

Community Wildfire Protection Plan Gallatin County, Montana



Photos courtesy: Gallatin County Emergency Management

PREPARED FOR

Gallatin County
311 W. Main Street
Bozeman, MT 59715

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LIST OF ACRONYMS

ACS	American Community Survey (US Census Bureau)
BLM	Bureau of Land Management
BP	Burn Probability
BTU	British Thermal Unit
BZC	Bozeman Interagency Dispatch Center
CFL	Conditional Flame Length
CFR	Code of Federal Regulations
CGNF	Custer-Gallatin National Forest
CWPP	Community Wildfire Protection Plan
DNRC	Department of Natural Resources and Conservation
ERC	Energy Release Component
FACLN	Fire Adapted Communities Learning Network
FEMA	Federal Emergency Management Agency
FLAME	Federal Land Assistance, Management, and Enhancement (Act, 2009)
HFI	Healthy Forests Initiative (2002)
HFRA	Healthy Forests Restoration Act (2013)
HMP	Hazard Mitigation Plan
MAC	Multi-Agency Coordinating Group
MCA	Montana Code Annotated
MSA	Metropolitan Statistical Area
NEPA	National Environmental Policy Act
NIFC	National Interagency Fire Center
NPS	National Park Service
NRCG	Northern Rockies Coordinating Group
NWCG	National Wildfire Coordinating Group
PSA	Predictive Service Area
PSAP	Public Safety Answering Point
RAWS	Remote Automated Weather Station
RMRS	Rocky Mountain Research Station
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
WFDSS	Wildland Fire Decision Support System
WRCC	Western Regional Climate Center
WUI	Wildland-Urban Interface

1 EXECUTIVE SUMMARY

Community Wildfire Protection Plans (CWPPs) are documents that are designed by a local group of stakeholders who are invested in the wildland fire threat to their area. The group of stakeholders typically consists of representatives from local fire districts; local, state, and federal land management agencies (e.g., U.S. Forest Service, National Park Service, Montana DNRC); and private property owners and managers. Each of these representatives bring different perspectives regarding strategies to manage and mitigate risks associated with wildland fire.

The Healthy Forests Restoration Act (HFRA) of 2003 provides incentives for federal agencies charged with forest and land management to collaborate with local communities as they develop hazardous fuel reduction projects. In turn, the HFRA provides communities an opportunity to influence where and how federal agencies implement fuel reduction projects on federal lands and how and where federal funds can be leveraged for projects on non-federal and private lands. The minimum requirements for a CWPP as described in the HFRA are:

- / A CWPP must be collaboratively developed by local and state government representatives, in consultation with federal agencies and other interested parties.
- / A CWPP must identify and prioritize areas for hazardous fuel reduction treatments and recommend the types and methods of treatment that will protect one or more at risk communities and essential infrastructure.
- / A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area.

The HFRA also requires that three governing entities must mutually agree to the final contents of a CWPP:

- / Applicable local governments (i.e., Gallatin County, incorporated cities/towns);
- / Local fire departments, districts or fire service areas; and
- / The state agency responsible for forest management (i.e., Montana Dept. of Natural Resources and Conservation - DNRC).

The initial CWPP for Gallatin County was completed in 2006. The goals of the 2006 CWPP were to:

- / Protect life and human safety
- / Prevent or limit the loss of property
- / Restore and preserve our forest ecology

Significant informational products and recommendations included in the 2006 CWPP included:

- / Definition and delineation (mapping) of the Wildland-Urban Interface (WUI)
- / Development of a WUI Risk Analysis Model
- / Ongoing review and update of subdivision regulations applicable to WUI areas and risks
- / Increased public education and outreach regarding the CWPP and WUI planning
- / Identification, planning and development of mitigation projects on private property

In the dozen years since completion of the 2006 CWPP, the population in Gallatin County has continued to grow at a rapid rate. Construction of new homes and housing subdivisions, roads, and other infrastructure, some of which has occurred in WUI areas, plays a significant role in how communities plan for wildland fire including prioritization of actions to mitigate risk. This update to the Gallatin County CWPP expands on the information and mapping contained in the 2006 plan and provides more detailed spatial analyses of relative wildfire probability, intensity and overall hazard or risk across the county. Specific items of note within this 2018 CWPP update include:

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

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 Gallatin County increases its capacity for resilient landscapes, fire adapted communities, and efficient response capabilities.

2 INTRODUCTION

The concept of community-based forest planning and management is neither novel nor new. Gallatin County communities and residents have been reminded by several recent wildfires of the need to engage in comprehensive forest planning and prioritization. These fires have included the Flaming Arrow fire (2009) in Bridger Canyon, the Bear Trap fire (2012) along the Madison River, the Bean Canyon Fire (2012) west of Maudlow, the Millie fire (2012) in the Storm Castle Creek drainage southwest of Bozeman, the Cottonwood Gulch (2015)



Photo Credit: ABC/FOX Montana

The Horseshoe Fire burns east of Clarkston on the afternoon of Sept. 10, 2018.

and Horseshoe (2018) fires in the Clarkston-Horseshoe Hills area, the Maple fire (2016) in the northwest corner of Yellowstone National Park, and the Bacon Rind fire (2018) within the Custer-Gallatin National Forest and Yellowstone National Park, along Highway 191 south of Big Sky. This document includes a review of Gallatin County's past fire history and describes current conditions and status of human development that affect fire probability, severity, and risk. This plan addresses risks to health, safety and property, and provides a comprehensive strategy to improve resiliency to wildfire.

