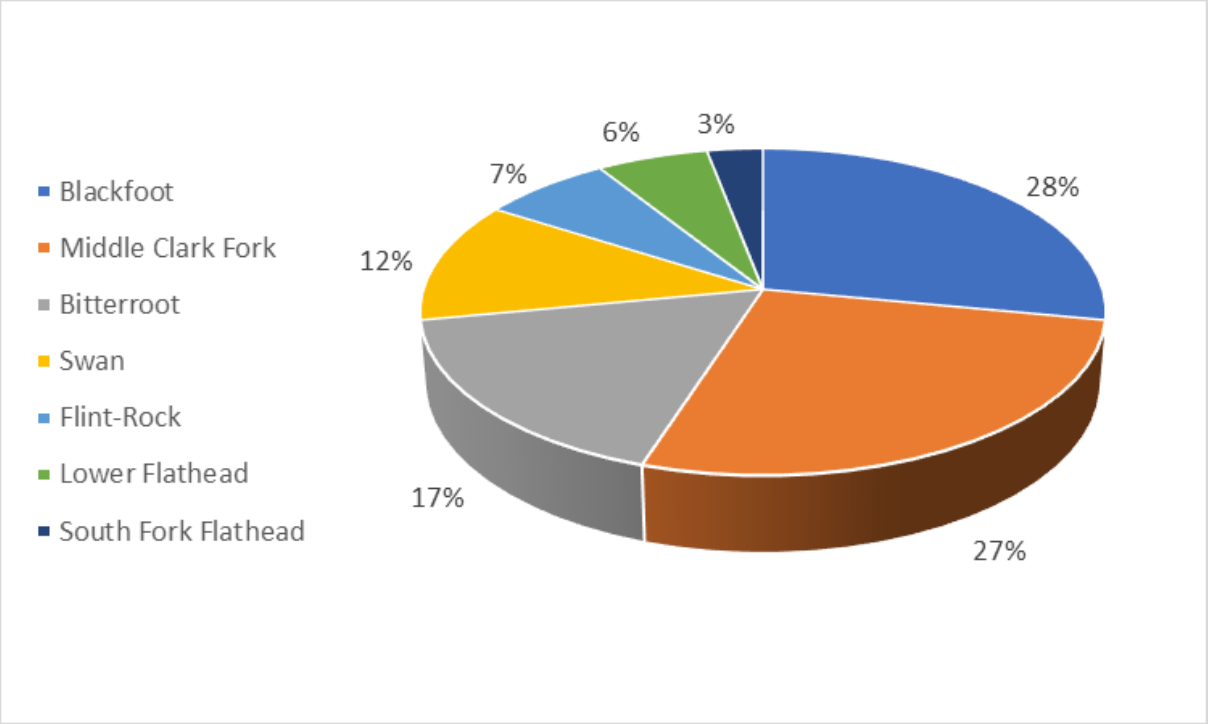
❖ Fire Environment

Assessing the factors that can contribute to wildfires that can potentially threaten homes and communities is an important step in developing a Community Wildfire Protection Plan. Those factors include the topography, vegetation (often referred to as fuels in a fire context), general climate, and specific fire weather patterns. Broadly, these physical characteristics combine to comprise the fire environment. The combination of this physical fire environment with ignition sources (both lightning and human) is responsible for a long history of wildfire activity in Missoula County. This section aims to describe the general characteristics of the fire environment and a summary of recent fire activity, with the goal of providing an understanding of the role of wildfire in the landscapes of Missoula County.

Topography

Missoula County is a mountainous region transected by five major rivers: Blackfoot, Clark Fork, Bitterroot, Swan, and Clearwater. Based on national hierarchical watershed boundaries from the U.S. Geological Survey, parts of seven subbasins (8-digit Hydrologic Unit Codes) fall in Missoula County. In order of land area, they are: Blackfoot (28% of the county), Middle Clark Fork (27%), Bitterroot (17%), Swan (12%), Flint-Rock (7%), Lower Flathead (6%), and South Fork Flathead (3%) (Figures 6 &7). These subbasins provide a useful reference for describing the variation in environmental and population characteristics across the county.

Figure 6. Hydrologic Subbasins Present in Missoula County by Percent Land Cover



Numerous smaller valleys, tributaries, and mountainous terrain features result in a complex mountainous region that ranges from elevations of approximately 3,000 feet at the bottom of the Clark Fork Valley to over 10,000 feet at some of the higher mountain peaks. The majority of land in the county (61%) is at middle elevations between 4,000 and 6,000 feet, with 21% on lower slopes and valley bottoms below 4,000 feet and 18% at elevations above 6,000 feet. The complex topographic characteristics create varying local conditions throughout the county that influence population distributions, vegetation patterns, and local-scale weather and climate.

Slope steepness is another important topographic characteristic that influences the spread of wildfire, as well as the types of fire mitigation strategies a community can consider. Approximately 28% of the county is relatively flat to gentle slopes (<15% slope), predominately in valley bottoms at low to middle elevations. Another 25% of the county has moderate slopes from 15 to 30%, mostly on lower slopes adjacent to valleys. Together, these two slope categories (< 30% slope) represent areas where mitigation strategies involving mechanical removal of trees and other fuels is often considered. The remainder of the county (47%) has slopes > 30%. These

steeper slopes generally result in faster spread of wildfires, and also make any mechanical fuel reduction treatments more difficult.

Vegetation and Fire Ecology

Despite being Montana's second-most populous county, the vast majority of land area in Missoula County remains dominated by native vegetation. Conifer forests cover roughly 80% of the county, followed by 10% in aspen/alder/cottonwood woodlands (mostly riparian), and 6% dominated by grasses and shrubs (Figure 7).

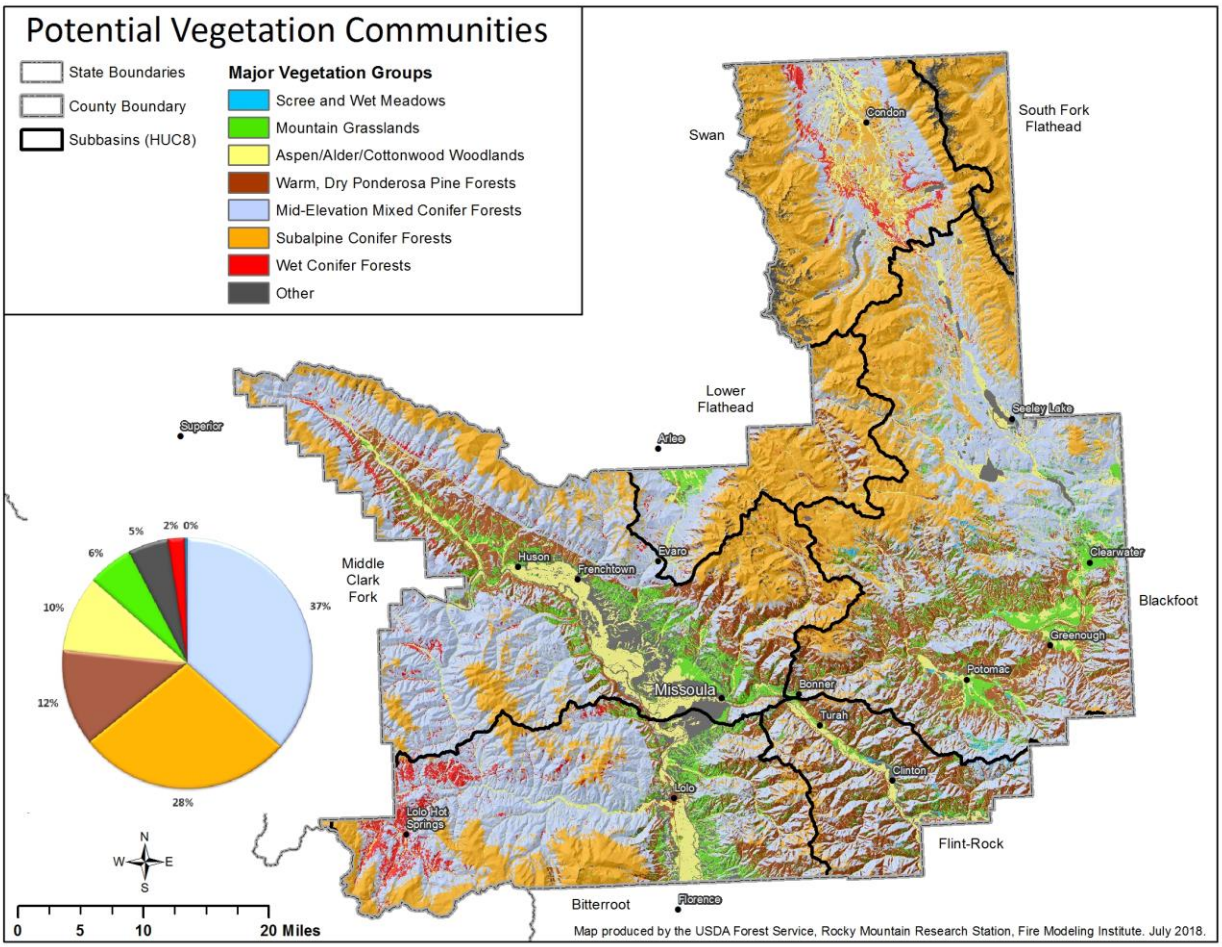
Vegetation can be described in terms of specific cover types based on the current abundance of specific species, or it can be described more broadly in terms of potential vegetation communities or ecosystems that are dynamic over time. For the purposes of describing the fire environment—and specifically the fire ecology—of Missoula County, the broader ecosystem concept is more useful. The Lolo National Forest manages the largest proportion of land in the county, and it describes fire ecology in terms of habitat types or ecosystems assigned to Fire Groups.[5] Ecosystems within a Fire Group have similar fuel characteristics, long-term ecosystem dynamics with respect to fire, and fire management considerations.

In this section, vegetation is described in terms of aggregations of Fire Groups. The aggregations used here were developed through consultation with the Lolo National Forest. These major vegetation groups, as they are referred to here, are mapped based on a national map of potential vegetation communities called Biophysical Settings from the LANDFIRE project[6].

[5] Fischer, W.C. and A.F. Bradley. 1987. Fire Ecology of Western Montana Habitat Types. USDA Forest Service, Intermountain Research Station. General Technical Report GTR-INT-223. 95 pp

[6] https://www.landfire.gov/

Figure 7. Major Vegetation Groups in Missoula County



Scree and Wet Meadows

This group is a subset of the Fischer and Bradley Fire Group 0, and consists of two fairly small ecosystems that do not typically burn. Scree refers to rocky areas that are generally characterized by non-contiguous fuel clusters that can burn but with limited spread and duration. Wet meadows are typically herbaceous forest openings that have a water source and are frequently too wet to burn, although they can carry a low-intensity surface fire under dry conditions in late summer and early fall.

The scree and wet meadows group occupies less than 1% of county land and is not a large factor in the fire ecology.

Mountain Grasslands

This group is also a subset of the Fischer and Bradley Fire Group 0, and includes areas dominated by native grasses and shrubs, ranging from valley bottoms to high elevations. These areas can carry fire in late summer and early fall and were maintained historically by low intensity fire. Historic fire frequency (i.e., time between fires) would have been generally less than 35 years, with some places burning much more frequently. In places where these grasslands

have become invaded by non-native species such as cheatgrass, they can become cured out by early summer and may be susceptible to burning both hotter and earlier in the summer than they would have historically.

Mountain grasslands occupy about 6% of land area in the county and are most abundant in valley bottoms and on lower elevation slopes. They occupy roughly 5% to 10% of the Middle Clark, Blackfoot, Bitterroot, and Flint-Rock subbasins, with a smaller amount in the Lower Flathead subbasin and very little in the Swan and South Fork Flathead subbasins.

Because of its location at lower elevations, the mountain grasslands group represents an important vegetation type in the WUI. Roughly 12% of the WUI Intermix area and 25% of the WUI Interface area across the county is occupied by mountain grasslands. With the close proximity of the grasslands and human developments, maintenance for hazard reduction and biodiversity/ecosystem objectives through frequent prescribed fire or other appropriate treatment applications is both important and challenging.

Aspen/Alder/Cottonwood Woodlands

This group is also a subset of the Fischer and Bradley Fire Group 0, including what they describe as aspen groves and alder glades. These can be either streamside (i.e., riparian) stands of quaking aspen and black cottonwood, or relatively wet openings in conifer forests occupied by alder or aspen. Because they occur on relatively wet sites, they can be resistant to burning and would have burned somewhat infrequently historically. However, under dry conditions they can burn intensely. Recovery after fire is usually more rapid than in conifer forests because aspen, alder, and cottonwood can all re-sprout from underground stems. At riparian sites, these woodlands will typically persist even in the absence of fire because the sites are too wet for conifers. However, where these occupy forest openings they will be replaced by conifers after enough years without fire.

Aspen/alder/cottonwood woodlands occupy about 10% of Missoula County, with much of that in the valley bottoms of the Middle Clark Fork, Blackfoot, Bitterroot, and Swan drainages. Because of their valley bottom location, these woodlands, as with mountain grasslands, are an important component of the WUI. Roughly 20% of WUI Intermix and 29% of WUI Interface across the county is within the aspen/alder/cottonwood vegetation community.

Warm, Dry Ponderosa Pine Forests

This group is a single Fischer and Bradley Fire Group: Warm, Dry Ponderosa Pine (Fire Group 2). These forests are found on relatively low elevation sites throughout the county, occurring on relatively dry sites with grass and dry shrub understories. The main carrier of fire historically was the understory vegetation, downed woody material, and other litter on the forest floor. Historic fire frequency would have generally ranged from 5 to 25 years. Fire intensity would have been mostly low intensity, with occasional patches of moderate to high intensity fire. Density of young trees increases in the absence of fire and increases the potential for more widespread high intensity fires.

Dry ponderosa pine forests occupy about 12% of land in the county. They occupy about 36% of land in the Flint-Rock subbasin and around 15% of land in the Middle Clark Fork and Blackfoot subbasin. Smaller amounts (6% to 8%) exist on dryer sites in the Bitterroot and Lower Flathead subbasins, but there is almost none of this forest type in the wetter Swan and South Fork Flathead subbasins.

These forests are an important vegetation community affecting the fire ecology of the WUI in Missoula County. They make up about 19% of the WUI Intermix area and 40% of the WUI Interface area. Fuel treatments to reduce tree density, particularly of young, small-diameter trees, in these forests can be very effective at reducing fire intensity and the potential for crown fires. These types of treatments, combined with prescribed burning at regular intervals, can move these forests into alignment with their historic fire ecology and reduce the potential for negative impacts to structures in the WUI.

Conifer forests cover roughly 80 percent of Missoula County. ***Credit: Albritton, BLM Missoula Field Office***

Mid-Elevation Mixed Conifer Forests

This group includes a mix of conifer forests found at middle elevations between about 4,000 and 6,000 feet. It is an aggregation of three Fischer and Bradley Fire Groups:

- Warm, Dry Douglas-fir Habitat Types (Fire Group 4);
- Cool, Dry Douglas-fir Habitat Types (Fire Group 5);
- Moist Douglas-fir Habitat Types (Fire Group 6).

Relative moisture at these sites is between the dryer ponderosa pine forests and the wetter, high elevation subalpine forests. Douglas-fir is typically the dominant tree species. Important co-dominant tree species include ponderosa pine on dryer sites and western larch and lodgepole pine on wetter and cooler sites. Dense understories can develop in these forests. Historic fire frequency was highly variable within this group, with fire-free intervals as short as 5 to 25 years on relatively dry sites but over 50 years at wetter sites. Fire of all intensities would have occurred historically, with intensity at any location driven by time since the previous fire and amount of fuel accumulation.

These mid-elevation forests are the most abundant vegetation type in Missoula County, occupying roughly 37% of land in the county. They occupy about 37% to 45% of land in the Middle Clark Fork, Blackfoot, Bitterroot, and Flint-Rock subbasins, about 25% of land in the Swan and Lower Flathead, and less than 5% in the South Fork Flathead.

These forests are also an important vegetation community affecting the fire ecology of the WUI in Missoula County. They make up about 36% of the WUI Intermix area, but given their location at middle elevations, they are further from higher population areas and make up just 2% of the WUI Interface area. As with the dry ponderosa pine group, treatments in these forests that reduce tree density may be effective at reducing fire intensity and the potential for crown fires.

However, treatments on the wetter end of the moisture spectrum in these mid-elevation forests may require more effort because maintaining stands in an open condition may not be in alignment with their ecology (i.e., what they're inclined to do naturally).

Subalpine Conifer Forests

This group is also an aggregate of four Fischer and Bradley Fire Groups:

- Cool Habitat Types Usually Dominated by Lodgepole Pine (Fire Group 7);
- Dry, Lower Subalpine Habitat Types (Fire Group 8);
- Moist, Lower Subalpine Habitat Types (Fire Group 9); and
- Cold, Moist Upper Subalpine and Timberline Habitat Types (Fire Group 10).

These forests are dominated by subalpine fir, Engelmann spruce, lodgepole pine, and whitebark pine. While they are typically found at upper elevations, spruce and fir forests can also occupy drainage bottoms where dense, cold air accumulates. They can have fairly lush and dense undergrowth that resists burning through much of the year but can support high intensity crown fire under dry conditions. Fires were generally less frequent historically than in lower and middle-elevation forests, with fire-free intervals ranging from around 50 to several hundred years.

Subalpine forests occupy 28% of land in the county. Much of this is in the portions of Swan, Lower Flathead, and South Fork Flathead drainages in Missoula County, where they occupy roughly 50%, 56%, and 78% of land area, respectively. Subalpine forests make up about 20 to 25% of land area in the Middle Clark Fork, Blackfoot, and Bitterroot drainages, and about 5% in the Flint-Rock drainage.

These forests are a minor component in the WUI, occupying only 5% of the WUI Intermix area and less than 1% of the WUI interface area. However, although they are typically located further from developed areas than other forest types, many wildfires ignite in high elevation areas and these subalpine forests can be source areas for wildfires that spread and ultimately impact communities.

LEARN MORE: CLIMATE CHANGE

Climate change is affecting multiple components of the wildfire system: fire behavior, ignitions, and vegetation fuels. Annual average temperatures in Montana have increased by 2.0-3.0° Fahrenheit (F) since 1950 and could continue to increase by another 4.5-6.0°F by 2050, while precipitation across the state is projected to decrease during the summer. These climate changes will lead to earlier snowmelt, lower humidity, increased chance of drought, and decreased fuel moisture. As a result, the Missoula Fire Science Laboratory predicts that over the next 95 years the fire season will increase by 17 days (32 percent), fire danger will increase by 15 percent, drought will increase by 16 percent, and fuel moistures will decrease by 16 percent.

Sources: 2017 Update to Pre-Disaster Mitigation Plan – Missoula County; Montana Climate Assessment (2017).

Wet Conifer Forests

The wet conifer forest group represents a single Fischer and Bradley Fire Group: Warm, Moist Grand Fir, Western Redcedar, and Western Hemlock Habitat Types (Fire Group 11). These forests are found on particularly wet topographic settings at lower and middle elevations. They are often dominated by grand fir, western hemlock, and western redcedar, and may have various

amounts of Douglas-fir and subalpine conifer species. These forests typically have a low fire hazard due to their moisture content but can support moderate- to high-intensity fire under drought conditions. Like subalpine forests, the fire-free intervals are typically greater than 100 years.

Wet conifer forests occupy only about 2% of land area in Missoula County. They are concentrated in the western-most portions of the Middle Clark Fork and Bitterroot subbasins, and along drainages and toe slopes in the Swan subbasin. They occupy 5% or less of each of these subbasins.

These forests are a very minor component in the WUI, occupying only 2% of WUI Intermix area and less than 1% of WUI Interface area.

Climate

Because of its location and proximity to the Continental Divide, Missoula County balances between a continental and maritime climate.[7] The county's valleys generally have warmer average annual temperatures than most of Montana, largely because polar, continental air fronts do not often penetrate west of the Continental Divide. Missoula County's climate is also characterized by pressure systems generated in the Pacific Northwest, influencing precipitation trends and weather patterns.

Temperature

According to Missoula International Airport weather records (1981-2010),[8] the annual average temperature in Missoula County is 45.9°F with an annual maximum of 58.1°F and an annual minimum of 33.7° F. Temperatures, at their extremes, vary from well below 0°F in the winter to above 100°F in the summer. Daily averages for maximum temperatures are 33°F (in January) and 86°F (in July).