2.1 PURPOSE

The purpose of the Gallatin County CWPP is to accomplish the following goals:

- / Protect lives and property from wildland fires
- / Foster personal responsibility for taking preventive actions regarding wildland fire
- / Improve public understanding of the risks associated with living in a fire-adapted ecosystem
- / Increase the community's ability to prepare for, respond to, and recover from wildland fires
- / Restore fire-adapted ecosystems
- / Create and maintain fire-adapted communities
- / Improve fire resilience of the landscape while protection other social, economic, and ecological values

2.2 MISSION

The overall **mission** of the Gallatin County CWPP is ***to protect against loss of life, property, and natural resources as the result of wildland fire***. The CWPP is structured to accomplish this mission and it continues to serve as a leading document in providing direction and guidance to persons seeking to protect both the human and natural resources within Gallatin County.

Wildland fire is a natural and necessary component of forest ecosystems across the country. Southwest Montana is no exception. Historically, wildland fires have shaped the forests valued by residents and visitors. Forests and other wildlands in Gallatin County, however, are now significantly altered due to past forest management practices, fire prevention efforts, modern fire suppression activities, residential development, and a general lack of large-scale fires. These activities have resulted in overgrown forests—some with closed canopies and all with abundant ladder fuels that dramatically increase the chances of large wildland fires that burn intensely and cause catastrophic losses.

Gallatin County has experienced high rates of population growth and home building within the last 20 years, which has led to increased residential development into forested areas and other wildlands, creating more wildland-urban interface/intermix (WUI) areas. A resulting increase in risk to life and property presents a challenge for fire protection, fire prevention, and law enforcement agencies.

While reducing and managing risk of high-intensity wildfire is a primary purpose of this plan, prescribed forest and wildland management for hazardous fuels reduction and fire resilience is only one objective. Residents and visitors desire healthy, fire-resilient forests and wildlands that provide habitat for wildlife, recreational opportunities, and scenic beauty. By establishing more fire-adapted communities that integrate efforts on both public and private property, overall fire-resiliency of the landscape improves, along with fire response outcomes that are more predictable and successful.

This CWPP update outlines the revised priorities, strategies, and action plan for fuels reduction treatments in the WUI and post-fire recovery. Recommendations are provided for reducing structural vulnerability and creating defensible spaces in communities and other areas at risk. With this revision, the Gallatin County CWPP delivers current information and methodologies for fuels reduction, education, and other projects to decrease the overall risk of loss from wildland fire. This is a “living” document, to be updated periodically to reflect new data, proposed projects and landscape management techniques.

2.3 RECENT FEDERAL INITIATIVES AND LEGISLATION

The Healthy Forests Initiative (HFI) was established by the federal government in 2002 to improve regulatory processes and ensure more timely decisions, greater efficiency, and better results in reducing the risk of high-intensity wildfire. This initiative allowed forest management agencies, for the first time, to expedite the documentation process for reducing hazardous fuels on public lands.

The U.S. Congress passed historical, bi-partisan legislation, The Healthy Forests Restoration Act (HFRA), in 2003. This legislation expands the initial effort under the HFI and directs federal agencies to collaborate with communities in developing CWPPs which include the identification and prioritization of areas needing hazardous fuels treatment. It further provides opportunities and authority for federal agencies to expedite the National Environmental Policy Act (NEPA) process for fuels reduction projects on federal lands. The act also requires that 50% of funding allocated to fuels projects be used in the WUI.

The development and implementation of this CWPP gives the communities of Gallatin County the opportunity to participate in determining where federal agencies place their fuels reduction efforts. With a CWPP in place, Gallatin County, community groups, and other stakeholders can apply for federal grants

to treat hazardous fuels and address special concerns to reduce the risk of catastrophic loss as a result of wildland fire.

Congress passed the Federal Land Assistance, Management, and Enhancement (FLAME) Act in 2009 and called for a National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) to address wildland fire-related issues across the nation in a collaborative, cohesive manner. The Cohesive Strategy was finalized in 2014 and represents the evolution of a national fire policy:

- / To safely and effectively extinguish fire, when needed; use fire where allowable; manage our natural resources; and, as a Nation, live with wildland fire
- / The primary, national goals identified as necessary to achieving the vision are:
 - » **Resilient 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.

2.4 RELATIONSHIPS TO OTHER PLANS, POLICIES, AND REGULATIONS

This CWPP includes compatibility with Federal Emergency Management Agency (FEMA) requirements for a Hazard Mitigation Plan (HMP), while also adhering to the guidelines proposed in the National Fire Plan, and HFRA. This CWPP has been prepared in compliance with:

- / The National Fire Plan: A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment, 10-Year Comprehensive Strategy Implementation Plan (USDA 2006)
- / HFRA
- / FEMA Region 8 guidelines for a Local Hazard Mitigation Plan as defined in 44 Code of Federal Regulations (CFR) Parts 201 and 206, and as related to a fire mitigation plan chapter of a Multi-Hazard Mitigation Plan
- / National Association of State Foresters: Guidance on identification and prioritizing of treatments between communities (2003). The objective of combining these complementary guidelines is to facilitate an integrated wildland fire risk assessment, identify pre-hazard mitigation activities, and prioritize activities and efforts to achieve the protection of people, structures, the environment, and significant infrastructure in Gallatin County while facilitating new opportunities for pre-disaster mitigation funding and cooperation.

Building a collaborative and cooperative environment with the local fire districts, community-based organizations, local governments, and the public land management agencies has been the first step in reducing the risk of loss from wildland fire. The importance of collaboration with neighboring counties and jurisdictions and understanding goals of their CWPPs is recognized by Gallatin County and is referenced throughout this CWPP as documentation of collaborative efforts to maximize hazardous fuels reduction efforts in the area.

Several local plans, policies and regulations are referenced within this CWPP update. This locally based guidance and information was used in development of the CWPP to ensure that consistent and cohesive wildfire management and mitigation strategies are presented. The most frequently referenced plans and policy documents include:

Gallatin County Hazard Mitigation Plan (HMP)

The 2018 update to the Gallatin County HMP is being completed in tandem with the CWPP update. The CWPP will become an *Attachment* to the updated HMP. Information on population trends, critical facilities and infrastructure, housing stock, and land use are incorporated into the CWPP. **Wildfire** is identified as a high-priority hazard in the HMP and data regarding wildfire history, risk, and vulnerability are presented. The mitigation strategy in the HMP includes goals and objectives aimed at preventing losses from wildfires and reducing wildfire risk within the WUI.

Growth Policies and Regulations

The Gallatin County Growth Policy (and accompanying Resource Documents) was adopted in April 2003 as the document intended to help guide future growth and land development in the county. It is the community's hope, and the County's commitment, that growth occur in a coordinated, logical, and cost-effective manner that minimizes unplanned, costly sprawl. The growth policy is used to guide land use decisions, and decisions relative to the provision of public facilities and services as well as the conservation and protection of environmentally sensitive lands. The County is currently engaged in an update of the Growth Policy with an expected completion date of 2021.

The City of Bozeman's Community Plan (Growth Policy) was adopted in June 2009. The Plan defines the city's goals and objectives for growth, provides maps and text that describe the characteristics and features of jurisdictional areas, and presents a timetable for implementing elements within the growth policy. Chapter 13 of the plan discusses the city's planning efforts for disaster prevention and response, with wildfire listed as one of the natural hazards present in the Bozeman area. The Community Plan is currently being updated with completion anticipated in 2019.

Other long-range growth and planning policy and study documents include the Belgrade Growth Policy (2006) and the Gallatin Triangle Planning Study (Sanderson Stewart, 2014), which includes recommendations for regional planning cooperation between Gallatin County and the cities of Belgrade and Bozeman. The City of Bozeman has also recently completed (April 2019) a Climate Vulnerability Assessment and Resiliency Strategy document which aims to guide the City in its preparations for the effects of climate change and build resilience in delivering services to its residents.

Subdivision and zoning regulations at both the county and municipal (Belgrade, Bozeman) levels provide additional tools for potential future implementation of risk reduction actions presented in this CWPP.

Other Local CWPPs

The purpose of this CWPP is to complement other local CWPPs that may be prepared by jurisdictions with the county (e.g., cities, towns, fire districts, homeowner's associations), or by adjacent counties including Broadwater, Madison, Meagher and Park. CWPPs prepared at different scales can prioritize risk mitigation activities that are focused on specific areas.

2.5 CWPP UPDATE PROCESS

The current Gallatin County CWPP was completed in 2006. Continued efforts have been made by local, state, and federal agencies to reduce the threat of high-intensity wildland fires through landowner education as well as fuels reduction activities on both public and private lands. In addition, private landowners have responded enthusiastically to community defensible space initiatives and recommendations to reduce hazardous fuels on their own properties.

Preparation of a CWPP follows a three-step process of development, adoption, and implementation:

- / During development, communication is initiated between resource agencies, local community representatives, private organizations and other stakeholders to discuss and mutually agree on wildfire risk reduction goals and strategies.
- / The adopted plan provides an informative and action-oriented framework to guide implementation of mitigation actions and projects.
- / Through ongoing and long-term actions, stakeholders work to achieve the goals set forth in the CWPP and suggest adjustments to improve actions, when necessary.