Precipitation

Average annual rainfall is 14.13 inches, with an average annual snowfall of 37 inches (Table 2). However, there are large variations in precipitation between valleys, mountains, lower valleys, and upper valleys. For example, average annual snowfall for parts of the Bitterroot Range is referenced at approximately 50 to 60 inches. Historically, June has the highest precipitation of the year, averaging 2.09 inches throughout the month. Late summer and early fall are characterized by clear skies and warm days.

Relative Humidity

Average summer relative humidity (i.e., the amount of moisture in the air) can range from 30 to 40% in the daytime (late afternoon) and 75 to 83% overnight (very early morning), based on a 30-year average. In 1994 and 2000 (both severe wildfire seasons locally), the daytime readings

[7] 2010. Federal Emergency Management Agency Flood Insurance Study Missoula County, Montana and Incorporated Areas. Flood Insurance Study Number 30063CV001A.

[8] U.S. Climate Data http://www.usclimatedata.com/climate/missoula/montana/united-states/usmt0231) (accessed February 12, 2018).

for relative humidity in August averaged 19% and evening readings averaged 63%. The average winter daytime and evening readings (for December) are 80% and 86%, respectively.

Wind

Wind speeds during the summer months (at the Missoula Airport) average seven miles per hour (mph) from the northwest. According to the National Weather Service (NWS), typical July winds are often calm during the morning hours (9 am - 12 pm), but due to daytime heating, winds pick up to a sustained six to seven mph until about 9 pm, when they generally calm again. During the Black Mountain Fire of 2003, sustained winds were measured at 20-25 mph with gusts of 40-45 mph.

Table 2. Missoula International Airport Average Monthly Weather[9]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Average High (°F)	33	39	50	58	67	75	86	85	73	58	42	31
Average Low (°F)	18	21	28	33	40	47	51	50	42	32	25	17
Average Precip. (inches)	0.87	0.71	0.98	1.22	2.01	2.09	0.98	1.18	1.18	0.87	1.02	1.02
Average Snowfall (inches)	8	6	5	1	0	0	0	0	0	1	5	11

❖ Fire Weather

While the climatology above describes the long-term averages for temperature, precipitation, relative humidity, and winds, the behavior of a fire at any specific point in time is largely driven by local conditions in that area at the time of the fire. This is referred to as the fire weather. Fire behavior specialists have special indices that integrate multiple weather factors important to the potential for ignition, spread, and heat release of a wildfire. The Energy Release Component (ERC) is an index related to the potential energy of a fire at the flaming front and is generated from weather and fuels inputs. It is considered a good measure for seasonal dryness trends in large fuels making it a good indicator of seasonal severity and potential fire duration and severity, especially in timbered areas. ERC is influenced by the minimum and maximum relative humidity and temperature, and duration of precipitation during the past 24-hour period. It is also sensitive to precipitation during the preceding weeks and its influence on moisture content in large, downed wood. Conditions are generally favorable for wildfire spread when ERC is above the 80th percentile, with extreme fire danger occurring when ERC is above the 97th percentile.

Figure 8 presents several traces of ERC from April 1 through October 31 that are helpful to describe typical and extreme seasonal severity in Missoula County. This graph was produced with data from the weather station at the Ninemile Ranger Station, which has a long and stable history of observations. These data are from the 20-year period from 1998 to 2017. The solid gray line represents the average across all 20 years. It shows a typical pattern of low ERC values in the spring, rising slightly with snow melt and green-up, then dipping in June due to higher precipitation amounts common in that month. With the onset of dry summer conditions in July,

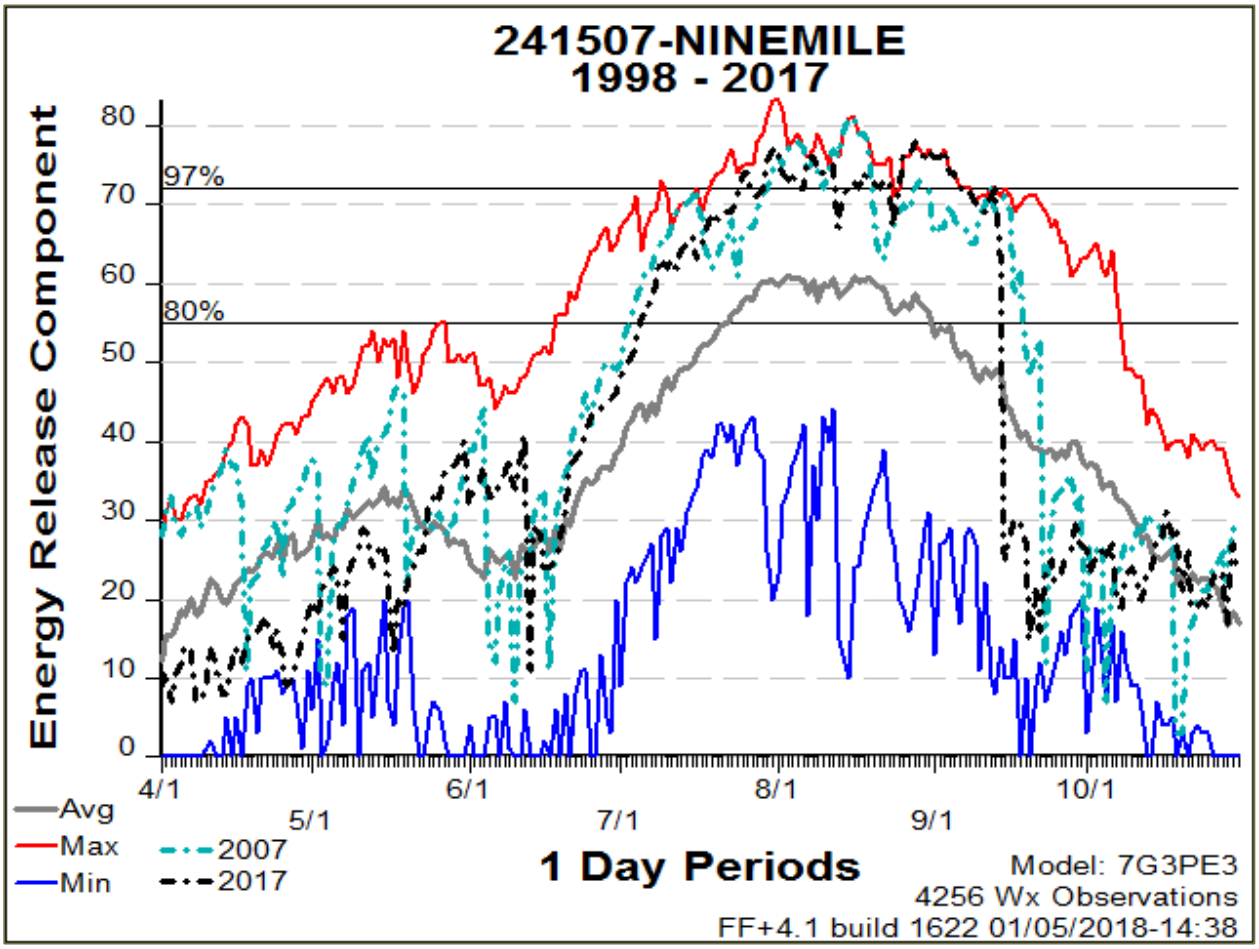
[9] U.S. Climate Data http://www.usclimatedata.com/climate/missoula/montana/united-states/usmt0231 (accessed February 12, 2018).

ERC rises steadily and in an average year it gets above the 80th percentile (i.e., favorable conditions for wildfire) from mid-July through late-August. As periodic moisture occurs in September and October along with steadily decreasing solar insolation, ERC drops steadily, as does the potential for wildfire.

Extremes in seasonal severity are shown as blue (minimum ERC) and red (maximum ERC) lines on the graph. These are the lowest and highest ERC values recorded on any particular date, and the lines don't necessarily reflect specific years. The minimum line reflects that with consistent summer precipitation, it is possible for ERC to never get to the 80th percentile, making wildfire spread unlikely. Conversely, the maximum line shows that it is possible for ERC to reach the 80th percentile as early as May and stay above that threshold into October.

Two particularly significant fire years for Missoula County are shown as dashed lines. More than 50,000 acres burned in 2007 from fires that originated within Missoula County. ERC set new record high values in April of that year and rebounded fairly quickly from each major precipitation event in the spring (dips followed by peaks). Starting in late June it rose rapidly and set new record high values again in mid-July, early August, and mid-September. ERC was above the 80th percentile in 2007 from the beginning of July through mid-September. The most significant fire year in the past two decades in terms of area burned was 2017. In that year, ERC was below average through most of the spring due to significant snowpack and spring moisture. However, starting in mid-June of 2017 the precipitation stopped, temperature remained consistently high, and ERC rose rapidly. By late summer much of western Montana was in what meteorologists called a "flash drought" and ERC was above the 97th percentile for most days between late July and early September. Despite having very different spring conditions, the number of days the ERC remained above the 80th and 97th percentiles was similar for both 2007 and 2017.

Figure 8. A Graph of Energy Release Component (ERC) from the Ninemile Ranger Station, 1998-2017



ERC is an index commonly used to indicate seasonal severity, especially in timbered areas. Solid lines represent the minimum (blue), average (gray), and maximum (red) ERC values recorded for each day over the 20-year period. Dashed lines represent two significant fire years for Missoula County – 2007 (green) and 2017 (black).

❖ Fire History

An analysis of wildfire activity in Missoula County over the past 20 years is also useful for understanding current patterns of wildfire activity (Figures 9 and 10). From 1998 to 2017, there were a total of 3,034 recorded fires that burned 393,036 acres (23% of county land area). The number of fires in any year varied from approximately 50 to 240, with an average of about 150 fires per year. Many of these fires, however, were very small; 72% were under 0.25 acre, and 97% were under 10 acres. Only about 1% of all fires were larger than 1,000 acres. Only five years (2000, 2003, 2007, 2013, 2017) recorded more than 10,000 acres burned. Three of these years (2003, 2007, 2017) had more than 50,000 acres burned. The fire season of 2017 was particularly exceptional, with more than 230,000 acres burned – almost four times more area than the next largest year (2003).

Other useful statistics for wildfire planning and preparedness include seasonality, cause, and daily fire load. Not surprisingly, most fires in Missoula County burn in the summer months. Approximately 65% of wildfires occur in July and August, while an additional 10% occur in September. Of the remaining 25%, most occur in April, May, June, and October. Lightning is the

largest single cause, accounting for 40% of all fires, but all human causes together are responsible for 60% of fire starts. Of these, debris burning (14%) and arson (14%) are the most common specific causes, and 24% fall into the catch-all miscellaneous class. In terms of daily fire load, there were 1,506 days from 1998 to 2017 with at least one wildfire in the county. This equates to an average of 75 fire days per year; 58%% of these days had just one fire, 22% had two fires, 8% had 3 fires, and 5% had 4 fires (93% cumulatively with four or fewer fires). These fire activity statistics are a product of the fuel conditions, weather, ignitions, and fire management practices of the past 20 years and are presented here to provide context for the level of wildfire activity Missoula County may expect in the near future.

Since the early 1900s, a number of significant fire events in and around Missoula County have resulted in losses of life and property. During the Great Fires of 1910, 78 firefighters and an unknown number of citizens died. In addition, five towns and three million acres in Montana and Idaho burned that year, influencing America's wildland fire policies for most of the 20th century. Fires resulting in property losses in and around Missoula County in recent decades include the Pattee Canyon Fire (1977), the Black Mountain Fire (1994), the Bitterroot Fires of 2000, the Black Mountain #2 Fire (2003), the Woodchuck Fire (2006), the Jocko Lakes Fire (2007), the Black Cat Fire (2007), the Lolo Creek Complex (2013), the Roaring Lion Fire (2016), and the Lolo Peak Fire (2017). Ironically, the fire suppression policies put in place after the 1910 fires resulted in a disruption of natural fire cycles in many places, leading to a build-up of fuels. These increased fuel loads, combined with warmer and drier climatic conditions and longer fire seasons in recent decades, as well as increased development in areas adjacent to wildlands, have increased the challenges of mitigating potential negative impacts of wildfire on communities in recent years.

Figure 9. Location and Fire Size Class of Wildfires in Missoula County, 1998-2017

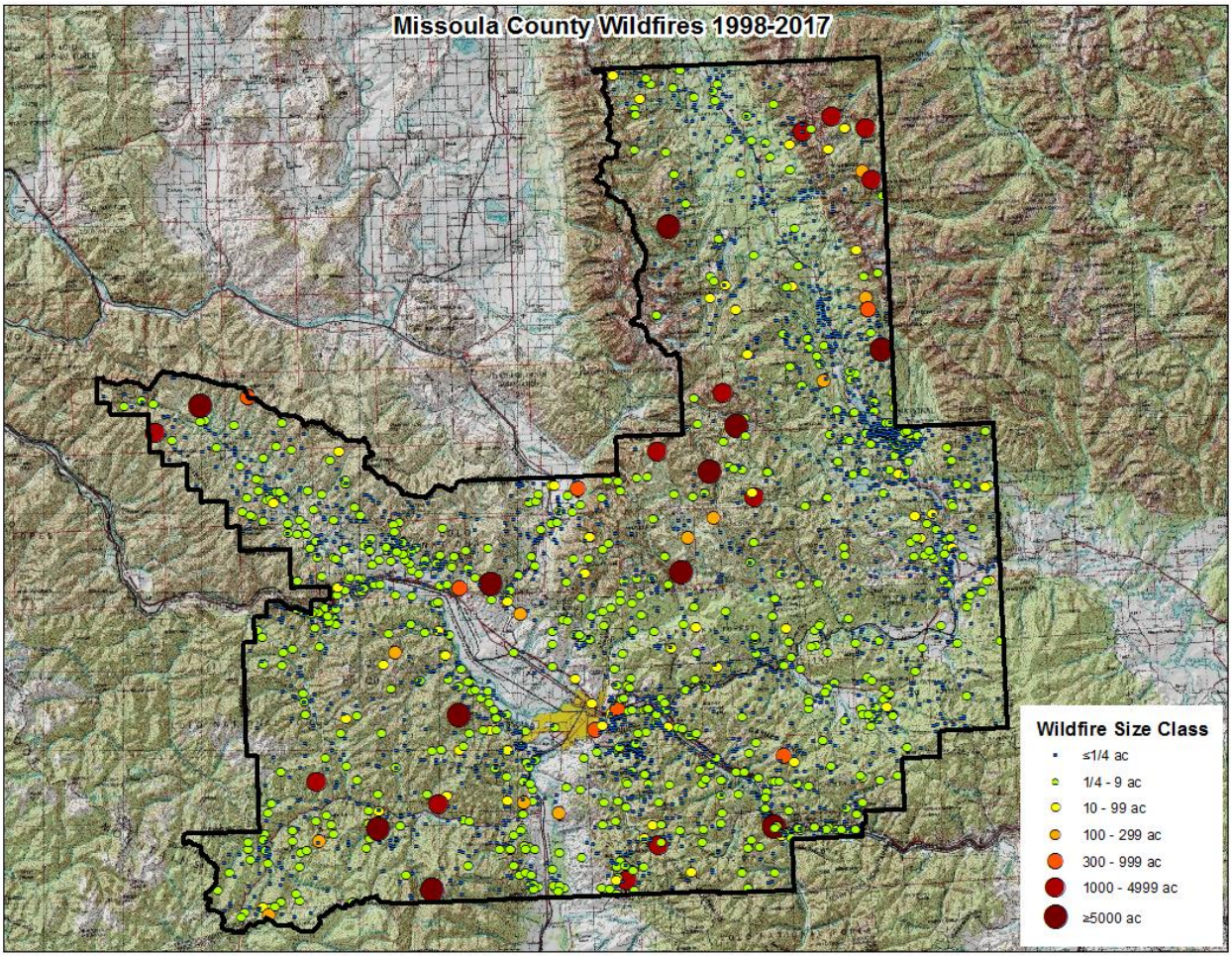
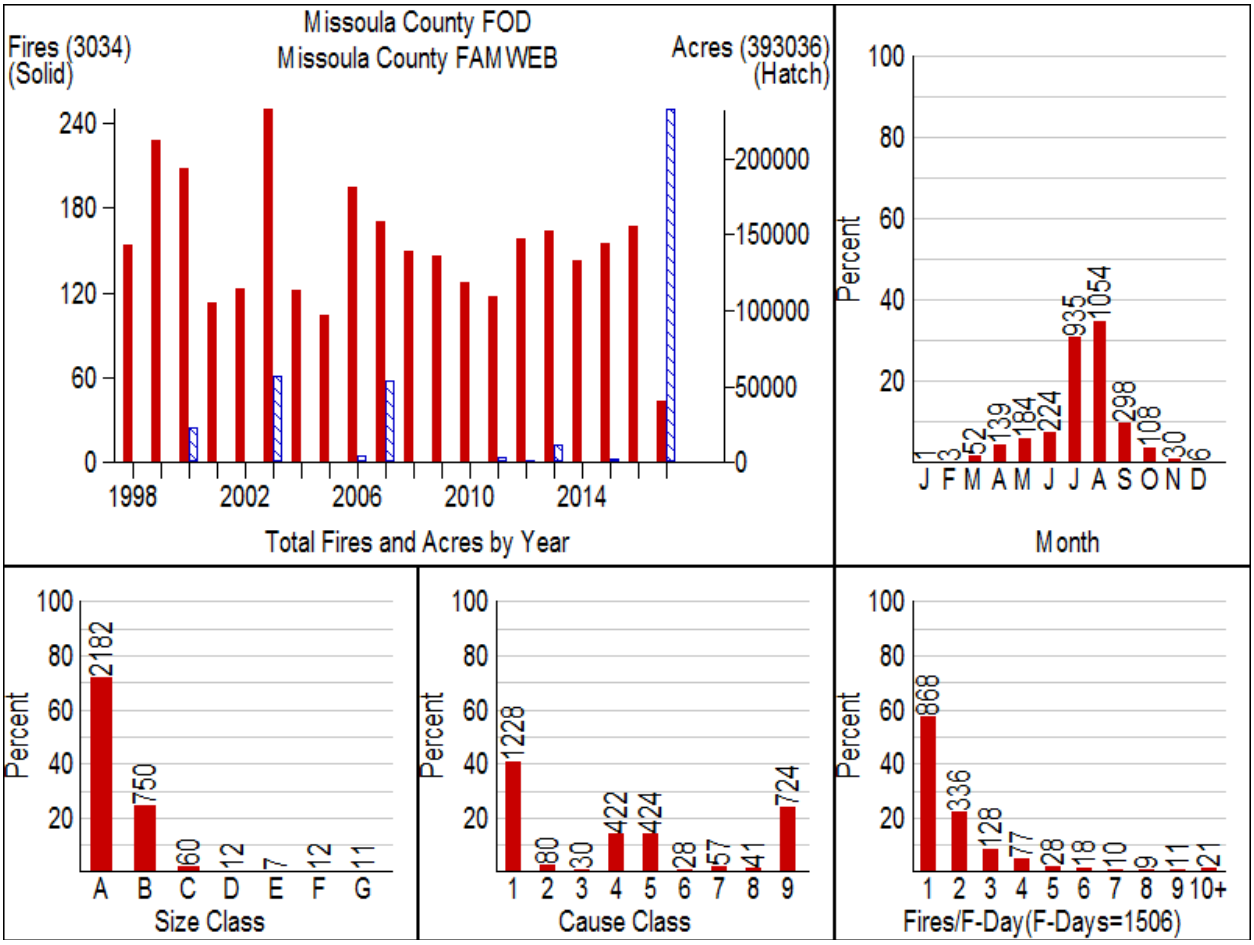


Figure 10. A Fire Summary Graph for Wildfires in Missoula County, 1998 to 2017[10]



Upper left: Annual summary of number of fires (solid bars) and area burned (hatched bars**). Upper right:** Number of fires by month of ignition**. Lower left:** Number of fires by final fire size class (classes: A is < 0.25 acres; B is 0.25 to < 10 acres; C is 10 to < 100 acres; D is 100 to < 300 acres; E is 300 to < 1000 acres; F is 1000 to < 5000 acres; G is ≥ 5000 acres). **Lower center:** Number of fires by cause class (classes: 1 is lightning; 2 is campfire; 3 is smoking; 4 is debris burning; 5 is arson; 6 is equipment use; 7 is railroad; 8 is children; 9 is misc). **Lower right**: Number of fires per fire day (i.e., daily fire load).

[10] Sources: FPA FOD (https://www.fs.usda.gov/rds/archive/Product/RDS-2013-0009.4/) for 1998 to 2015, USFS and Montana DNRC fires from the FAMWEB Data Warehouse for 2016 and 2017, and tribal fires for 2016 and 2017.