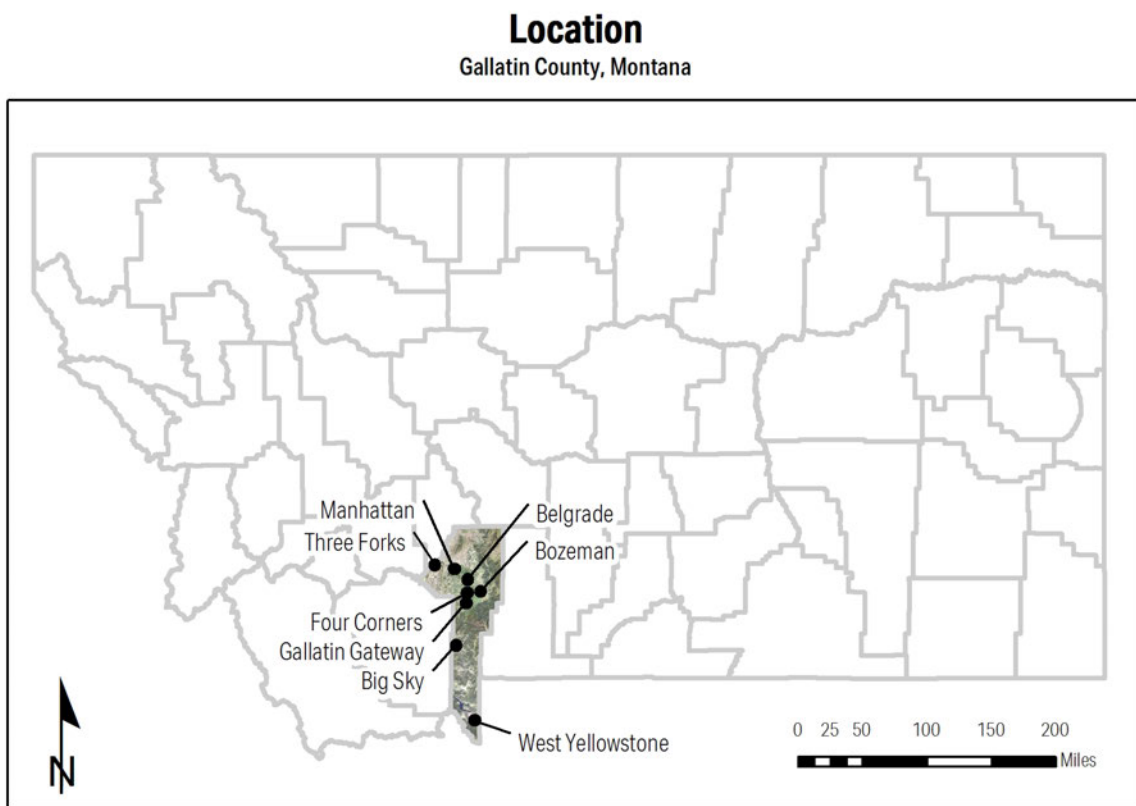
Photo Credit: M. Rotar

West Yellowstone, Montana looking to the east into Yellowstone National Park.

3 GALLATIN COUNTY LOCAL ENVIRONMENT

3.1 OVERVIEW

Gallatin County is located in southwest Montana as shown in **Figure 1**, with an area of approximately 2,631 square miles and elevations ranging from approximately 4,000 to 10,700 feet. Gallatin County is bordered by Meagher County to the northeast, Park County to the east, Jefferson and Broadwater Counties to the northwest, Madison County to the southwest, and Yellowstone National Park and the state of Wyoming to the southeast. The state of Idaho borders the far southwest corner of Gallatin County. The City of Bozeman is the county seat and largest city. Other incorporated communities include the cities of Belgrade and Three Forks, and the Towns of Manhattan and West Yellowstone. The communities of Big Sky, Four Corners, and Gallatin Gateway and Willow Creek represent other population centers.

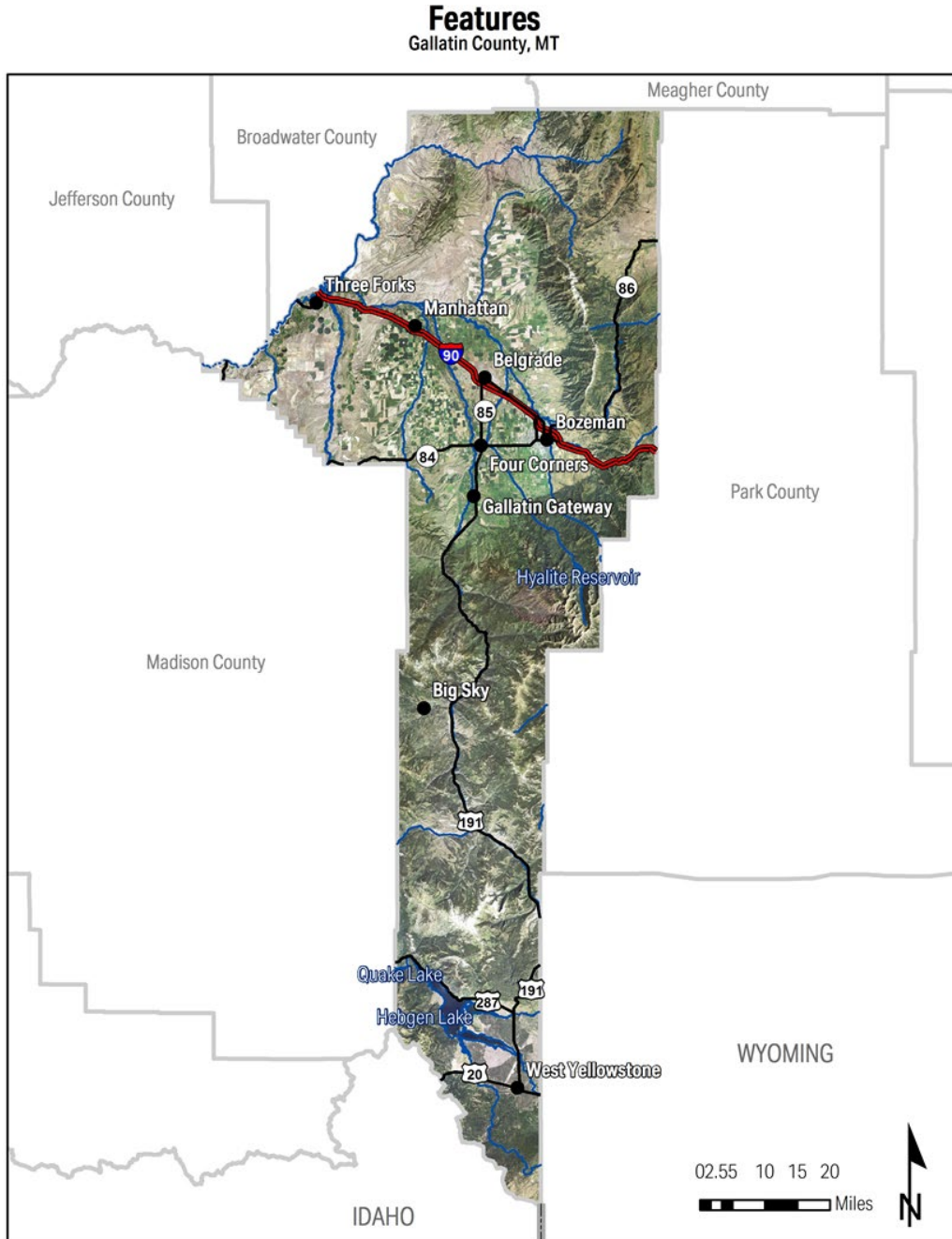


Data Source: Varied
Data Date: Varied
Map Coordinates: NAD 1983, State Plane Montana

Figure 3-1. Gallatin County Location

Figure 2 shows the general features in the county. The Gallatin Valley is a dominant feature in the northern portion of the county, bisected south to north by the Gallatin River and covering a land area of approximately 400 square miles. The valley is bordered by the Bridger Mountain range to the northeast, the Gallatin Mountains to the south and the Horseshoe Hills to the north. The Madison and Jefferson River valleys occupy the western extent of the county, with the three rivers (Gallatin, Jefferson, Madison) meeting northeast of Three Forks to form the headwaters of the Missouri River. The southern portion of

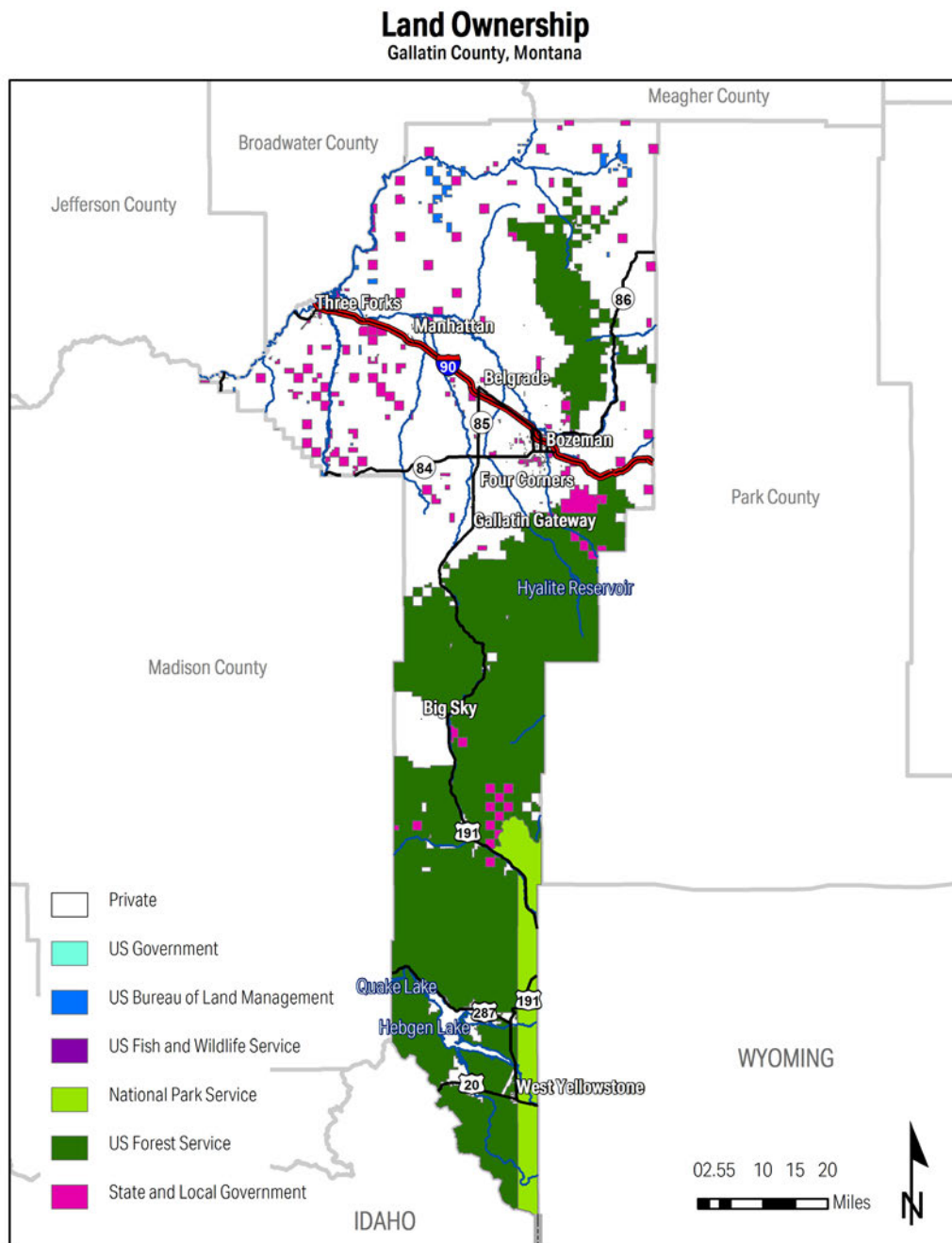
the county is dominated by the Gallatin River drainage and canyon running from south to north. Peaks of the Gallatin Range are located on either side of the canyon. At the far southern end of the county, the Madison River enters the county from the east and Yellowstone National Park, flowing into Hebgen Lake and then Quake Lake. The Town of West Yellowstone is located at the southern end of the county and is adjacent to one of the four main entrances to Yellowstone Park.