❖ Local Environment Summary

Wildfire has been a natural process shaping the landscapes of Missoula County for thousands of years, but it has the potential to cause significant damage to human developments. The native vegetation communities described above have all developed adaptations to wildfire and receive long-term ecological benefits from fires at most intensities. Ignitions from lightning will occur, and in most summers there will be weeks or months during which wildfire will readily spread.

Prescribed fire is one of the tools land managers use to manage and restore the natural fire environment. ***Credit: Albritton, BLM Missoula Field Office.***

Missoula County is not only the second most populous county in Montana, but has a widely variable population density that is expected to grow significantly over the next few decades. The fire environment combined with increased growth will likely exacerbate the potential for damage to human developments if left unchecked by appropriate mitigative strategies.

Eliminating wildfire from Missoula County is not possible or desirable. However, by understanding the fire environment, reducing the number of unwanted human ignitions, using prescribed fire as a tool when appropriate, and taking other measures to reduce wildfire spread and intensity around developed areas, it is possible to eliminate or reduce the loss of life and property from the wildfires that will burn in Missoula County.

Part 2. Risk Assessment

❖ Overview

Wildfire risk is a measure of both the probability and consequences of uncertain future wildfire events.[11] For any location within Missoula County, wildfire risk depends on the chances of a fire occurring there, the likely intensity of the fire, and the vulnerability of something of value at that location. Scientists describe these three components of risk using a triangle where the sides are likelihood, intensity, and susceptibility (Figure 11).[12] These three factors, and the resultant wildfire risk, vary across the county. In this section, we describe tools currently available to assess this risk in Missoula County. This provides spatial context for where different wildfire management and mitigation strategies will be most effective.

Figure 11. The Wildfire Risk Triangle

By understanding the components that contribute to wildfire risk and engaging in a coordinated and collaborative planning effort, the county can take steps to influence each side of the risk triangle in different ways. For example, prevention measures that reduce human-caused fires can reduce the likelihood of fire occurrence, particularly in areas of human activity. Vegetation treatments focused on reducing fuel loads can reduce the intensity of fires that do occur, and efforts to reduce the flammability of building materials and increase defensible space around structures and communities can reduce susceptibility of homes and other structures to wildfire.

[11] Thompson, M.P., T. Zimmerman, D. Mindar, and M. Taber. 2016. Risk Terminology Primer: Basic Principles and a Glossary for the Wildland Fire Management Community. Fort Collins, CO: USDA Forest Service Rocky Mountain Research Station. Gen. Tech. Rep. RMRS-GTR-349. https://www.fs.usda.gov/treesearch/pubs/50912

[12] Scott, J.H., M.P. Thompson, and D.E. Calkin. 2013. A wildfire risk assessment framework for land and resource management. Fort Collins, CO: USDA Forest Service Rocky Mountain Research Station. Gen. Tech. Rep. RMRS-GTR-315. https://www.fs.fed.us/rmrs/publications/wildfire-risk-assessment-framework-land-and-resource-management

Mapping Wildfire Likelihood, Intensity, and Hazard

Computer simulation modeling of hypothetical wildfires provides a robust and defensible means of mapping wildfire likelihood and potential intensity. Fire models use weather data from long-term stations in the county (like that presented in the Fire Environment section of this document), along with detailed spatial data depicting topography and aspects of vegetation that characterize wildland fuels to simulate fire spread across the landscape from semi-random ignition points.[13] Simulations can be run for a specific set of weather conditions over a single burning period (i.e., a day) using a model called FlamMap.[14] Results from these types of simulations can provide insight into fire intensities that could be expected under "typical" or "near worst-case" conditions during fire season. Simulations can also be run for an entire suite of statistically possible weather scenarios across thousands of iterations of a whole fire season using a model called FSim.[15] The outputs from FSim include maps of the annual probability of fire occurrence and the most likely intensity for every pixel in the modeled landscape.

LEARN MORE: UNDERSTANDING RISK

Risk assessments delineate risk into classes (e.g., low, moderate, and high) based on a number of inputs. Community stakeholders, including first responders, policymakers, elected officials, and neighborhood groups, use this information to inform their activities.

It's important to keep in mind that classifications such as "low" and "moderate" risk do not mean that there is *no* risk. Many wildfires occur in areas other than "high" or "extreme" risk areas, and can have negative consequences. For this reason, communities should consider all risk when discussing potential wildfire impacts.

Ultimately, a community must determine what level of risk is acceptable, and make appropriate risk reduction decisions.

Fortunately for Missoula County, simulations from both FlamMap and FSim that cover the entire county were completed in 2016. The FlamMap modeling was done by the Anchor Point Group as part of the Community Planning Assistance for Wildfire effort for the county. This work used 90th percentile weather conditions to reflect fire behavior during a typical day during the fire season. The FSim modeling covering the county was done by the U.S. Forest Service Rocky Mountain Research Station (RMRS) as part of a wildfire risk assessment for the Lolo National Forest. Both efforts used input data representing landscape fuel conditions as of 2015, and weather data from Remote Automated Weather Stations (RAWS) in and around Missoula County. Additional details about the two projects are described in a comparison report mutually produced by Headwaters Economics and RMRS.[16]

[13] Location of ignition points is computer-generated but informed by the generalized spatial pattern of actual ignitions in recent decades.
[14] https:/www.firelab.org/project/flammap
[15] Finney, M.A., C.W. McHugh, I.C. Grenfell, K.L Riley, and K.C. Short. 2011. A simulation of probabilistic wildfire risk components for the continental United States. Stochastic Environmental Research and Risk Assessment 25: 973-1000. https://www.fs.usda.gov/treesearch/pubs/39312
[16] Headwaters Economics. 2016. A Comparison of Two Wildfire Risk Modeling Approaches in Missoula County, Montana. Bozeman, MT.

The outputs from both modeling efforts are integrated and summarized here to provide an overview picture of spatial variation in wildfire risk components in Missoula County. The raw outputs from modeling are raster, or pixel-based, datasets that divide the landscape into evenly-sized square cells. For the FlamMap modeling, these cells were 30m (97ft) on a side. The increased complexity of FSim modeling required larger cells, each 180m (583ft) on a side. Summarizing these pixel-based datasets into larger polygon areas is important because any one spot on the landscape is inevitably impacted by the values of its neighbors. Displaying results by summary polygons makes them more easily interpretable, and allows for broad-scale patterns to emerge that may not be immediately visible in the pixel datasets. Therefore, outputs of wildfire likelihood and intensity are summarized below using fine-scale watershed polygons, referred to as catchments.[17] There are 2,751 catchment polygons that intersect Missoula County, ranging in size from about 40 to 9,900 acres (average = 697 acres). We calculated the average likelihood and intensity values for each catchment, as well as the integrated wildfire hazard, which combines likelihood and intensity into a single index.

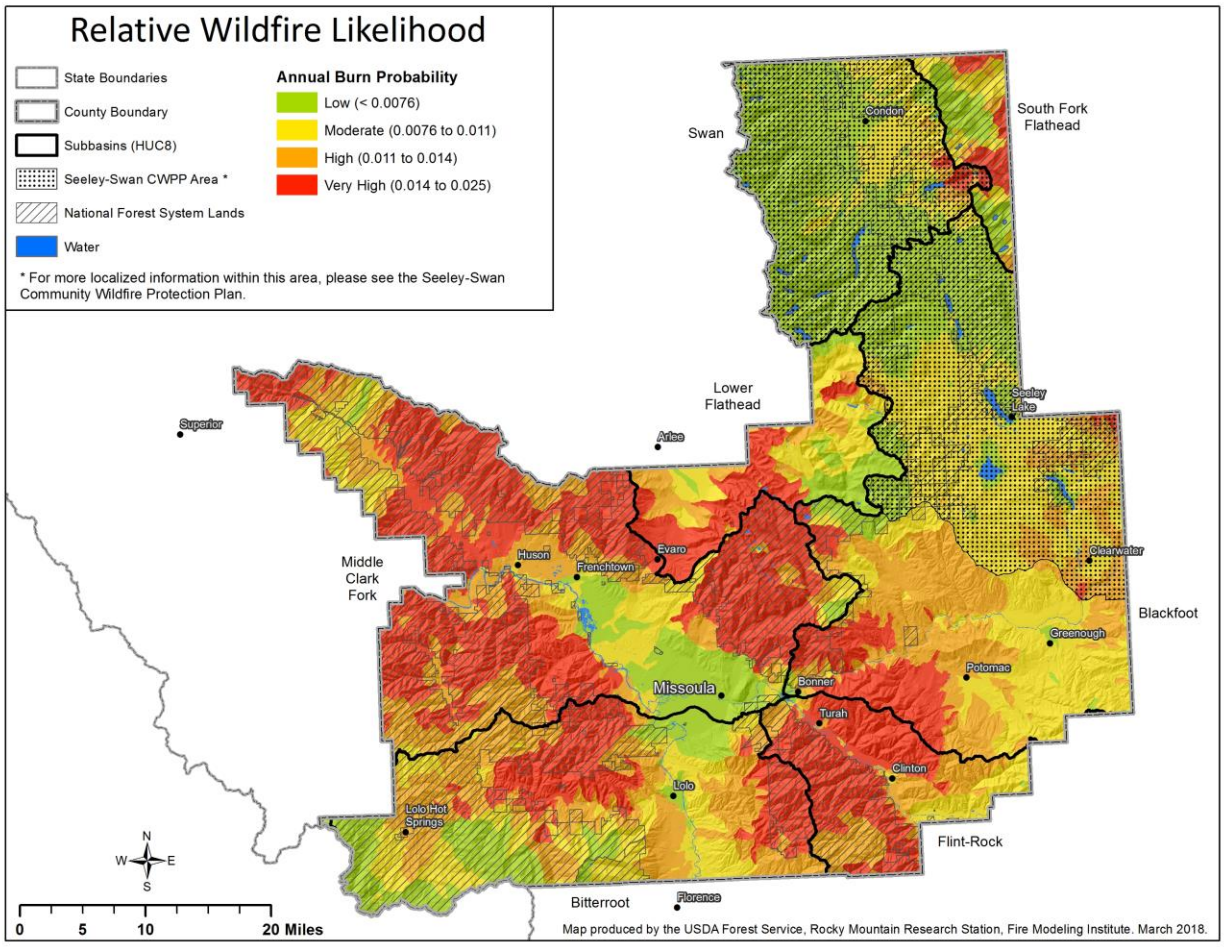
Likelihood

The best data product available to represent wildfire likelihood in Missoula County is the burn probability (BP) output from the FSim modeling done for the Lolo National Forest risk assessment. It represents a true annual burn probability that considers all possible weather scenarios. This provides a long-term perspective on the relative likelihood of fire for any location in the county in any given year.

To produce a map of relative likelihood for the county, the average BP for each catchment was calculated, and those averages were classified those into four classes of low, moderate, high and very high (Figure 12). The classes are relative to the distribution of catchment averages only within Missoula County, and are based on quartiles. Therefore, the high and very high classes represent all catchments with an average BP value above the county median. The average BPs for watersheds range from 0 to 0.025, with a mean of 0.01. This means, on average, any *specific location* (i.e., 180-m pixel) has about a 1 in 100 chance of burning in any given year.

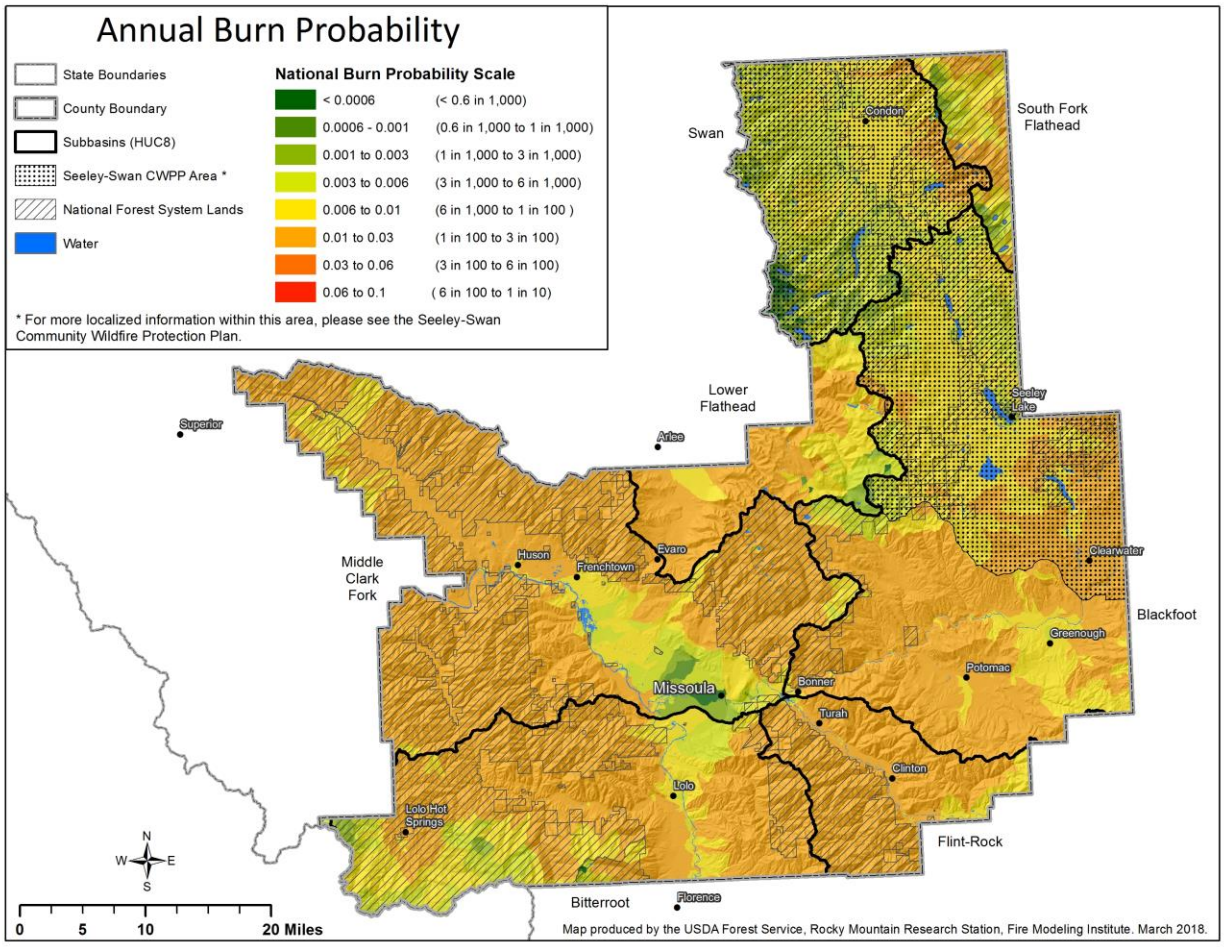
[17] Source: US EPA and USGS National Hydrography Dataset Plus v2. https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus. Catchment polygons smaller than 40 acres were merged into adjacent polygons.

Figure 12. Relative Likelihood of Wildfire in Missoula County



In general, wildfire likelihood is highest on forested, middle- to upper-elevation sites in the western and southern parts of the county. While there is some high to very high likelihood in the southern portion of the Blackfoot subbasin, the Blackfoot and Swan subbasins have mostly lower burn probability than the rest of the county. Areas of particularly low likelihood include the Mission Mountains on the west side of the Swan subbasin, the northern portion of the Blackfoot subbasin, and the heart of the Missoula Valley. However, it is important to stress again that the four likelihood classes shown here are just a relative distribution within the county. When mapped on a standard national scale for burn probability (Figure 13), it is clear that most of the county is in the moderate to high range of burn probability. Indeed, the average of annual burn probability for the county (0.01) is quite high compared to many other areas of the country.

Figure 13. Annual Burn Probability in Missoula County

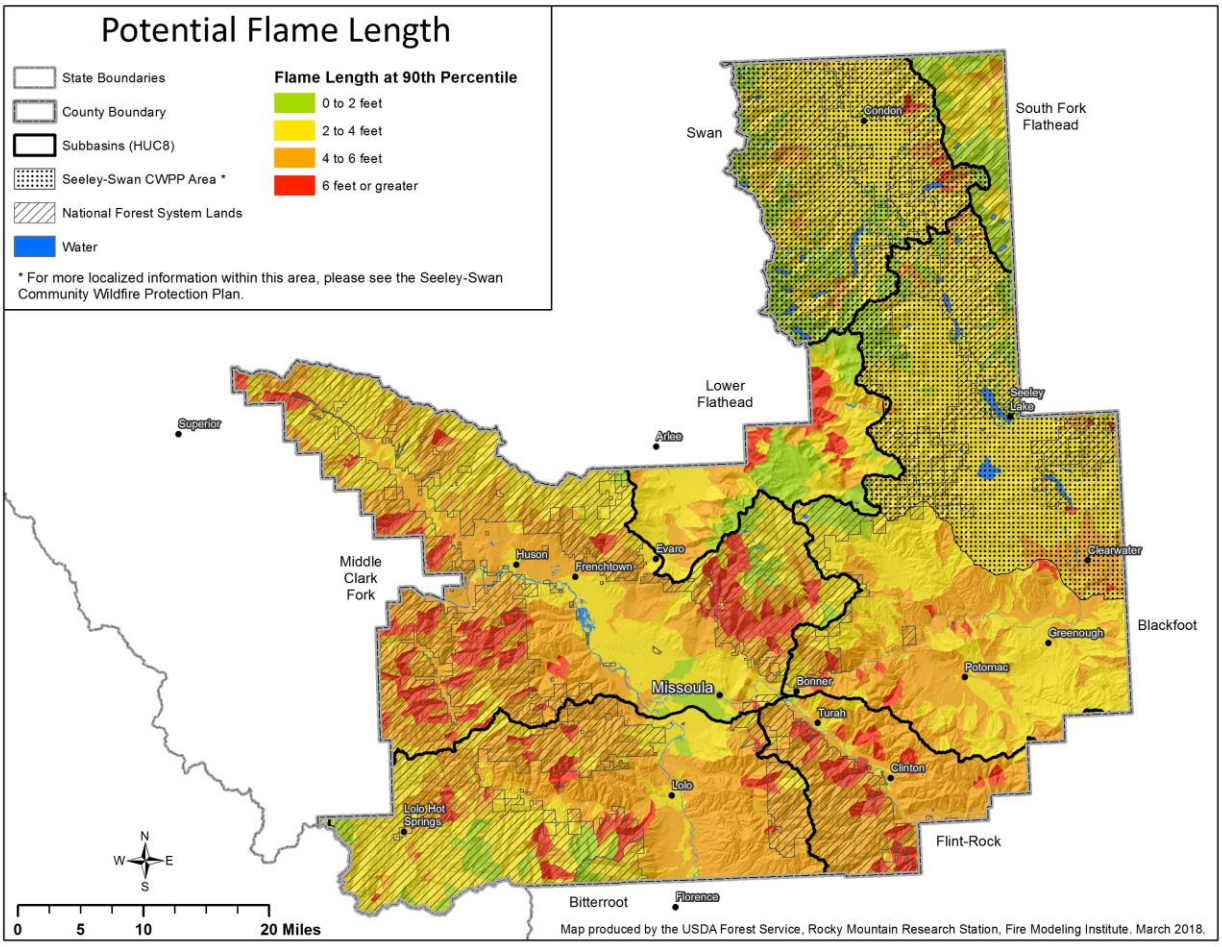


Intensity

The datasets available to represent potential wildfire intensity include the flame length modeled for a typical fire day (90th percentile) using FlamMap, and the conditional flame length from FSim that represents the average intensity for each pixel from many simulated fires. The two products are fairly similar, but the intensity from FlamMap may be more appropriate for the purposes of the CWPP. The fact that FSim intensities are averaged across many fires representing a range of conditions causes less variation from one catchment to another and fewer catchments showing potential for higher intensity fire. Therefore, the flame length map from FlamMap is presented here.

The map of relative wildfire intensity for the county was created by calculating the average 90th percentile flame length for each catchment and grouping those into four classes (Figure 14). In this case, the classes are based on standard flame length categories of 0 to 2 feet, 2 to 4 feet, 4 to 6 feet, and 6 feet and greater. The average flame lengths for catchments range from 0.01 to 14, with a mean of 3.8 feet.