Data Source: Montana NRIS
Data Date: August 2017
Mapp Coordinates: NAD 1983, State Plane Montana

Figure 3-2. Gallatin County Features

Gallatin County has varied land use, with nearly half of the land area under public ownership by the U.S. Forest Service, State of Montana, Bureau of Land Management (BLM) or the National Park Service. Both urban and rural communities are present, with individual residences and farms interspersed. Significant population growth and accompanying land development is occurring in several areas within the **Figure 3-3** shows the land ownership in the county.



Data Source: Montana NRIS
 Data Date: August 2017
 Mapp Coordinates: NAD 1983, State Plane Montana

Figure 3-3. Gallatin County Land Ownership

3.2 DEMOGRAPHICS

Gallatin County, and particularly the City of Bozeman, is growing rapidly. Between 2000 and 2018, the county’s population increased by almost 65% from 67,831 to 111,876 (U.S. Census Bureau, 2018). This represents an average annual growth rate of 2.8%. In 2018, the City of Bozeman was ranked as the fastest growing micropolitan area (cities under 50,000 population) in the U.S. (POLICOM, 2018). Bozeman’s estimated population in 2018 is 48,532 (U.S. Census Bureau, 2018), and by 2020 it is expected the population will eclipse 50,000, thus making the city and a large portion of Gallatin County the state’s fourth Metropolitan Statistical Area (MSA). The other incorporated communities in Gallatin County include: Belgrade (2018 pop. est. 8,993), Manhattan (2018 pop. est. 1,822), Three Forks (2018 pop. est. 2,053), and West Yellowstone (2018 pop. est. 1,382). Other census-designated places in the county include Big Sky (pop. 2,904, 2017 ACS 5-yr population est.), Gallatin Gateway-Four Corners (pop. 4,943, 2017 ACS 5-yr population est.), and Willow Creek (pop. 207, ACS 5-yr population est.). **Table 3-1** provides a snapshot of several key demographics within Gallatin County.

Table 3-1. Overview of Key Demographics in Gallatin County, Montana.

Demographic	Magnitude / Quantity of Key Statistic	Notes
Population (2018 est. ¹)	111,876 residents	Population has increased by 22,363 residents (25%) since 2010
Projected Population (2040 est. ²)	122,432 – 177,477 residents	A steady increase in population is forecast through 2040, however estimates vary considerably based on different modeling scenarios, which is to be expected as future population trends are estimations at best
Population Density	43 persons / square mile	Average population density for Montana is 6.8 persons per square mile ³
Median Age ⁴	33.4 years	
Total Number of Housing Units ⁵	51,011 units	
Median Household Income ⁵	\$59,397	
Workforce Employment (2016) ⁵	45,778 persons	
Poverty Rate ⁴	13.0%	

¹ U.S. Census Bureau Data, population estimate July 1, 2018.

² MT Dept. of Commerce, Census and Economic Information Center (sourced by eREMI) – low projection; Belgrade Long-Range Transportation Plan (sourced by Woods and Poole Economics) – high projection.