Figure 14. Potential Flame Length for a Typical Fire Day in Missoula County



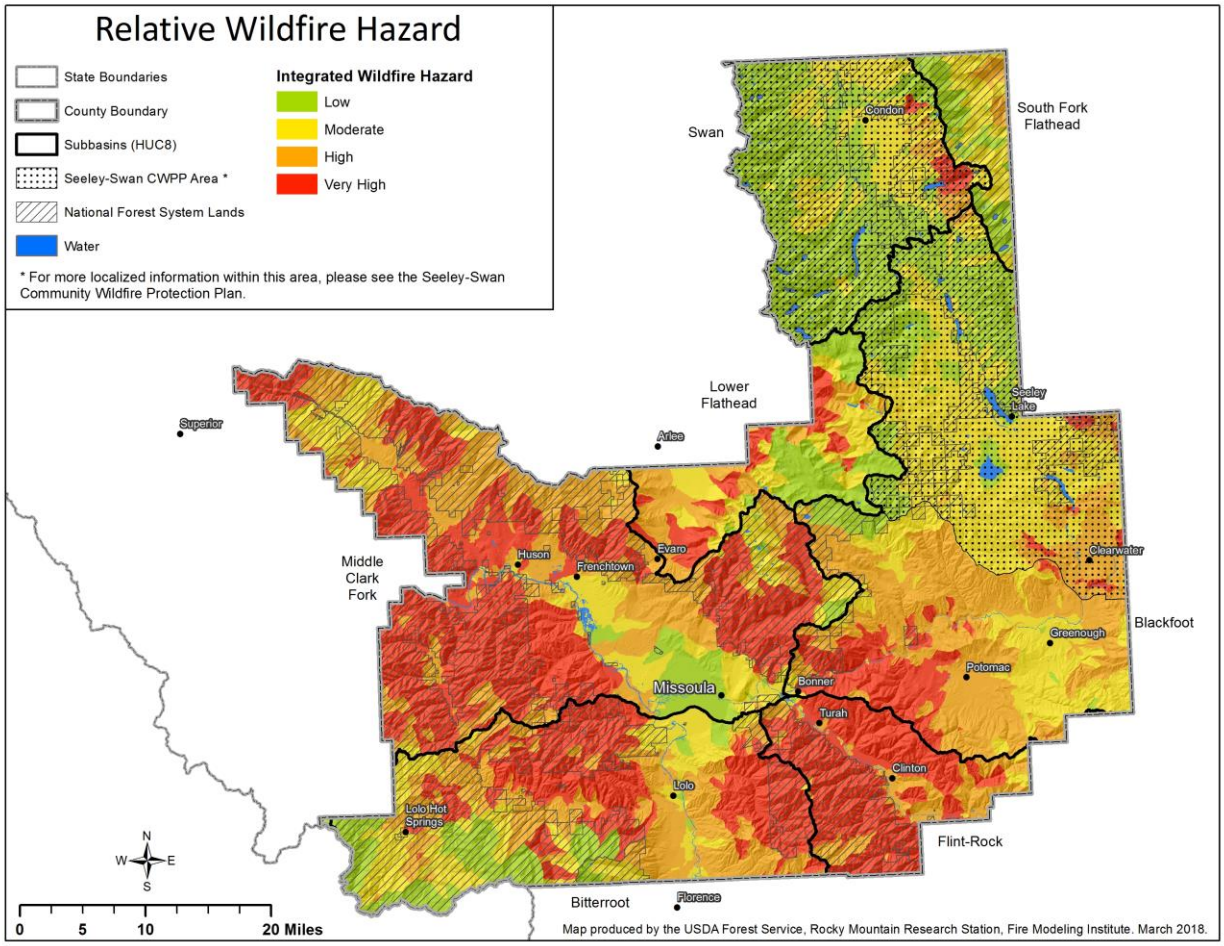
Areas with the highest potential fire intensity are mostly middle-elevation watersheds, likely with higher fuel loads, while the lowest intensity areas are generally at higher elevations that retain moisture longer into the summer and may have more sparse fuels. The majority of the county has low to moderate potential flame lengths under the modeled 90th percentile conditions.

Hazard

Taken together, the likelihood and intensity sides of the wildfire risk triangle represent wildfire hazard. An index of hazard, therefore, can be calculated by multiplying burn probability by the expected flame length. We did this at the pixel level by multiplying the burn probability from FSim by the 90th percentile flame length values modeled by FlamMap. The result represents the relative degree of wildfire hazard for each pixel under 90th percentile weather conditions. The average of this hazard index within each catchment polygon is presented here (Figure 15). As with likelihood, the average hazard values for catchments were grouped into four classes based on quartiles of the distribution across the county. The actual numeric values of hazard are less directly interpretable than BP or flame length, but they do provide a relative depiction of hazard across a landscape.

In comparing all three maps, the contributions of likelihood and intensity are both apparent in the hazard map. As with likelihood, the areas of highest hazard are in the western and southern portions of Missoula County, but there are pockets of high to very high hazard in each subbasin.

Figure 15. Relative Wildfire Hazard in Missoula County



Susceptibility and Risk

Information about susceptibility (or vulnerability) of specific assets is more difficult to map. Neither the Anchor Point nor the RMRS work in Missoula County provides enough information to adequately represent the susceptibility of communities to wildfire. While the Anchor Point analysis included some datasets that could address community-level susceptibility (e.g., distance to roads, fire stations, water sources, golf courses, etc.), their assessment did not integrate this information with likelihood and intensity data into standard, accepted metrics of risk. The RMRS analysis for the Lolo National Forest did develop abstract estimates of susceptibility (known as response functions) for a variety of natural resources and built assets, but the focus of that assessment was on setting land management and wildfire management priorities on National Forest lands. The response function for communities developed in that analysis estimated negative impacts to communities at all levels of fire intensity, but these impacts are vaguely defined and not specific for different types of structures. While information from both

assessments provides some insights into wildfire risk, neither facilitates a thorough mapping of risk across the county.

Moving forward, susceptibility could be evaluated in a few different ways to facilitate calculation of wildfire risk metrics in and around developed areas in the county. At a community or neighborhood scale, factors similar to those used in the Anchor Point assessment could be used to develop community-level susceptibility ratings. The rating areas could be watersheds, like the catchments used here, but may be more meaningful if they represent specific community or neighborhood boundaries used for planning and fire response purposes. Within each rating area, factors such as ingress/egress, distance to nearest fire station (or average response time), local water supply (e.g., streams, lakes, cisterns, etc.), and structure density could inform integrated ratings of community susceptibility to wildfire of different intensities.

At the parcel level, assessments of invidiual structures that evaluate factors such as building materials, defensible space, and fuel loads on the property can inform susceptibility at a much finer scale. The Missoula County Fire Protection Association and some individual fire districts are currently undertaking such assessments. The Montana Department of Natural Resources and Conservation (DNRC) has also developed a program using software developed for the state of Montana by the Intterra Group (Situation Analyst)[18] which may be useful to fire districts in supporting this task. As with the community scale, susceptibility ratings at the parcel scale should consider wildfire of different intensity levels.

Combined with susceptibility information at either of the scales described above, the likelihood and intensity data presented here could be used to calculate relative wildfire risk to either communities or individual parcels. With spatial data for all three sides of the wildfire risk triangle, a metric called Net Value Change (NVC) can be calculated that accounts for the risk posed by wildfire at different intensities for any location on the landscape. At the community or landscape scale, the NVC metric, and the component information used to calculate it, can support the prioritization and planning of specific community-level mitigation through vegetation management and local land use planning and policy. At the parcel scale, the same information can support landowners in making the right decisions to make their property fire safe.

Firesheds

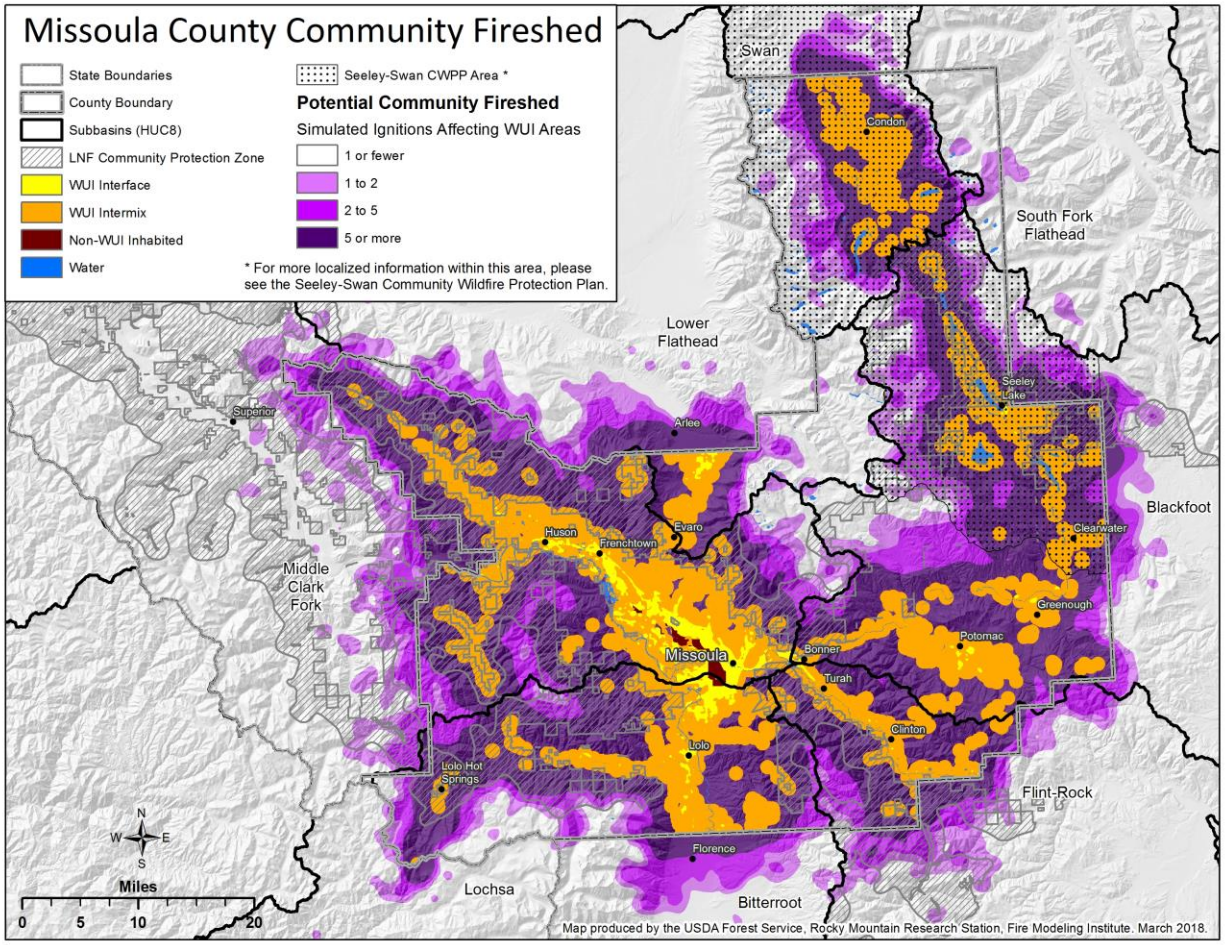
Wildfire is inherently a process that operates on the landscape independently of ownership, jurisdictional, or other municipal boundaries. For that reason, it is important for communities to look beyond their boundaries and consider the contributing area from which wildfires might impact areas within the community. Just like a watershed is the land area from which water may drain to a specific point, line, or area, a "fireshed" is a potential source area for wildfires that could impact a particular location.[19]

[18] http://dnrc.mt.gov/divisions/forestry/fire-and-aviation/fire-prevention-and-preparedness/home-fire-risk
[19] Scott, Joe H.; Thompson, Matthew P. 2015. Emerging concepts in wildfire risk assessment and management. https://www.fs.usda.gov/treesearch/pubs/49444

Firesheds can be spatially defined using data generated by a simulation model like FSim. In addition to the pixel-based outputs depicting burn probability and intensity, FSim also generates a polygon outline and associated ignition point location for each of the tens of thousands of simulated fires. These data make it possible to identify all simulated fires that reach an area of interest and where they came from.

For the purposes of this CWPP, all fires from FSim modeling that intersected areas with structure density greater than zero were used to generate a *community fireshed*. The ignition point locations for those fires can be used to create a map of ignition density; looking at different thresholds in this ignition density then provides a way to visualize the potential community fireshed (Figure 16). Again, these firesheds represent areas with the greatest potential for wildfire ignitions, under the right conditions for fire growth, to result in direct impacts to structures in Missoula County.

Figure 16. Community Fireshed in Missoula County



Similar fireshed concepts were used by the Lolo National Forest in their wildfire risk assessment completed in 2016. Using the same FSim data used here, they delineated a "Community Protection Zone" from the ignition density of simulated wildfires impacting communities and other lands neighboring National Forest System lands. Figures 5 and 16 show this Community Protection Zone and how it relates to both WUI and the community fireshed for the county. The Community Protection Zone is one of four strategic fire management zones delineated on the Lolo National Forest as a result of their risk assessment.[20]

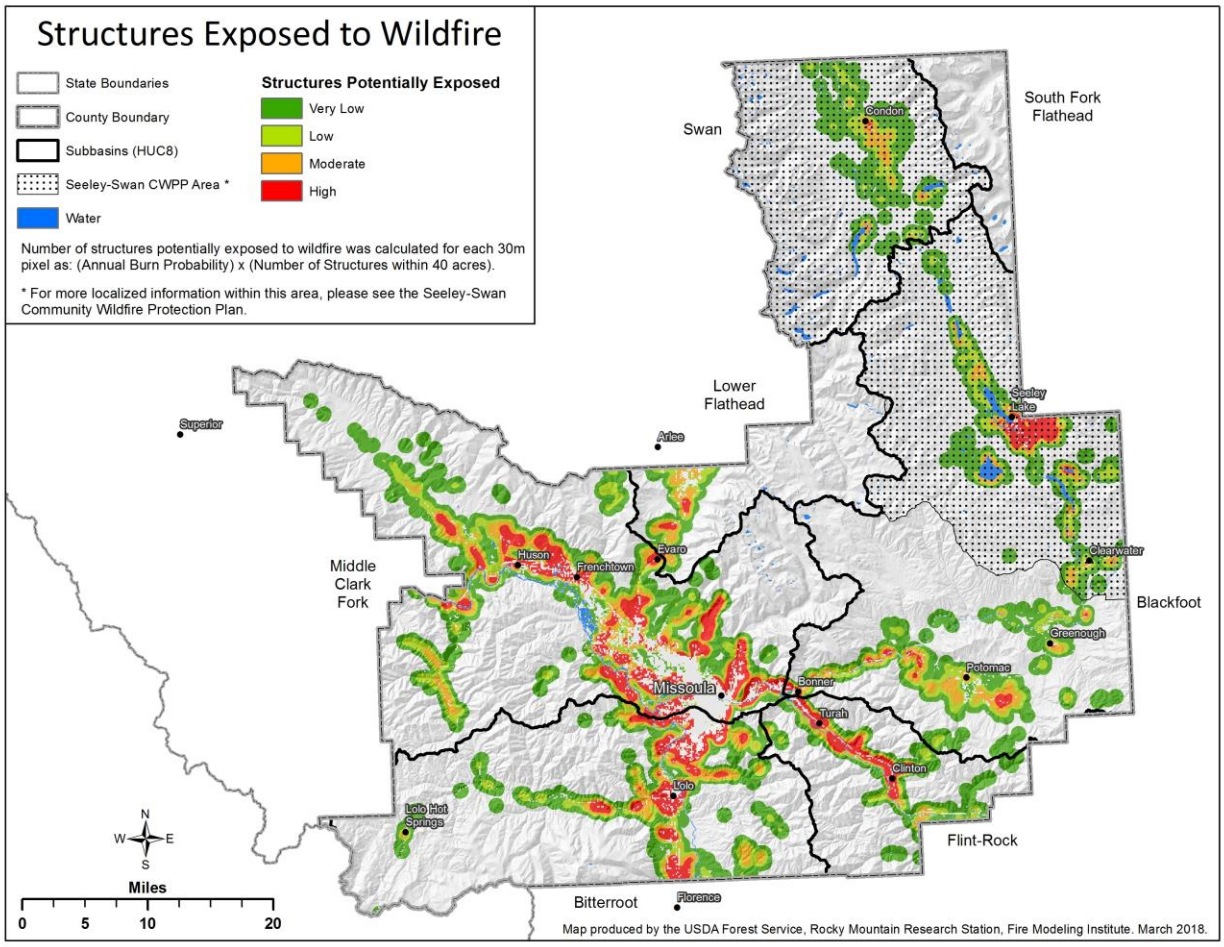
Exposure

Another metric related to risk is wildfire exposure, which refers to the spatial intersection of wildfire likelihood and intensity with something of value. In the case of this community assessment, we can measure the potential structures exposed to wildfire as well as the source areas that result in wildfire exposure to structures.

To evaluate potential structures to wildfire, the annual burn probability from FSim can be multiplied by the structure density per pixel (Figure 17). The result looks very much like the structure density map (Figure 4), except that areas that do not have wildland fuels (i.e., core developed areas) have a burn probability of zero and therefore do not show structure exposure. This map highlights areas where direct flame contact with structures is possible.

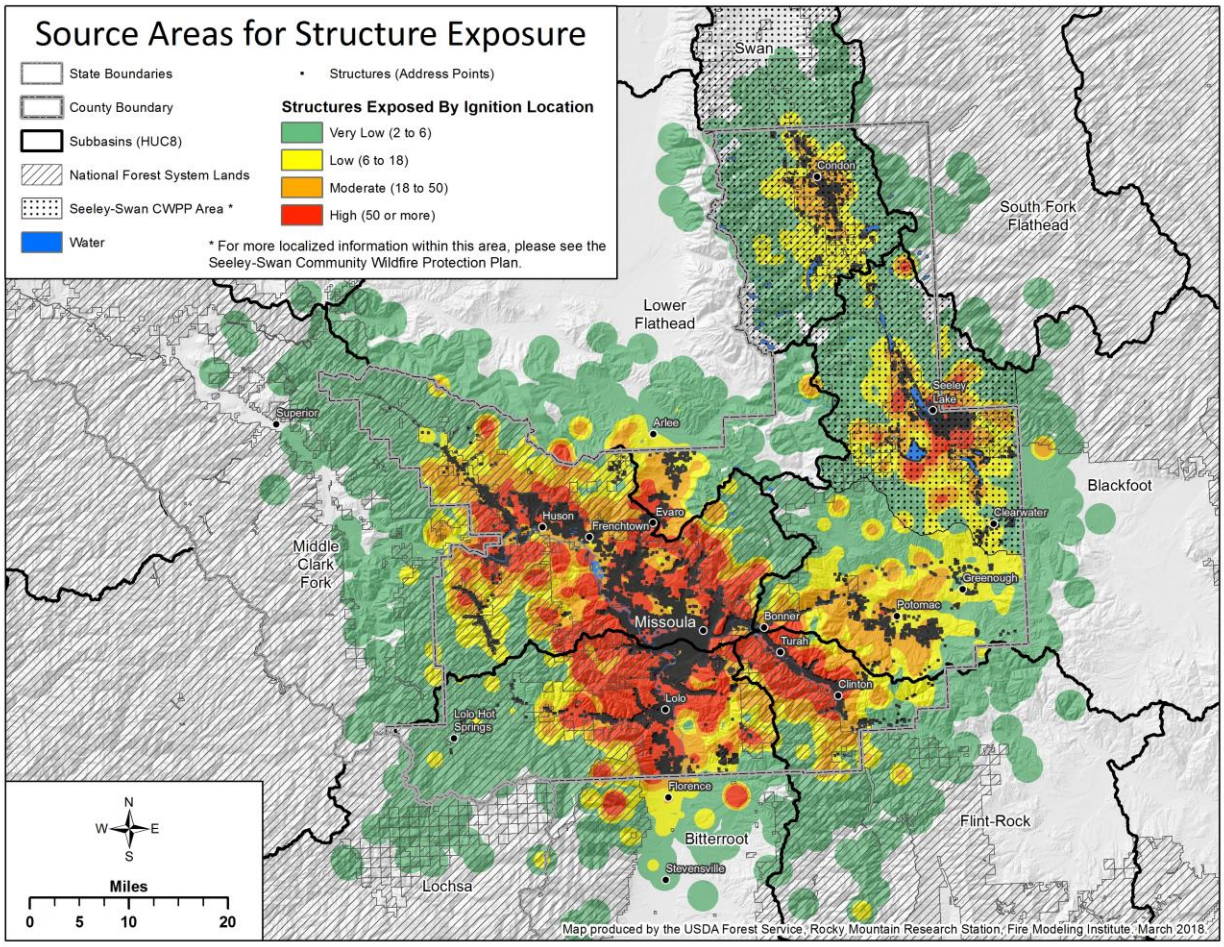
[20] More information about how the Lolo National Forest is prioritizing fuel treatments and fire management activities in the Community Protection Zone is available in an interactive online story map.
https://usfs.maps.arcgis.com/apps/MapJournal/index.html?appid=115847256eec4ad7b9371beb2d34d1b3

Figure 17. Structures Exposed to Wildfire



To identify source areas that could result in structure exposure, we used the same data used to generate the community fireshed – polygon and ignition point data from fires simulated with FSim. Using the structure density data, it is possible to calculate the total number of structures impacted by each simulated fire. An ignition density map can then be produced that shows the number of structures potentially exposed by wildfires starting in any particular location (Figure 18). This map is similar to the community fireshed map (Figure 16), but includes all possible ignition locations that could cause structure exposure. It also highlights two common patterns of structure exposure: 1) that fires starting close to areas of high structure density generally have the potential to expose the highest number of structures; and 2) that even fires starting quite far away from structures, and outside of the county, have potential to impact structures in Missoula County.

Figure 18. Missoula County Structures Exposed to Wildfire Based on Ignition Location



This information can be used to support the planning and prioritization of prescribed fire and other fuel treatments targeted at limiting the fire spread and intensity around communities and reducing the potential exposure.

Improve Risk Assessment Information

Specific CWPP actions to improve risk assessment information are:

1. **Update the Missoula County risk assessment and include WUI identification map.** Resulting landscape changes from the 2017 wildfire season should be incorporated into an updated wildfire risk assessment. This will require extensive field work and data analysis.

2. **Compile parcel-level assessment data to inform and complete risk assessment, increase first responder information, encourage public engagement.** Parcel-level assessment data will not only provide the susceptibility information required for a complete risk assessment, but will also provide valuable information for fire districts and residents to guide private property mitigation efforts.

❖ Risk Assessment Summary

The 2017 wildfire season was one of the worst fire seasons in Montana history both for acres burned and cost of suppression. Wildfires burning in and around Missoula County during the 2017 season resulted in over 300,000 acres burned; these fires have likely altered the local landscape significantly that are not yet fully understood. The 2016 wildfire risk assessments currently available to the county will require updating to reflect the changed landscape. This will require field data collection, fuels mapping, and an updated analysis of the risk based on this new information. Once this initiative is undertaken, it will take several months to complete. To continue the forward momentum of this CWPP update, the plan will be completed ahead of the new risk assessment and mapping. The 2016 analysis will be included in this CWPP and the updated risk assessment will be added later.

Part 3: Taking a Cohesive Strategy Approach In Missoula County

❖ Overview

The Federal Land Assistance, Management, and Enhancement Act of 2009 (known as the FLAME Act of 2009) directed the Secretary of the Interior and the Secretary of Agriculture to jointly submit a report to Congress which contained a cohesive wildfire management strategy. This led to the development of a National Cohesive Wildland Fire Management Strategy ("Cohesive Strategy")—a multi-phased effort engaging partners from federal, state, local, and tribal governments, non-governmental organizations, and public stakeholders to examine how the nation can plan for its wildfire future.

The Cohesive Strategy is centered around three goals to achieve its vision:[21]

- **Restore and maintain landscapes**: Landscapes across all jurisdictions are resilient to fire-related disturbances in accordance with management objectives.
- **Fire adapted communities**: Human populations and infrastructure can withstand a wildfire without loss of life and property.
- **Wildfire response**: All jurisdictions participate in making and implementing safe, effective, efficient, risk-based wildfire management decisions.

LEARN MORE: COHESIVE STRATEGY

The Cohesive Strategy's Vision for the next century is *to safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and as a Nation, live with wildland fire.*

Three Regional Strategy Committees (Northeast, Southeast, West) were established in 2011 to support and facilitate implementation of the Cohesive Strategy.

Montana is part of the Western Regional Committee. More information about the Western Region's Cohesive Strategy activities, including success stories, can be found online at wildfireinthewest.blogspot.com

In an effort to align with the Cohesive Strategy, Missoula County stakeholders expressed an interest in organizing this CWPP update to address each goal at a local level. This alignment reinforces the importance of collaboration among all local, state, and federal partners, and helps organize the multi-faceted nature of wildfire topics and mitigation strategies under the most appropriate goal.

Each of the following sections provides an overview of the topic, local information, and strategies and resources to address this goal. Specific actions are located in the Action Table (Part 4).

[21] The National Strategy – *The Final Phase in the Development of the National Cohesive Wildland Fire Management Strategy.* Accessed May 3, 2017: https://www.forestsandrangelands.gov/strategy/documents/strategy/CSPhaseIIINationalStrategyApr2014.pdf

❖ Restoring and Maintaining Resilient Landscapes in Missoula County

Through fire suppression, human development, and the changing climate, the terrestrial ecosystem and the role of wildland fire have been significantly altered over time. Restoring landscapes to a resilient state and promoting fire's natural role in ecosystems where appropriate must be an integral part of increasing the county's resilience to wildfire and becoming fire adapted. To achieve this, an ecosystem-based approach to fire management that incorporates prescribed fire in overall land management planning objectives is important in achieving the desired fire effects and mitigating undesirable fire effects on the ecosystem and the public. Finally, post wildfire recovery is an important component in resiliency to ensure that any negative fire effects that impact the ecosystem and the community can be addressed to minimize their impact. With the diverse ownership of land, restorative land management will require a collaborative effort among multiple stakeholders.

Restoration and Maintenance Strategies

Restoration and maintenance strategies should align with the National Cohesive Strategy, as outlined below.

Ecology/Ecosystem-Based Fire Management

- Where allowed and feasible, manage wildfire for resource objectives and ecological purposes to restore and maintain fire-adapted ecosystems and achieve fire-resilient landscapes, including the importance of the high-intensity fire regime component.
- Restore forest processes that are currently under-represented in the landscape, compared to historical conditions, including low- and mixed-severity fire regimes.
- Maintain and promote the growth of specific large tree species component, which are also under-represented, across the landscape.
- Control and eradicate invasive and noxious weeds.

Insect outbreaks, such as the Mountain Pine Beetle (top), require strategies such as mechanical fuels treatment to harvest insect-affected areas (bottom). ***Credit: Hancock (top), Albritton (bottom), BLM Missoula Field Office***

Fuel Treatments for Landscapes (Public and Private)

The 2005 Missoula County CWWP identified priority fuel treatment areas across the county and within specific fire districts, as well as projects that were completed, or ongoing at the time (Appendix C). The plan also provided public communications on the following possible treatment options for these areas and did not receive any significant indication of preference or opposition from the public:

- Slashing and Underburning
- Slashing and Pile Burning
- Commercial Harvest with Ground Based Systems and Under burning
- Commercial Harvest with Ground Based Systems and Chipping
- Commercial Harvest with Ground Based Systems and Pile Burning
- Commercial Harvest with Ground Based Systems and No Fuel Treatment
- Thinning (pre-commercial or commercial)

A prescribed burn at Blue Mountain achieves multiple ecological and risk reduction goals. *Credit: Hensiek, US Forest Service.*

Moving forward, the following general fuel treatment guidance should be followed:

- Continue to design and prioritize fuel treatments (prescribed fire and mechanical treatments) to reduce fire intensity, structure ignition, and negative wildfire impacts to values.
- Where feasible, implement strategically placed fuel treatments to interrupt fire spread across landscapes.
- Use and expand fuel treatments involving mechanical, biological, or chemical methods where economically feasible and sustainable, and where they align with landowner objectives.
- Reduce the risk of wildfire by removing fuels, especially small-diameter trees, while maintaining forest structure to protect ecosystem components.

Prescribed Fire

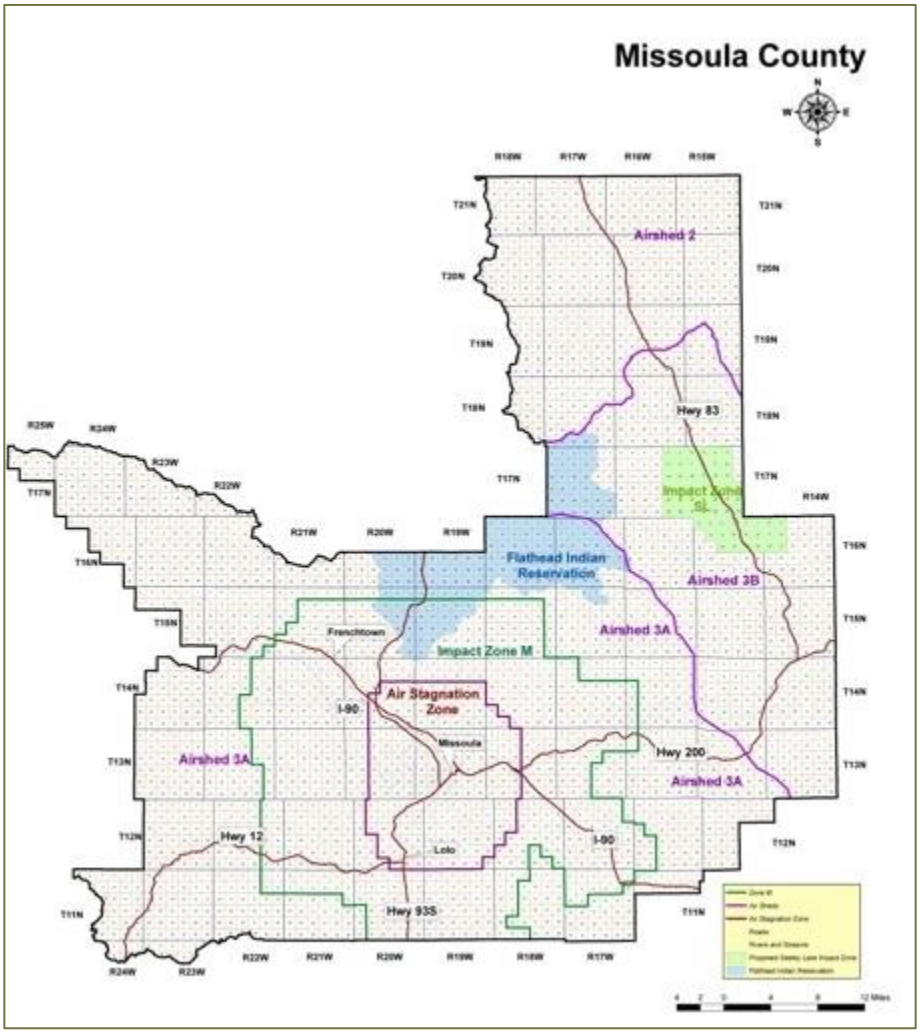
Prescribed fire continues to be recognized as an important fuel treatment and ecological restoration tool, where appropriate; therefore, stakeholders should:

- Continue and expand the use of prescribed fire to meet landscape objectives, improve ecological conditions, and mitigate negative wildfire impacts on human development.
- Ensure that prescribed fire planning includes the management of smoke in accordance with the Clean Air Act and the regulations and policies of the Environmental Protection

Agency (EPA) with specific reference to the Missoula County Airsheds and Smoke Impact Zones map (Figure 19).

- Ensure that prescribed fire planning follows state and local regulations.

Figure 19. Missoula County Airsheds and Smoke Impact Zones Map

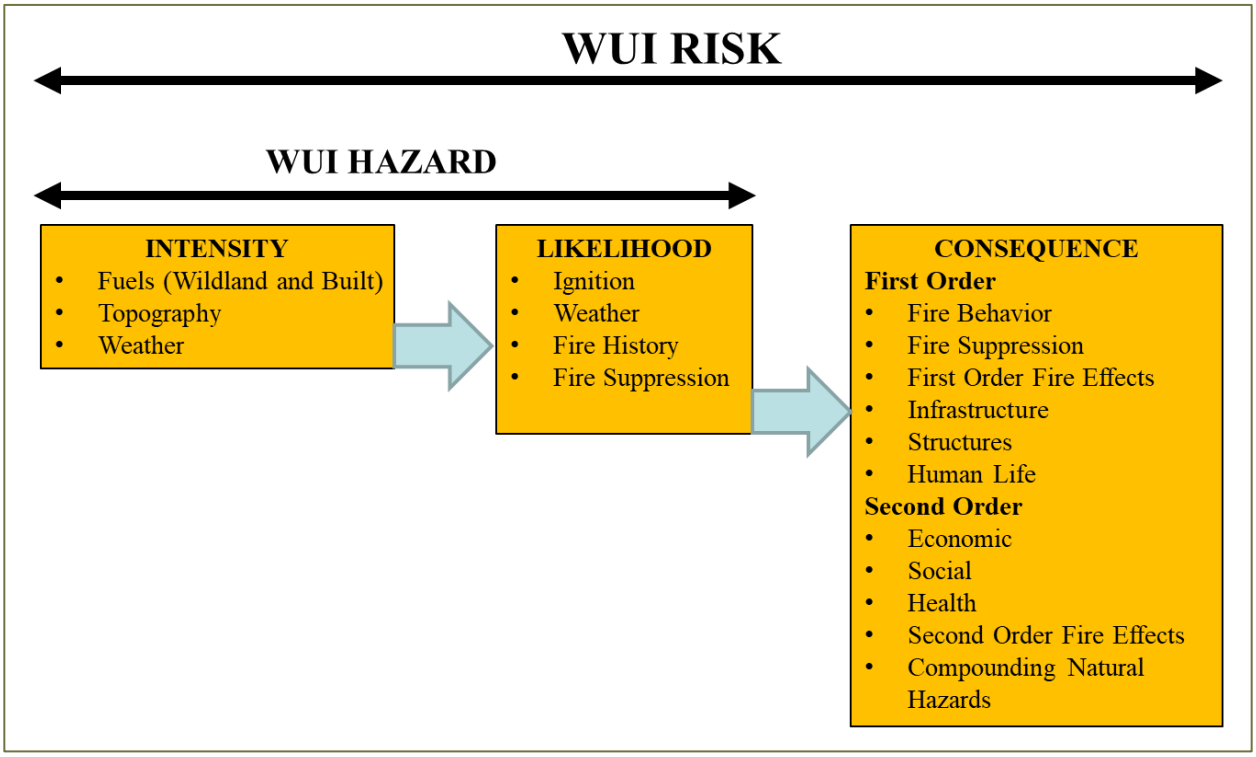


Post-Fire Effects and Recovery

A number of post-fire effects can result from either wildfire or prescribed fire occurrence. Prescribed fire planning goals and objectives are typically driven by desired ecosystem, or hazard reduction outcomes. These goals and objectives should be clearly stated in the prescribed fire plan and a monitoring program should be in place to measure the post-fire effects.

Wildfire events can result in significant post-fire impacts—both positive and negative. Risk assessments can provide guidance in anticipating post-wildfire impacts (Figure 20), mitigating these impacts before a fire occurs and reducing recovery efforts. The development of a post-wildfire recovery plan, based on the anticipated impacts, can help the communities affected become more resilient to wildfire.

Figure 20. Using a Wildfire Risk Assessment to Anticipate Post-Fire Effects



Land Management Planning (State and National Forest)

Collaborative planning efforts between county stakeholders, state, and national forest land managers should be ongoing. Actions resulting from the update of the Missoula County CWPP should be incorporated into both state and national forest land management plans.

Increasing Resiliency of Landscapes

Increasing resiliency of the landscapes within the county involves and requires an integrated approach.

Specific CWPP actions to increase resiliency of landscapes are:

1. **Review and identify priority landscapes and potential treatments options.**

   The 2005 CWPP priorities should be reviewed for relevance, and new potential priorities considered based on the updated hazard assessment information. Appropriate treatments (e.g. commercial thinning, hand thinning, prescribed fire) should also be determined and undertaken.

2. **Advance prescribed fire activities.**

   Prescribed fire use should be advanced in areas where it is determined to be the appropriate treatment for achieving ecological restoration or hazard reduction goals and objectives.

3. Implement post-fire recovery activities.

The post-fire recovery activities resulting from the 2017 wildfire season are currently underway and should take priority. As a result of these activities, there may be opportunities to leverage long-term post-fire planning that can support future wildfire and prescribed fire activity.

❖ Promoting a Fire Adapted Missoula County

Overview

Promoting fire adapted communities focuses on preventing, preparing for, and protecting lives and properties during wildfire events and ensuring a full recovery. A fire adapted community considers all aspects of its built environment, including homes, businesses, infrastructure, main streets, critical facilities, cultural sites, hospitals, and more.

There are many paths to becoming fire adapted, such as through education, mitigation, policies, and regulations. Fire adapted communities may implement established national programs, such as Firewise Communities/USA and Ready, Set, Go!, develop a CWPP, enhance local capacity, conduct fuel reduction and forest management activities, and utilize codes and ordinances to regulate development in fire-prone areas. The more actions a community takes, the more fire adapted it becomes (Figure 21). Because communities have limited resources, however, strategic identification of actions is necessary to best leverage fire adaptation at the local level. Promoting a fire adapted Missoula County also requires alignment with activities for restoring resilient landscapes and improving wildfire response.

Figure 21. Examples of Community Actions to Become Fire Adapted

Community Values

Missoula County has many community values that could be at risk to wildfire. It's important to consider these values at risk when locally planning for fire adapted communities, which broadly include:

Missoula County has a diverse set of values land uses that are considered when planning for wildfire. ***Credit: kenterphotography.com***

- Homes, businesses, and commercial areas;
- Communication and power transmission lines;
- Airports and transportation corridors;
- Watersheds, creeks, rivers, lakes, forests, and open space;
- Wildlife, fisheries, and biodiversity;
- Air quality, public health, and safety;
- Local, state, federal, and tribal recreational lands;
- Historic sites, historic districts, cultural and sacred areas;
- Critical infrastructure and facilities, such as hazardous-material facilities, hospitals, public shelters, and schools;
- Timber and wood products industries.

LEARN MORE: MISSOULA COUNTY'S VALUES AT RISK

Missoula County's values at risk are further detailed in other local plans, including:

- The **Pre-Disaster Mitigation Plan** for Missoula County and the City of Missoula (2017 update), which provides a detailed description of critical facilities and infrastructure, and provides a vulnerability analysis of the number of residences, commercial/industrial/ agricultural properties, critical facilities, and persons at risk to wildfire.

- Both **Growth Policies** for Missoula County and City of Missoula, which discuss local values and amenities, including public infrastructure, parks, trails, wildfire, fisheries, and cultural resources.

Trends in Community Development and Growth

Missoula County is experiencing growth and change in terms of its population, land use, ownership, and development patterns. The county estimates that unincorporated Missoula County alone will require between 2,740 and 3,220 new housing units by 2035 to meet growing population needs.[22] To address current and anticipated changes, the county must consider how wildfire can be further integrated into planning and development decisions. For example:

- Conversion of agricultural, forest and riparian lands to developed lands is contributing to the expansion of the wildland-urban interface. Building activity is also on the rise as the county continues to recover from the housing recession. The updated wildfire hazard assessment (see Part 2) can be consulted to help evaluate proposed new developments; developments that are proposed in hazardous areas should incorporate strategies that reduce risk to the built environment and increase firefighter and public safety.
- Some populations living in wildfire-prone areas, such as the elderly and those with fixed and low incomes, may have difficulty in performing or paying for mitigation, or require additional planning for evacuations. Coordinating with emergency managers and fire districts when planning for vulnerable populations can help address unique needs.
- Continued growth in seasonal and second-homeowner markets—particularly in amenity-driven areas, such as Seeley Lake, Nine Mile, Condon and areas east of Missoula—can affect how stakeholders plan for local response needs and resources. Community outreach and engagement with part-time residents and visitors must accommodate unique considerations such as seasonal schedules, changes in population, or varying levels of awareness regarding local wildfire concerns.

LEARN MORE: REDUCING STRUCTURAL IGNITABILITY

Too often, structures and properties are not prepared for wildfire conditions. However, research from the USFS Rocky Mountain Research Station Fire Sciences Lab, Insurance Institute for Business and Home Safety (IBHS), and the National Institute of Standards and Technology (NIST) shows that proper structure ignition measures can increase their survivability during a wildfire by decreasing their susceptibility to flames, radiant heat, and embers.

Several strategies in this CWPP therefore promote policies, regulations, education, and outreach programs that focus on addressing the structure ignition zone. These strategies aim to reduce home, business, and other property losses during a wildfire. To help achieve this, strategies may also be required in local codes.