³ 2018 Economic Profile – Population Trends, Prospera Business Network, Bozeman.

⁴ U.S. Census Bureau, 2013-2017 American Community Survey (ACS).

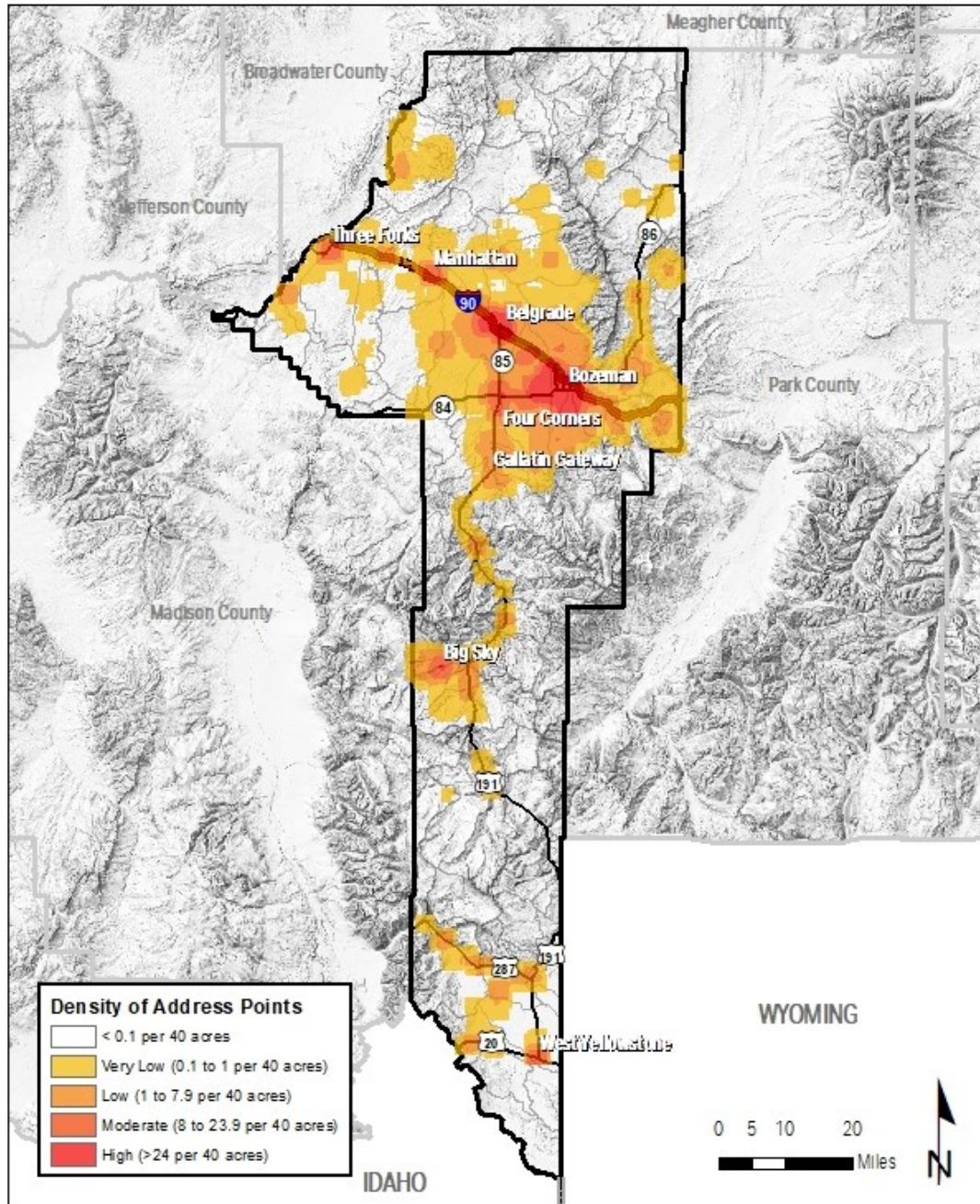
⁵ U.S. Census Bureau, QuickFacts, July 1, 2018 (site accessed 5/28/2019).

While Gallatin County’s population density is substantially greater than the average population density in Montana, it varies widely across the county. The City of Bozeman’s population density was 1,950 persons per square mile in 2010 (U.S. Census, 2018). Outside of Bozeman and the county’s other incorporated cities and towns, and census-designated places, the average population density in the county is approximately 13 persons per square mile.

Figure 3-4 illustrates the distribution of structure density patterns across the county (based on address point data). Structure density can be used as a surrogate to represent population density given the strong correlation between population and the built environment.

Structure Density

Gallatin County, Montana



Data Source: Montana NRIS
 Data Date: August 2017
 Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
 Troy Benn
 December 2018



Figure 3-4. Gallatin County Structure Density.