For additional tips on reducing structural vulnerability, visit the FireSafe Montana Ignition Resistant Construction Guide (available on Firesafemt.org)

Increasing Community Fire Adaptation & Reducing Structural Ignitability

Recent and future population and development changes, combined with an increase in wildfire risk, highlight the need for Missoula County to develop strategies to plan for and adapt to wildfire. Strategies must consider a range of current and future community values, including

[22] Missoula County, MT. 2016. Missoula County Growth Policy. p. 9-7, 9-37.

existing and new homes, vulnerable populations, local amenities, critical facilities and infrastructure, and businesses. Strategies can be in the form of new policies and regulations, education and outreach initiatives, and other programmatic activities that help community members prepare for, and adapt to, future wildfire events.

Strategies below are focused on leveraging existing county activities to increase their impact across the county. Actions listed below are also captured in the Action Table (Part 4).

Promote Implementation of WUI Policies and Regulations

Several key county and city plans already incorporate wildfire topics into their goals and actions, including the Missoula County Growth Policy, City of Missoula Growth Policy, and County and City Pre-Disaster Mitigation Plan. For example:

- The Missoula County Growth Policy Goal #11 aims to reduce the safety risks and costs associated with wildland fire, flooding, and other hazards. Implementation objectives aim to discourage development in hazard areas and take appropriate measures to limit safety risks and ensure sufficient response resources. The Growth Policy describes how planning mechanisms, such as subdivision regulations, can address future development features including defensible space, access, and water supply. Local codes also provide improved opportunities for public health, first-responder and community safety, and welfare.
- The Pre-Disaster Mitigation Plan contains a goal to reduce wildland fire risk within the WUI. Several objectives and corresponding actions focus on encouraging the use of fire-resistant materials/design of non-combustible homes in future developments and encouraging the review of subdivision regulations for coordination with the update of this CWPP.

This CWPP leverages existing plan goals to advance risk reduction by providing more detailed implementation guidance. In other words, CWPP actions build on current WUI community actions in the Growth Policies and Pre-Disaster Mitigation Plan.

Specific CWPP actions to address development are:

1. **Update County Growth Policy land use map and local area plans, as needed and appropriate, using wildfire hazard area information to steer growth away from more hazardous areas.**
    a. Using tools such as the WUI map and wildfire hazard assessment during policy updates and implementation ensures consistency of information among plans and informs future policy decisions.
1. **Implement land use map updates using zoning to guide growth to more appropriate areas and away from more hazardous areas.**

    Using proactive strategies to guiding growth to appropriate locations helps reduce risk to future neighborhoods and homes.
2. **Utilize land conservation tools such as the open space bond to buffer developed areas from wildfire.**

Creating land buffers between development and the natural environment makes it easier to manage vegetation near homes and neighborhoods and protect these homes during future wildfire events.

3. **Adopt development regulations that require best possible hazard mitigation to protect communities, neighborhoods, fire professionals, and properties/structures in the event of a wildfire. Propose updated development regulations that incorporate best practices, including changes to building code, zoning code, and subdivision regulations.**

   Evaluating the effectiveness of regulatory tools, such as the building code, subdivision regulations, and zoning regulations, helps determine whether additional fire protection measures are necessary at each applicable scale. This could include exploring the adoption of a wildland-urban interface code. The county risk assessment can be used to further inform this action.

Promote WUI Public Education & Outreach

Mitigation strategies are often most accepted when the public and stakeholders understand their effectiveness. For example, scientific tests on building construction identify which types of materials are most effective during ember storms. When the public understands this information, they are more likely to see the value in supporting building codes that include ignition-resistant construction requirements.

Mitigation strategies are also effective in addressing existing development through education and outreach activities to help increase awareness and motivate voluntary actions. Activities can target residents and landowners, youth, industry professionals, and elected officials.

Many education and outreach efforts are already underway by local, state, and federal stakeholders. For example, the agencies that make up the Missoula County Fire Protection Association (MCFPA) implement wildfire outreach activities, which include:

- Conducting free property assessments to help residents identify hazards;
- Promoting participation in the national Firewise Communities /USA program to encourage neighborhood activities and local recognition;
- Delivering Ready, Set, Go! program messages to residents to help them prepare for wildfires and evacuations;
- Working with local schools on youth education programs;
- Offering informational meetings on wildfire to the public during open houses and public meetings.

An Elk Meadows Community Burn Day with the Frenchtown Rural Fire District. ***Credit: Koppen, MT DNRC***

Similar to the first strategy, both the Pre-Disaster Mitigation Plan and Growth Policy also encourage and promote the use of education materials to residents and landowners in hazardous areas.

Specific CWPP actions to enhance outreach and education are:

1. **Engage with industry professionals on mitigation programs, activities, and opportunities to improve public education and outreach across neighborhoods and communities.**

   Many industry professionals, including insurance agents, realtors, developers, and builders, can play a critical part in understanding their role and educating other audiences in community fire adaptations. Working with this group by providing specific resources and messaging materials can accelerate local efforts to reduce wildfire risk.

2. **Update county and MCFPA websites with wildfire education resources and materials.**

   Missoula County and other partners, including the Missoula County Fire Protection Association, can add additional website resources in the form of informational brochures, interactive maps that highlight local risk, educational videos, or other guides to help the public learn more about wildfire. Topics may include home construction and landscaping techniques, evacuation planning and preparedness, and parcel-level risk assessments.

3. **Promote having neighborhoods and communities develop mitigation activities and evacuation plans through programs such as Firewise Communities/ USA and Ready, Set, Go!**

   Risk reduction happens at multiple scales. Neighborhoods are encouraged to engage in mitigation planning. This can be through participation in national programs, such as Firewise Communities/USA program or Ready, Set, Go! (supported through local agencies), and the development of local CWPPs or similar fire plans.

❖ Increasing Wildfire Response Throughout Missoula County

The multiple agencies responsible for fire suppression have developed an excellent network of interagency support and cooperation. Generally, suppression resources have been able to respond to wildland fire occurrences with adequate resources using this system. However, some concern is expressed over the ability of this system to sustain itself in the face of climate change and the current trend of decreasing volunteer capacity, aging firefighters, and decreasing budgets.

Fire managers making a plan during the Lolo Complex Fire in Missoula County (2013). ***Credit: Seidlitz, Meagher County Fire*.**

Primary Stakeholders and Response Areas

Most Missoula County communities are within the jurisdictions of one of the ten legally recognized, community-based rural fire districts, fire service areas, or a municipal fire department (Table 3). According to the database of all addressed structures (not including outbuildings) within Missoula County, there are very few known structures located outside the response areas of these fire protection districts.

Table 3. Overview of Community-Based Fire Response Agencies in Missoula County, MT

Community-based Fire Response Agency	Communities Served	Response Area (sq. mi)
Arlee Rural Fire District	• South of Arlee	152
Clinton Rural Fire District	• Clinton • Lower Rock Creek	8
East Missoula Rural Fire District	• East Missoula	.98
Florence Rural Fire District	• North of Florence	7
Frenchtown Rural Fire District	• Evaro • Frenchtown • Huson/Ninemile • Petty Creek • The Wye • Alberton- Mineral • Southside Road	125
Greenough/Potomac Fire Service Area	• Greenough • Potomac	201
Missoula Rural Fire District	• Blackfoot/Turah • Grant Creek/Rattlesnake • Pattee Canyon • Lolo/Miller Creek • Target Range/Big Flat	84.5
Missoula City Fire Department	• Missoula	25
Seeley Lake Rural Fire District*	• Seeley Lake	60
Swan Valley Fire Service Area*	• Condon	139
*Covered by Seeley/Swan Fire Plan		

Of the ten fire protection districts, only the Missoula City Fire Department has an all-paid staff. Missoula and Frenchtown rural fire districts (together covering more than 200 square miles) have a mix of paid and volunteer firefighters. The other districts rely completely on citizen volunteers to respond to structure fires, wildland fires, and other emergencies such as medical calls and vehicle accidents on the interstate or secondary roads within each jurisdiction.

Additional Stakeholders

In addition to fire suppression resources available within the fire protection districts, seasonal wildland firefighters are available through the Forest Service (USFS), the Montana Department of Natural Resources and Conservation (DNRC), and the Confederated Salish and Kootenai Tribes (CSKT). These resources are trained and equipped to fight wildland fire only; unlike the

fire protection district resources, they are not trained or equipped to fight a structure fire. The USFS and DNRC also offer access to national incident and area command teams and resources, when required.

Crews at the Sapphire Complex Fire (2017). *Credit: Lolo National Forest*.

Missoula County Fire Protection Association

All of Missoula County's fire agencies belong to the Missoula County Fire Protection Association (MCFPA), which serves as a collaborative discussion group on fire prevention and other fire-related needs. The MCFPA website offers a contact list for local jurisdictions as well as a link to the 2005 Community Wildfire Protection Plan (www.mcfpa.org).

Suppression Responsibilities

When an unwanted wildland fire (wildfire) is discovered in Missoula County, a fire response crew from a local fire response jurisdiction, a USFS ranger district, and/or DNRC fire unit may respond, depending on its location. The Missoula City/County 911 Center and the Missoula Interagency Dispatch Center use the "closest forces" concept in wildland fire dispatch.

This allows for the closest suppression resource to be sent, regardless of boundaries or jurisdictional responsibilities. This arrangement is particularly helpful at either end of the federally recognized fire season (typically mid-June through mid-September). When wildfires start early, as they did in 2000 (the first wildfire occurred on March 15), federal fire crews are not yet employed so it is the community-based firefighter who is often first on scene.

Interagency Agreements

Through pre-established mutual aid agreements, all fire suppression resources in Missoula County are authorized to leave their jurisdictional boundaries to aid a requesting agency partner. In addition, Montana statute allows these resources to assist throughout the state when needed/possible. This is primarily accomplished through the Southwest Montana Zone Multi-Agency Coordinating Group within the Northern Rockies Coordinating Group, which allows all responsible jurisdictional agencies to coordinate resources and priorities throughout the Southwest zone during fire season. The Southwest Zone Multi Agency Coordination (MAC) Group consists of representatives from:

- Lolo National Forest;
- Bitterroot National Forest;

- County Fire Wardens Association;
- Confederated Salish and Kootenai Tribes;
- Montana DNRC;
- Bureau of Land Management;
- U.S. Fisk and Wildlife Service;
- Missoula County DES.

Automatic aid agreements are also utilized between most Missoula County agencies sharing boundaries. These agreements are triggered by verbal request, typically at the time of first dispatch.

Emergency Preparedness/Evacuation

Emergency evacuation procedures are the responsibility of the Missoula County Sheriff s Office. During a wildfire, the Incident Commander (in coordination and with the approval of the agencies having jurisdiction) will recommend evacuation. Routes and locations of shelters/centers depend on fire location and numbers of affected individuals, and so must be made on a case-by-case basis at the time of the incident. Missoula County has an Evacuation Plan. For more information about it, contact the Missoula County Sheriff s Office.

Current Suppression Challenges and Limitations

Areas Without Organized Fire Response

There are approximately 22,000 acres of private land in Missoula County without an organized fire-response system. Under the terms of a cooperative agreement between the county commissioners and the State of Montana, the county has assumed fire suppression responsibility in these areas from the State. The County Fire Warden and Rural Fire Chief (one-and-the-same) is responsible for coordinating response to wildland fires that occur within these areas and has historically relied on mutual aid from adjacent fire districts and/or MT DNRC, through the County Cooperator program. Development of formal mutual aid agreements for protection of these lands is ongoing. Lands without fire protection are located throughout Missoula County. Some of the larger examples include the following areas: Upper Miller Creek, Holloman Saddle, Ninemile Prairie, and Upper Lolo Creek. There is also some unprotected land near the Missoula Airport and the Eight-Mile area near Florence.

Volunteer Firefighter Capacity

The current national trend of a decreasing and aging pool of volunteer firefighters has been expressed as an increasing local concern for most departments that rely on volunteer responders.

LEARN MORE: VOLUNTEER FIRE SERVICE

- Volunteer firefighters are called to a variety of emergencies, including fires, emergency medical incidents, natural disasters, terrorist incidents, water rescue emergencies, and more. Volunteers spend an enormous amount of time training to prepare for responding to these emergencies.
- Volunteers comprise 70 percent of firefighters in the United States. Of the total estimated 1,160,450 firefighters across the country, 814,850 are volunteer.
- The majority of fire departments in the United States are volunteer.
- The number of volunteer firefighters in the U.S. reached a low in 2011, and many local volunteer fire departments are struggling to meet staffing needs. Challenges includes increased time demands and rigorous training requirements.
- Learn more at the National Volunteer Fire Council (nvfc.org)

Source: *National Volunteer Fire Council Fact Sheet*. 2017

Most departments can currently function adequately when faced with in-district emergencies However, as county and regional wildland fires grow in frequency and size—increasing the need for solid mutual and automatic aid support—and compounded with the demand of other year-round response commitments (medical calls, structure fires, rescues, motor vehicle accidents)—the majority of these departments are unable to provide support to the desired level.

Climate Change

A changing climate, resulting in fires of increased intensity and extended shoulder seasons, will require increased resources. This adds an additional stressor on volunteer firefighter capacity.

Response Area Commitment

Many of the local fire districts are responsible for significant response areas—some extending into neighboring counties and many with multiple communities or values at risk. There is some concern regarding the capacity during a heavy multiple fire load scenario that these resources that are relied upon for mutual aid will be over-committed.

Improving Response

Specific CWPP actions to improve wildfire response capabilities are:

1. **Promote and support fire departments to increase capacity and funding.** Stakeholders and all levels of government should work together in developing a coordinated approach to increasing fire department capacity and funding with respect to wildfire response.
2. **Establish wildland fire response agreements between the county and fire districts.** The county and local fire districts should continue to work together in establishing formalized agreements that include fire protection for lands within the county that are not currently protected.

❖ Cohesive Strategy Section Summary

Missoula County has a diverse set of community and ecological values at risk, requiring a comprehensive approach to mitigation. Ecological health challenges, increased development pressures, local fire response capacity challenges, and climate change all increase the complexity and emphasize the need for this approach. The county anticipates future growth and must plan where and how development should occur to avoid increasing wildfire risk to lives and properties. Accordingly, the natural landscape must also be managed with the combined appropriate combination of vegetation management (mechanical, chemical, and prescribed fire) and response. Wildfire mitigation actions must consider both existing and future development to increase community fire adaptation. Actions listed in this section and summarized in the CWPP Action Plan (Part 4) advance the goals of the county and city Growth Policies and Pre-Disaster Mitigation Plan, as well as increase the wildfire response capacity and overall wildfire resiliency. Actions take a wide-ranging approach to address multiple scales and stakeholders and to provide voluntary and regulatory options.

Part 4: Putting the CWPP Into Action

❖ Overview

Part 4 focuses on putting the CWPP into action. The first section provides an overview of stakeholders associated with this CWPP to promote understanding of roles and responsibilities. The second section provides an action plan to guide stakeholder implementation activities. This ensures the CWPP process moves forward in tangible ways. Finally, additional guidance on plan maintenance outlines key considerations to ensure this plan stays timely and relevant in the future.

❖ Stakeholder Roles

The success of this CWPP requires the participation of all stakeholders to engage in understanding their role and taking appropriate actions. The following table shares roles that community members at local, state, and federal levels play in Missoula County's wildfire resilience and risk reduction.

Table 4. Overview of CWPP Stakeholder Roles

Stakeholder Group	Overview of Roles
City, County, and Local Partners	
Elected Officials	• Board of County Commissioners (BCC) has jurisdiction and power to represent the county and has care of the county property, management, and business concerns. • Missoula County Sheriff is an elected position that has responsibility for the enforcement of state and county laws and statutes. • The Missoula City Council and Mayor of Missoula are elected to represent citizens of Missoula.
Missoula County Community and Planning Services	• Responsible for developing and administering plans and regulations, including zoning and subdivision, growth policy, regional plans. • Includes Parks, Trails and Open Lands Section, which manages county park lands and trails, and supports landscape conservation projects on public and private land. • Includes Grants Division, which administers grants program to enhance access to state, federal, and private dollars.
Fire Departments and Rural Fire Districts	• Responsible for community fire response and protection services for areas across Missoula County.
Missoula County Fire Protection Association	• Nonprofit association with members from city, county, rural, state, and federal agencies, including fire departments and

Stakeholder Group	Overview of Roles
	districts, Missoula County Office of Emergency Management, Montana Department of Natural Resources and Conservation, USDA Forest Service, and other organizations • Coordinates on fire prevention and response activities.
Missoula County Office of Emergency Management (OEM)	• Coordinates emergency response components in Missoula County and the City of Missoula. • Comprises Missoula's 9-1-1 Center and Missoula County Disaster and Emergency Services (DES).
Missoula City-County Health Department	• Responsible for air quality monitoring and burning permits.
City of Missoula Development Services	• Responsible for planning, permitting and land use, building, engineering, and transportation services for the city of Missoula.
Missoula County and City Residents, Private Landowners, and Community Councils	• Responsible for personal property and engaging in community projects. • Seven community councils participate in planning process by facilitating communication between communities and local government. • Includes private landowners, such as citizens and entities with large landholdings (e.g., The Nature Conservancy, Weyerhaeuser).
Non-Governmental Stakeholders	• Includes stakeholders from Missoula Building Industry Association, Missoula Organization of REALTORS and other industry professionals. • Volunteer organizations, Resource Conservation and Development Councils, Chamber of Commerce, utilities, university partners, and other businesses.
State Partners	
Montana Department of Natural Resources	• State agency providing fire resources and information, including WUI maps, air quality updates, current fire restrictions, and historical fire information.
FireSafe Montana	• Private, nonprofit organization coordinates and supports a statewide coalition of diverse interests working together to help Montanans make their homes, neighborhoods, and communities fire safe.
Federal and Tribal Partners	
USDA Forest Service	• Manages Lolo National Forest, Flathead National Forest. • Local support and resources also include Rocky Mountain Research Station.
Confederated Salish and Kootenai Tribes	• Manages Flathead Indian Reservation. • Maintains a culturally sensitive site inventory for lands on and off the Reservation.

Stakeholder Group	Overview of Roles
Bureau of Land Management	• Manages public lands out of the Missoula Field Office.
U.S. Fish and Wildlife Service	• Administers environmental stewardship programs and services to guide conservation, development and management of national fish and wildlife resources. • Issues permits under various wildlife laws and treaties.

❖ Action Plan

The following action plan (Table 5) captures actions listed throughout this CWPP. Each action has a proposed lead(s) responsible for advancing the action, a priority level for implementation, a desired timeframe for completion, and any additional notes relevant to support the action. Many actions may relate to one another.

Table 5. Missoula County CWPP Action Plan

Action	Lead(s)	Priority	Timeframe	Notes
Risk Assessment				
1. Update the Missoula County risk assessment and include WUI identification map.	USFS, County, CAPS	High	Summer 2018	• See pages 28-39 for more information
2. Compile parcel-level assessment data to inform and complete risk assessment, increase first-responder information, encourage public engagement.	Fire Districts, County	High	2019/ Ongoing	• See pages 28-39 for more information
3. Continue Cohesive Strategy Working Group (CSWG).	MCFPA, USFS, DNRC, CSKT, BLM, County	High	Spring 2018	• See page 41 for more information
Resilient Landscapes				
4. Review and identify priority landscapes and potential treatment options.	CSWG	High	Summer 2018	• See pages 42-45 for more information
5. Advance prescribed fire activities.	CSWG	Medium	Ongoing	• See pages 42-45 for more information

Action	Lead(s)	Priority	Timeframe	Notes
6. Implement post-fire recovery activities.	CSWG	High	Ongoing	• See pages 42-45 for more information
Fire Adapted Communities				
7. Update County Growth Policy land use map and local area plans, as needed and appropriate, using wildfire hazard area information to steer growth away from more hazardous areas.	CAPS	High	Update for urban areas: 2019 Update for rural areas: 2021	• Updates should be triggered by development patterns, and tied to update of WUI identification map and risk assessment • See pages 46-51 for more information
8. Implement land use map updates using zoning to guide growth to more appropriate areas and away from more hazardous areas.	CAPS	Medium	Occurs in conjunction with land use mapping updates	• See pages 46-51 for more information
9. Utilize land conservation tools such as the open space bond to buffer developed areas from wildfire.	CAPS	High	Ongoing (dependent upon open space bond approval)	• See pages 46-51 for more information
10. Adopt development regulations that require best possible hazard mitigation to protect communities, neighborhoods, fire professionals, and properties/structures in the event of a wildfire. Propose updated development regulations that incorporate best practices, including changes to building code, zoning code, subdivision regulations.	CAPS	Medium	Timeframe based on future growth and development patterns.	• Action will consider other possibilities, such as adopting a stand-alone WUI code • See pages 46-51 for more information • Additional resources available from Community Planning Assistance for Wildfire (planningforwildfire.org)
11. Engage with industry professionals on mitigation programs, activities, and opportunities to improve public	CAPS, CSWG, MCFPA	High	Ongoing	• Engagement includes realtors, insurers, developers, and builders • See pages 46-51 for more information

Action	Lead(s)	Priority	Timeframe	Notes
education and outreach across neighborhoods and communities.				
12. Update county and MCFPA websites with wildfire education resources and materials.	OEM, CAPS, MCFPA, City Planning	High	Summer 2018/ ongoing	• See pages 46-51 for more information
13. Promote having neighborhoods and communities develop mitigation activities and evacuation plans through programs such as Firewise Communities/ USA and Ready, Set, Go!	OEM, MCFPA CSWG	High	Ongoing	• See pages 46-51 for more information • Additional resources available from FireSafe Montana (firesafetmt.org)
Improved Response				
14. Promote and support fire departments to increase capacity, funding opportunities.	OEM, BLM, MCFPA, USFS, BLM, DNRC	High	Ongoing	• See pages 51-55 for more information
15. Establish wildland fire response agreements between the county and local fire districts.	OEM, Local Fire Districts	Medium	Summer 2018	• See pages 51-55 for more information

❖ Plan Updates and Maintenance

The continuous nature of implementing the Action Plan makes this CWPP a living document. Different stakeholders will be meeting at various times to discuss and implement applicable actions—some of which may take months or years to complete, while others could be ongoing.

An annual review of the action plan with lead stakeholders, as identified in the Action Plan, will help further coordinate and re-evaluate the status of actions. More significate updates should occur on an as-needed basis, such as following significant fire seasons.

A major update to this CWPP should be anticipated on a five-year cycle to coincide with the next Pre-Disaster Mitigation Plan update. This increases the efficiency of stakeholder participation and further links content between both plans. The major CWPP update will include:

- Review of all content to confirm accuracy of information, such as recent wildfire history, changes to demographics and land ownership, relevance of Cohesive Strategy themes, fire response areas, and more.

- Re-assessment of risk inputs based on changes to the local environment.
- Confirmation of participating stakeholders, stakeholder roles, and signatories.
- Updated Action Plan based on revised content, updated risk assessment, and stakeholder interests.

Importantly, keeping the plan updated also helps share successes with other stakeholders and community members as Missoula County increases its capacity for resilient landscapes, fire adapted communities, and efficient response capabilities.

❖ Action Plan & Stakeholder Summary

The CWPP Action Plan builds on the information provided in Parts 1-3 of this CWPP and was collaboratively developed by stakeholders representing different areas of expertise and perspectives. Upon adoption of this CWPP update, stakeholders—including the public—are ready to move forward with implementing actions that prepare Missoula County for future wildfire seasons. As implementation occurs, lead stakeholders (as outlined in the CWPP Action Plan) will continue to coordinate activities and evaluate outcomes to ensure actions remain timely, relevant, and successfully achieve the desired results.

Appendix A: Primary Plans Related to CWPP Action Table

To support the development of the CWPP Action Plan, several county and city plans were referenced to understand existing goals, objectives, and/or actions to address wildfire risk reduction and the wildland-urban interface, primarily including:

- Missoula County Growth Policy (2016)
- City of Missoula Growth Policy (2015)
- Pre-Disaster Mitigation Plan for Missoula County and City (2017 Update)

The following list of wildfire and/or WUI-related actions serves as a quick reference to help readers see the linkages between this CWPP and other county and city plans. These references are not exhaustive in naming all actions that could support wildfire risk reduction. Primary documents should be consulted for additional details and any future updates.

Missoula County Growth Policy (2016)

Goal 7: Sustain and promote the land- and resource-based industries of agriculture, timber, restoration, and recreation that are part of the local economy and heritage.

Objectives	Actions	Timeframe	Lead Partners
Objective 7.3 – Support efforts of public and private sectors to restore and maintain healthy forests, including harvesting timber, while meeting other resources management goals.	7.3.1 Engage in the Southwest Crown of the Continent Collaborative and other initiatives as opportunities arise.	Ongoing	BCC, CAPS, USFS
	7.3.2 Encourage forest restoration projects that result in economic activity, fuels reduction and improvements to wildlife habitat.	Immediate	OEM, USFS, PTOL
	7.3.3 Support legislation that enables collaborative efforts to restore and maintain healthy forests and reduce wildfire risks.	Ongoing	BCC

Goal 11: Reduce the safety risks and costs associated with wildland fire, flooding, and other hazards

Objectives	Actions	Timeframe	Lead Partners
Objective 11.1 – Discourage development in hazardous areas and areas where public and emergency	11.1.1 Identify hazardous areas, including mapping of wildfire and floodplain risks.	Immediate, ongoing (complete)	OEM, CAPS, DNRC, USFS, fire districts, fire service fee areas
	11.1.2 Provide mapping and other information to the public about local hazards in an easily accessible format.	Immediate	CAPS, OEM, other partners

responder safety is compromised.	11.1.3 Explore zoning regulations to guide growth to appropriate locations (outside of hazard areas).	Mid-term	CAPS, OEM
Objective 11.2 – When development in hazardous areas does occur, take appropriate measures to limit safety risks and ensure emergency personnel have sufficient resources to respond safely and effectively.	11.2.1 Work with public safety and resource agencies to identify and mitigate risks and provide appropriate resources for public and responder safety.	Ongoing	OEM, CAPS, GCP, fire districts, fire service areas
	11.2.2 Adopt development regulations that require the best possible hazardous mitigation techniques, including Firewise construction, multiple accesses, etc.	Ongoing	OEM, CAPS, PW, DNRC, fire districts, fire service areas
	11.2.3 Provide information to landowners regarding development in hazardous areas (evacuation plans, Firewise development practices, etc.). Explore the possibility of providing risk disclosure statements.	Ongoing	OEM, CAPS, fire districts
	11.2.4 Support efforts such as cost sharing to help landowners reduce fuels and take measures to make their properties more resilient to hazards.	Ongoing	OEM, GCP

City of Missoula Growth Policy (2015)

Goal SW10: Ensure the security of Missoulians through the development of well-prepared and responsive emergency and disaster services and infrastructure.

Objectives:

1. Encourage development of a collaborative, community-wide emergency preparedness system to help preserve and maintain public safety including crime, wildfire, flooding, avalanche, disease, wildlife, transportation incidents, and hazardous material spills.
2. Support personal and community emergency preparedness for all Missoulians.
3. Encourage a land use pattern that facilitates provision of emergency services.
4. Support efforts to facilitate and expand inter-jurisdictional cooperation between public safety agencies.

(Relates to implementation actions 1.16, 2.3, 2.12, 3.4, 3.20, 4.8, 4.11, 7.9, 7.16, 8.9, 8.30, 9.25, 10.8 listed in Chapter 9.)

Pre-Disaster Mitigation Plan for Missoula County and City (2017)

Goal 1: Reduce Wildland Fire Risk within WUI

Objective	*Project*	*Jurisdiction*	*Benefit-Cost Ranking Score*	*County Priority*

Objective 1.1 – Conduct mapping/ analysis/ planning projects to reduce impacts from wildfires	1.1.1 Continue to work with cooperating agencies to develop population protection plans.	County, City	High/18	High
	1.1.2 Update CWPP based on new fire data.	County, City	High/18	High
	1.1.3 Assist fire jurisdictions/community groups with messaging.	County, City	High/18	Medium
Objective 1.2 – Perform property protection projects to reduce impacts from wildfire	1.2.1. Continue to look for funding opportunities for fuel mitigation on private land.	County, City	High/18	Medium
	1.2.2. Implement FireWise principles and upgrade county facilities with non-combustible materials in Seeley Lake area.	County	Medium/14	Low
	1.2.3. Apply for federal competitive grant to sustain fuel mitigation on private land for 10 year period.	County, City	High/18	Medium
	1.2.4. Track complete fuel-reduction projects to update vulnerability and support future grants.	County, City	High/18	Medium
Objective 1.3 – Implement public awareness and education projects to reduce impacts from wildfires	1.3.1. Update education materials targeting high priority areas	County, City	High/18	High
Objective 1.4 – Encourage projects to prevent impacts from wildfire	1.4.1. Encourage use of fire-resistant materials/design of non-combustible homes in future developments.	County, City	Medium/16	Medium
	1.4.2. Encourage review of subdivision regulations for coordination with the updated CWPP.	County, City	Medium/16	High
Objective 1.5 – Upgrade emergency service capabilities to reduce impacts from wildfires	1.5.1 Continue to enhance availability of water supply for firefighting in urban and rural locations.	County, City	High/18	High
	1.5.2 Formalize agreements for fire response in unprotected County lands.	County	Medium/16	High
	1.5.3 Obtain mobile air quality monitors to determine unhealthy wildfire smoke conditions.	County, City	Medium/14	Medium

Appendix B: Stakeholder and Public Engagement During CWPP Update Process

The CWPP update began in January 2017 and occurred over the course of 16 months. During this update process, four separate CWPP drafts were shared with stakeholders for input, including the final draft which was provided to the public during an official public review and comment period. The process was coordinated by a consulting team who worked closely with the Missoula County Office of Emergency Management and other local stakeholders. This appendix provides an overview of the CWPP engagement process.

Stakeholder Outreach and Survey (February 2017)

An initial set of 38 stakeholders was contacted to inform them about the CWPP update and invite their participation in the update process. Stakeholders represented county and city departments, local elected offices, federal and state agencies, fire departments and districts, and nonprofit organizations.

Twenty-eight of these stakeholders responded to an initial online questionnaire to provide guidance and direction on CWPP content updates. Questionnaire results indicated that the majority of the stakeholders thought the 2005 CWPP was due for a significant re-write. Stakeholders also shared that they wanted a CWPP that reflected current science and data, was well-aligned with national planning priorities while retaining relevance and detail for local application, and was user-friendly for multiple audiences to read. Finally, stakeholders emphasized taking an action-oriented approach by including an action plan with adequate detail for implementation.

Stakeholder Kick-Off Meeting (February 16, 2017)

Stakeholders had the opportunity to meet face-to-face for a kick-off meeting in Missoula on February 16, 2017. The purpose of the meeting was to initiate discussions on the CWPP update through large and small group conversations. Specific discussions focused on the value of CWPPs and their local application, existing limitations to the current CWPP, ideas for improvement, and local wildfire concerns that should be addressed in the CWPP update. Approximately 24 stakeholders were in attendance.

Stakeholder Meeting (July 12, 2017)

A follow-up stakeholder meeting occurred on July 12, 2017. The purpose of the meeting was to discuss the CWPP Draft #2 and provide initial input on CWPP actions. Ten stakeholders were in attendance. Turnout was lower due to the timing of recent wildfires. As a result, many CWPP stakeholder engagement activities were put on hold until stakeholder availability increased in late fall following the end of fire season.

Stakeholder Calls and Emails

Stakeholder calls were coordinated throughout the process to provide stakeholders the ability to discuss CWPP drafts and provide feedback. In addition, stakeholders were invited to provide written comments on CWPP drafts.

Public Open House (March 22, 2018)[23]

A core component of the development process includes public engagement and feedback. A public open house is scheduled for March 22, 2018 and provides the public with an opportunity to engage with stakeholders to answer questions, highlight outcomes, and discuss any CWPP concerns.

Public Review and Comment Period (March-April 2018)

Members of the public are also invited to review and comment on the CWPP during the public review period which is scheduled for March 8 - April 12. Details about the public comment and review period are available on the Missoula County website.

Additional Resources

To assist the public's understanding of the CWPP, several outreach resources were created:

- CWPP Outreach Handout distributed by stakeholders to help the public understand the purpose of a CWPP, benefits of having a CWPP in place, and reasons for updating the Missoula County CWPP.
- Missoula County also created a local CWPP Story Map to coincide with the public comment and review period. This Story Map shares information about the CWPP in an online, user-friendly format and is hosted by the county.

[23] NOTE: Public Open House and Public Review and Comment Period content will be updated by the county following these events prior to CWPP adoption.

Appendix C: Missoula County CWPP Fuel Treatment Project Status and Priorities

The 2005 Missoula County Community Wildfire Protection Plan provided the following status of current and completed federal fuel reduction projects and identified the following critical egress areas and fuel treatment priorities; the priorities of the 2005 CWPP have not substantially changed for this update

❖ Current/Completed Federal Fuel Reduction Projects

USDA Forest Service Missoula Ranger District

Projects that are done:

- Northside Fuels Units
- Blue Mountain PCT
- Deep Gilman EMB
- Iris Point EMB
- Johnson EMB
- Northside EMB
- O'Keefe EMB

Ongoing Projects:

- Pattee Blue Fuels Units - Pattee Canyon & Blue Mtn
- Pattee PCT

Not Sure of Status:

- Rattlesnake EMB's
- Rattlesnake Proposed EMB's

USDA Forest Service Ninemile Ranger District

Projects that are done:

- Kennedy Creek PCT/Burning
- Southside Fuels Reduction
- Sawmill/Cyr Project
- Starkhorse Project
- Petty Rock Project

Ongoing Projects:

- Frenchtown Face
- Rennic-Stark Project
- Barrette Fuels Reduction
- Ninemile Thinning
- Small Tree Thinning
- Upper Madison Fuels
- Petty Creek WUI Fuels Reduction
- Petty Creek Big Game EMB

Projects in NEPA process

- Ninemile Divide EMB's

Soldier-Butler Project

USDI Bureau of Land Management (BLM)

Projects that are done:

- Five Mile Subdivision Timber Sale
- Bear Creek Flats Stewardship
- Bear Creek Flats RX
- Messina Subdivision Stewardship
- Lower Blackfoot Timber Sale and RX

Ongoing Projects:

- Lower Blackfoot Corridor Ecosystem maintenance, Forest Restoration, and Fuels Reduction
- Dunnigan Gulch Stewardship

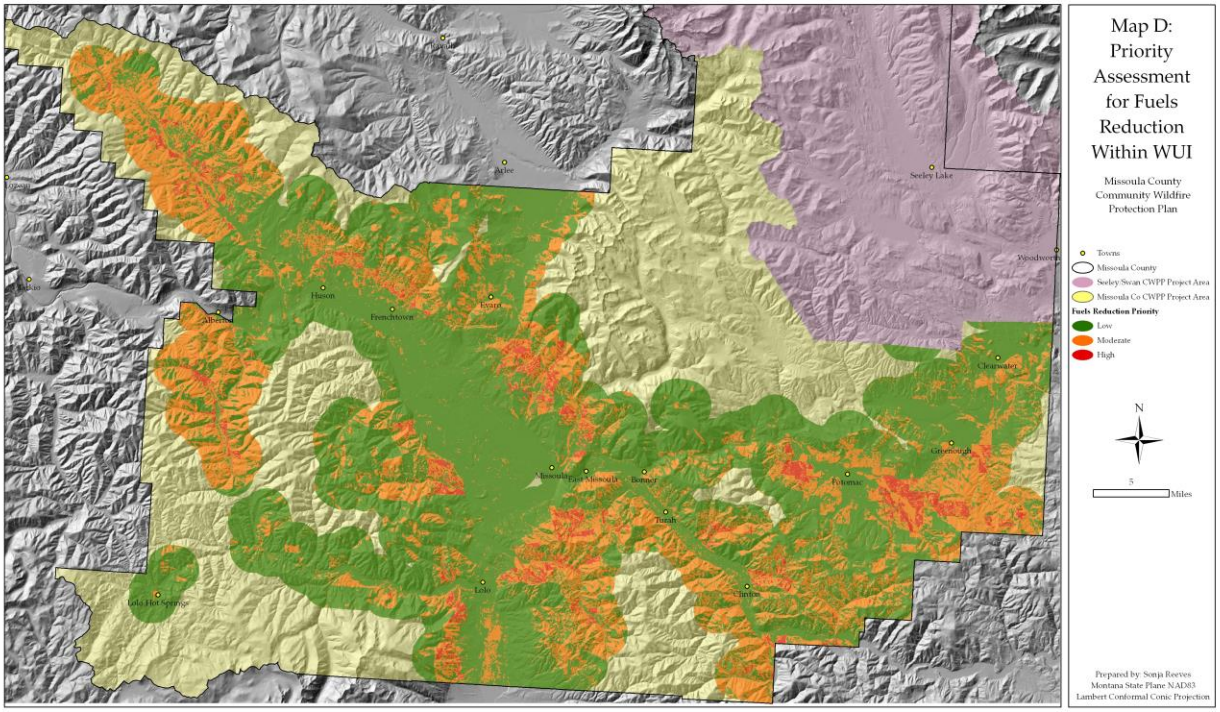
Confederated Salish & Kootenai Tribes (CSKT)

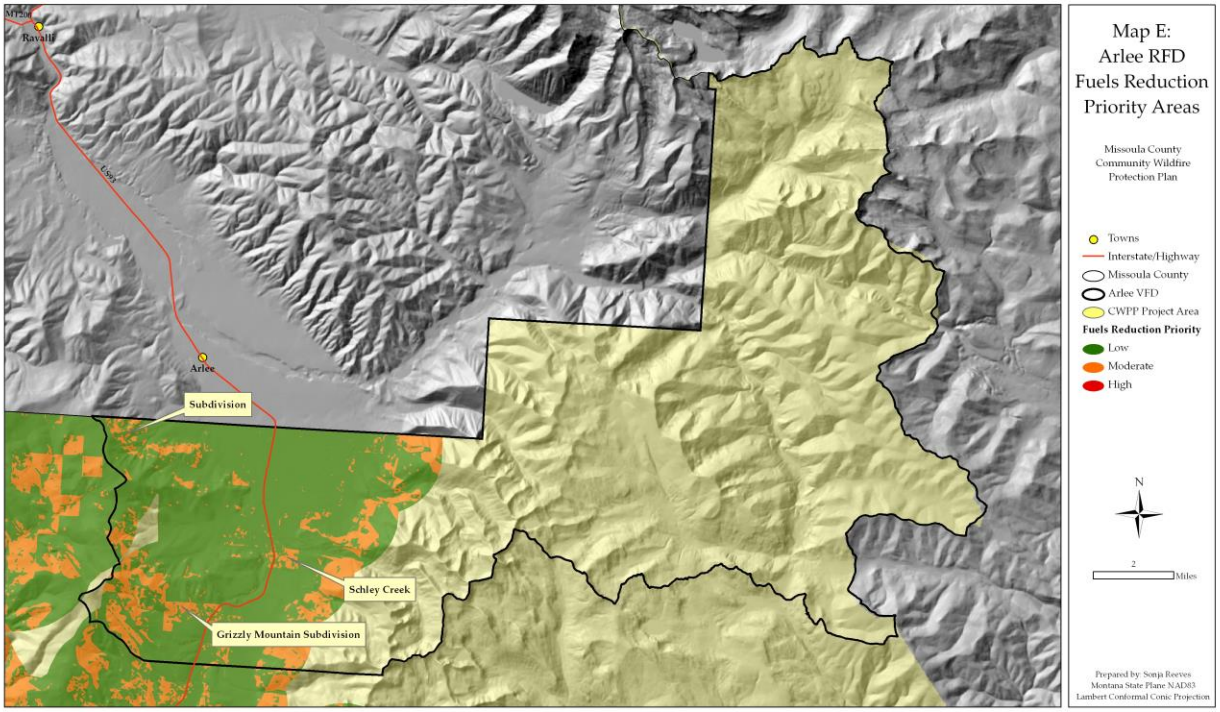
The Confederated Salish & Kootenai Tribe has a few fuels-reduction projects going as well.

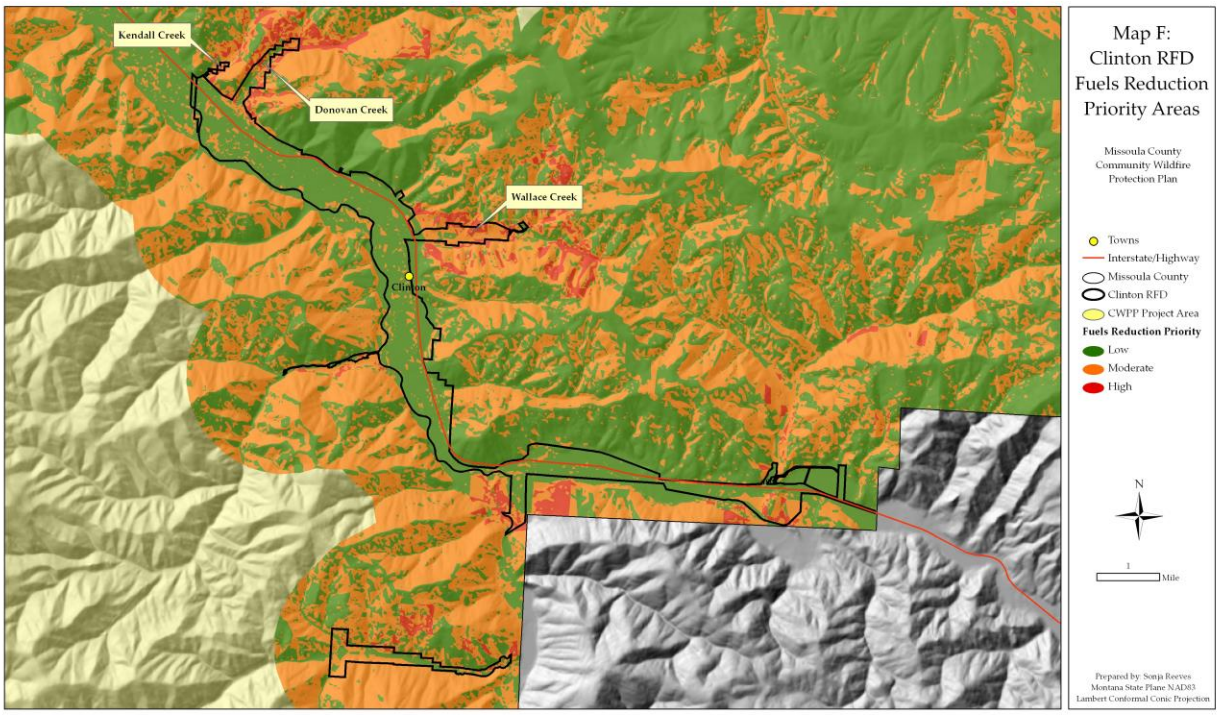
❖ Missoula County Critical Egress Areas

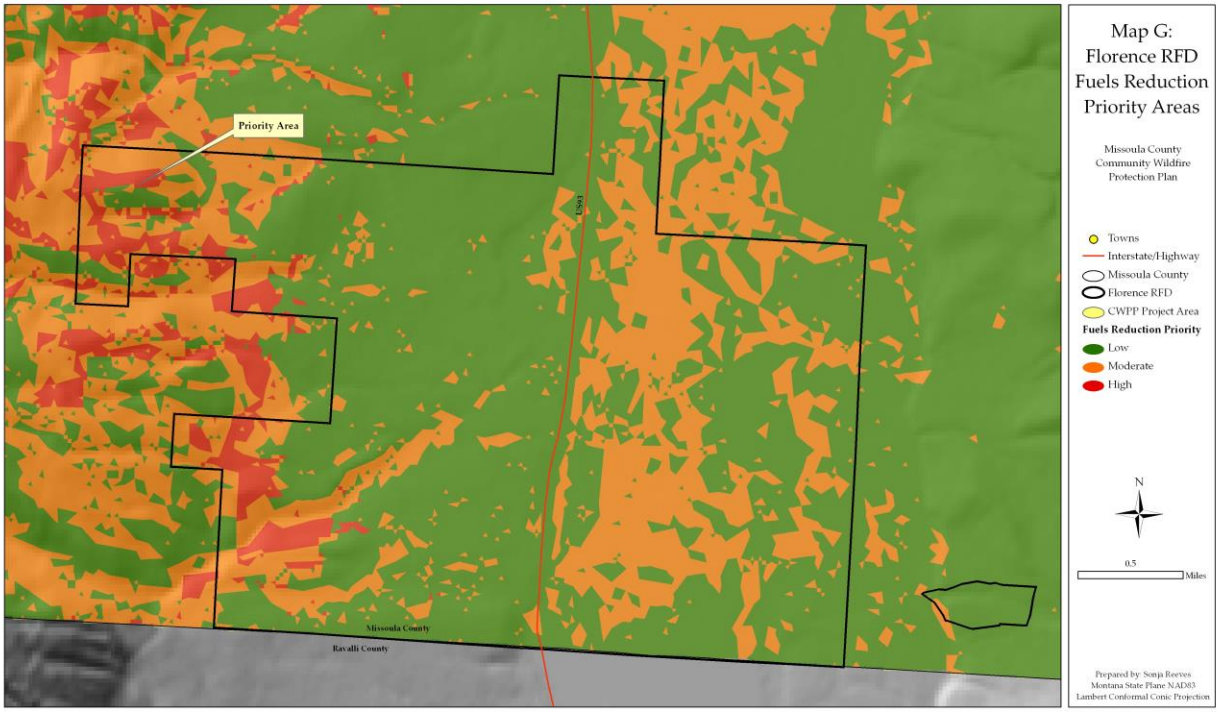
- Glacier Drive (Condon)
- Guest Ranch Road
- Rumble Creek
- Crescent Meadows
- Double Arrow
- Placid Lake
- Kramer Creek
- Beavertail Hill
- West Of Rock Creek
- Schwartz Creek
- Wallace Creek
- Kendall Creek
- Donovan Creek
- Hole In The Wall (Potomac)
- Marco Flats (Private)
- Trout Lane (Blackfoot)
- Bear Creek
- Ninemile
- Sixmile
- Houle Creek
- Sorrel Springs
- Mill Creek (Frenchtown)
- Butler Creek
- Grant Creek
- Rattlesnake Valley
- Sherman Gulch
- Horseback Ridge
- O'brien Creek
- Pattee Canyon
- Miller Creek
- Mill Creek (Lolo)
- Sleeman Gulch
- Balsamroot
- Mormon Creek
- Bitterroot Valley S of Lolo
- Petty Creek
- Deer Creek

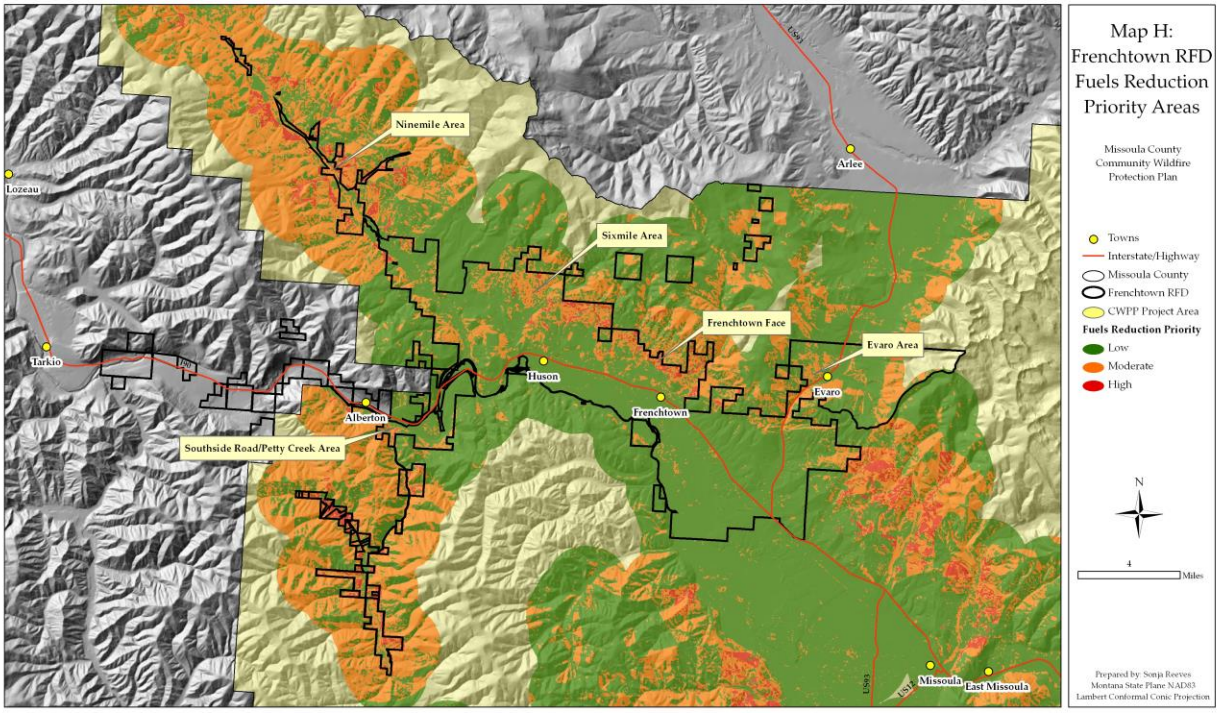
❖ Fuel Treatment Priorities (Maps)

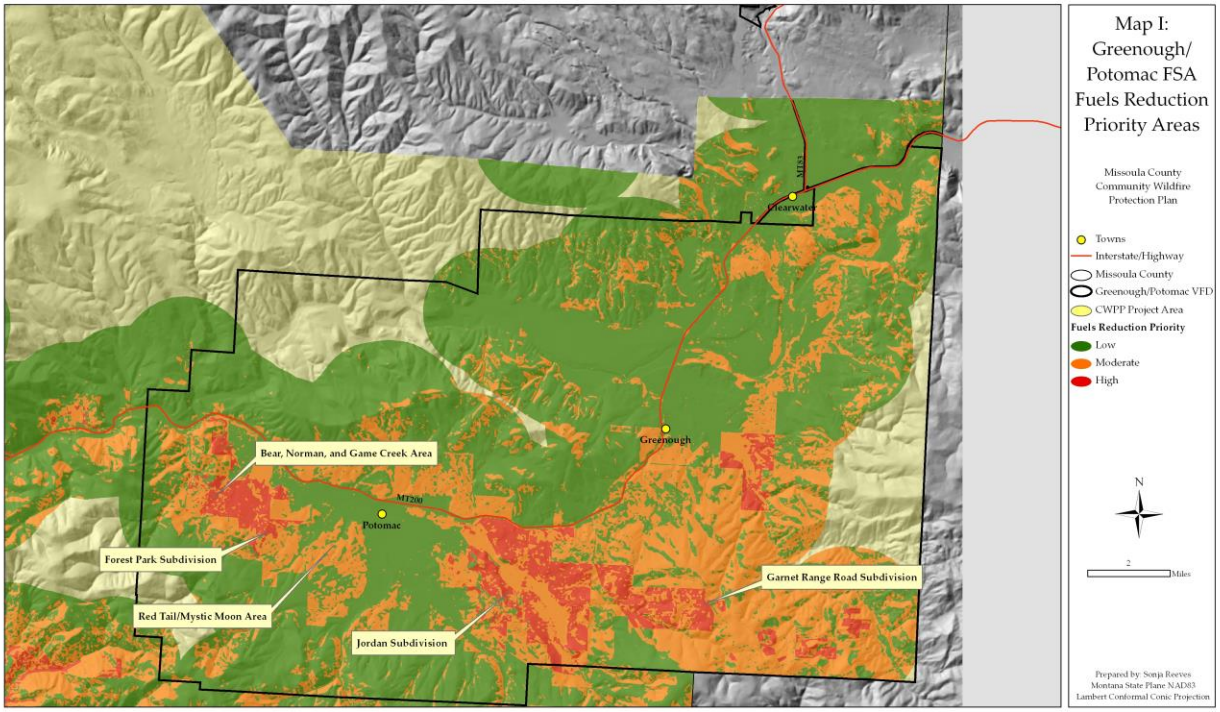


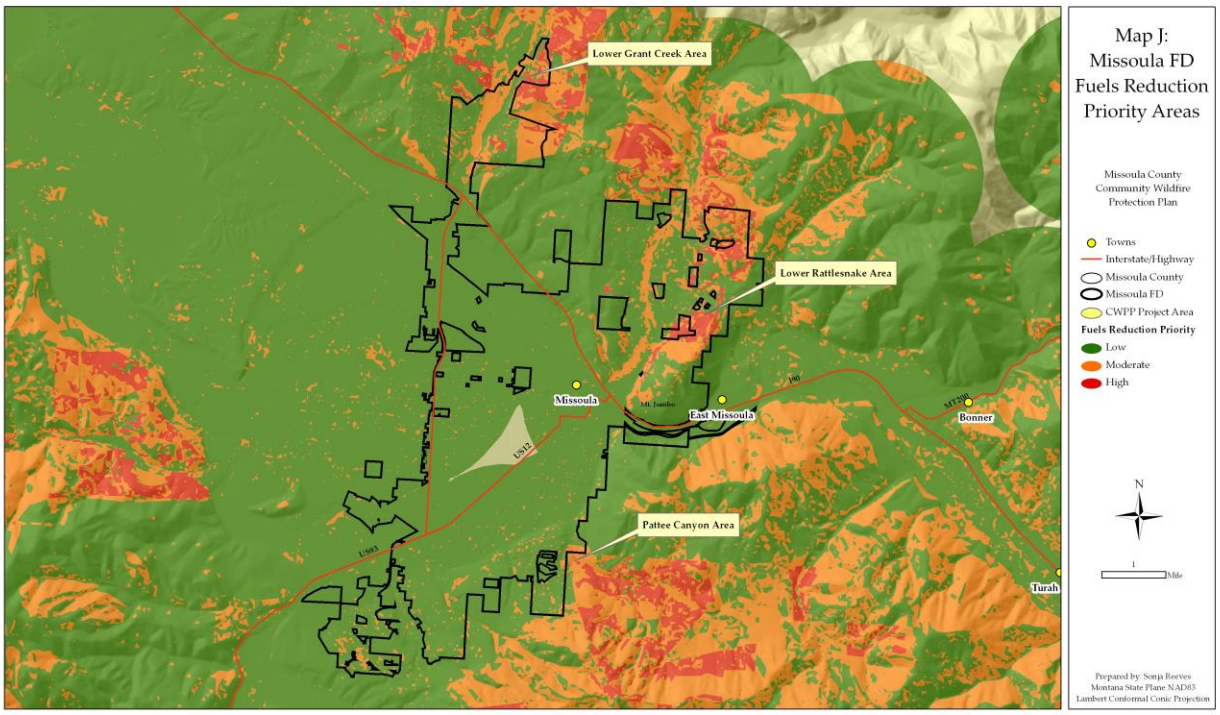


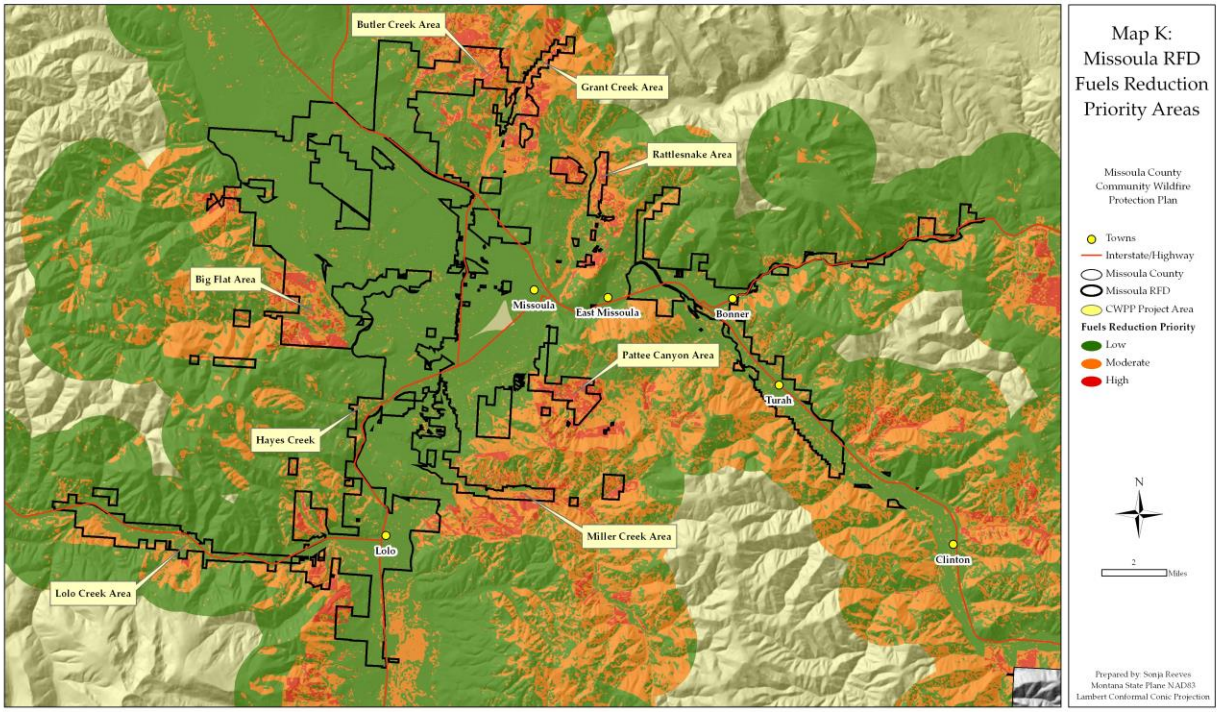

Kendall Creek
Donovan Creek
Wallace Creek
Clinton
Map F:
Clinton RFD
Fuels Reduction
Priority Areas
Missoula County
Community Wildfire
Protection Plan
Towns
Interstate/Highway
Missoula County
Clinton RFD
CWPP Project Area
Fuels Reduction Priority
Low
Moderate
High
N
1
Mile
Prepared by: Sonja Reeves
Montana State Plane NAD83
Lambert Conformal Conic Projection


Priority Area
Missoula County
Ravalli County
Map G:
Florence RFD
Fuels Reduction
Priority Areas
Missoula County
Community Wildfire
Protection Plan
Towns
Interstate/Highway
Missoula County
Florence RFD
CWPP Project Area
Fuels Reduction Priority
Low
Moderate
High
N
0.5
Miles
Prepared by: Sonja Reeves
Montana State Plane NAD83
Lambert Conformal Conic Projection


Ninemile Area
Lozeau
Arlee
Sixmile Area
Frenchtown Face
Evaro Area
Tarkio
I90
Huson
Evaro
Alberton
Frenchtown
Southside Road/Petty Creek Area
Missoula
East Missoula
US93
US12
Map H:
Frenchtown RFD
Fuels Reduction
Priority Areas
Missoula County
Community Wildfire
Protection Plan
Towns
Interstate/Highway
Missoula County
Frenchtown RFD
CWPP Project Area
Fuels Reduction Priority
Low
Moderate
High
N
4
Miles
Prepared by: Sonja Reeves
Montana State Plane NAD83
Lambert Conformal Conic Projection


MT83
Clearwater
Greenough
Bear, Norman, and Game Creek Area
MT200
Potomac
Forest Park Subdivision
Red Tail/Mystic Moon Area
Jordan Subdivision
Garnet Range Road Subdivision
Map I:
Greenough/
Potomac FSA
Fuels Reduction
Priority Areas
Missoula County
Community Wildfire
Protection Plan
Towns
Interstate/Highway
Missoula County
Greenough/Potomac VFD
CWPP Project Area
Fuels Reduction Priority
Low
Moderate
High
N
2
Miles
Prepared by: Sonja Reeves
Montana State Plane NAD83
Lambert Conformal Conic Projection


Lower Grant Creek Area
Lower Rattlesnake Area
Missoula
Mt. Jumbo
East Missoula
Bonner
MT200
90
US12
US93
Pattee Canyon Area
Turah
Map J:
Missoula FD
Fuels Reduction
Priority Areas
Missoula County
Community Wildfire
Protection Plan
Towns
Interstate/Highway
Missoula County
Missoula FD
CWPP Project Area
Fuels Reduction Priority
Low
Moderate
High
N
1
Mile
Prepared by: Sonja Reeves
Montana State Plane NAD83
Lambert Conformal Conic Projection


Butler Creek Area
Grant Creek Area
Rattlesnake Area
Big Flat Area
Missoula
East Missoula
Bonner
Pattee Canyon Area
Turah
Hayes Creek
Miller Creek Area
Lolo
Clinton
Lolo Creek Area
Map K:
Missoula RFD
Fuels Reduction
Priority Areas
Missoula County
Community Wildfire
Protection Plan
Towns
Interstate/Highway
Missoula County
Missoula RFD
CWPP Project Area
Fuels Reduction Priority
Low
Moderate
High
N
2
Miles
Prepared by: Sonja Reeves
Montana State Plane NAD83
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Appendix D: 2013 Seeley Swan Fire Plan