3.3 CRITICAL INFRASTRUCTURE

Critical Infrastructure is a critical component of planning for, and responding to, wildfires in Gallatin County. By default, utility distribution systems, communications infrastructure, watersheds, primary egress routes and other human-made attributes that prevent their failure, are critical to the continued operation of the community and considered critical infrastructure. This plan captures and identifies some, but not all critical infrastructure. This is because some critical infrastructure's details are considered sensitive and not for public distribution, while accurate and complete data may not exist for other infrastructure. We also recognize that new infrastructure is continually being added and may not be captured until the next update of this plan. Regardless of whether a specific piece of human-made infrastructure is listed in this plan, if its continued operation is vital to the continuity and/or safety of our community, it should be considered critical infrastructure and treated as such in mitigation, planning and response activities.

The Community recognizes the importance of mapping as much critical infrastructure as possible and the important relationship it plays in connection to our mapped Wildland-Urban Interface. The County intends to develop a Critical Infrastructure Wildland-Urban Interface layer to be utilized in conjunction with the other mapped Wildland-Urban Interface areas. Implementation of this Critical Infrastructure WUI layer was not able to be completed prior to initiation of the State and Federal review process of this Plan. The County intends to add this data layer prior to the final adoption process.

3.4 CLIMATE AND TEMPERATURE

The Gallatin Valley, which occupies a substantial portion of the northern half of Gallatin County, experiences a dry continental climate. A gradient of average annual precipitation extends from west to east across the valley, with Three Forks at the west end receiving an average of 12 inches per year, and the foothills along the Bridger and Gallatin Mountains at the east and south end of the valley receiving an average of up to 25 inches of precipitation. The fertile soils of the valley are very conducive to agricultural production, and indeed the principal economic driver as the valley was settled in the 1860s was agriculture. This continues to the present, although light industry, recreation and tourism have steadily increased over the last century, reducing the footprint that agriculture has on the valley today. Beyond the Gallatin Valley, the county is dominated primarily by higher elevation mountain ranges and smaller intervening valleys. The Horseshoe Hills in the far northwest area of the county is characterized by a steppe environment. The higher, mountainous areas range from the montane, through subalpine to alpine ecosystems. As expected, these higher elevation areas are substantially cooler than the valley floors and receive significantly greater amounts of precipitation, primarily as snow during the winter season. **Table 3-2** (Western Regional Climate Center, 2017) provides a summary of climatic data for Gallatin County.

Table 3-2. Gallatin County Climate Statistics.

	Montana State University 1982-2016	Belgrade (Bozeman Yellowstone Int'l Airport) 194-2016	Trident 1922-2016	West Yellowstone 1924-2013
Annual Average Daily Temp	55.2°F	56.0°F	60.2°F	50.3°F
Annual Average Monthly Temp.	31.2°F	28.2°F	32.0°F	19.6°F
Annual Average Total Precip.	18.48 inches	13.92 inches	12.43 inches	21.56 inches
Annual Average Total Snow	86.0 inches	47.0 inches	28.5 inches	160.10 inches
Highest Temperature Recorded	105°F (7/31/1892)	106°F (7/6/2007)	109°F (7/22/1931)	97°F (7/19/1936)
Lowest Temperature Recorded	-43°F (2/8/1936)	-46°F (1/26/1957)	-55°F (12/31/1927)	-66°F (2/9/1933)
Annual Average Number of Days Dropping Below Freezing	181.7 days	199.3 days	172.2 days	270.7 days
Annual Average Number of Days Staying Below Freezing	48.0 days	51.9 days	33.6 days	87.8 days
Annual Average Number of Days Reaching 90° or Higher	7.4 days	19.8 days	31.3 days	2.2 days
Highest Annual Precipitation	25.57 in (1997)	20.04 in (1969)	20.96 in (1997)	29.32 in (1955)
Lowest Annual Precipitation	10.54 in (1934)	8.65 in (1961)	6.42 in (1974)	15.68 in (1934)
1-Day Maximum Precipitation	2.68 in (5/7/1988)	2.14 in (6/25/1969)	2.00 in (5/25/1980)	2.70 in (6/17/1925)
Highest Annual Snowfall	159.5 in (1975)	87.4 in (1955)	75.0 in (1989)	276.1 in (1994)

¹ Based on a calendar year, not a snowfall season.

3.4.1 Wind

Wind plays an important role in the fire environment and extent of fire spread across all landscapes found in Gallatin County. The prevailing winds that influence fire spread originate from the southwest, pushing fire movement in the northeasterly direction. During extreme weather events, the montane landscapes experience high, hot and dry winds originating from the easterly direction, which can cause unpredictable fire behavior situations. Strong winds are associated with cold fronts and thunderstorms, resulting in drastic, erratic shifts in wind direction and strong downdraft wind activity. Winds gust in excess of 40-70 mph are not uncommon with cold fronts and thunderstorms in this area.

3.5 VEGETATION

3.5.1 Fire Adapted Landscape

The forested areas in Gallatin County exhibit a variety of fire regimes, depending on forest type and elevation. Cycles of frequent, low-intensity fire could be found at the lowest elevations, while mid to high elevations exhibited less frequent fire at moderate to high intensity. Over a century of successful fire suppression activities and excessive fuels build-up has altered the historical fire regime intensity and severity, primarily in the lower to mid elevation forest types. The most recent forest assessment for the CGNF indicates a trend of more extreme disturbance events (large-scale fires) with longer durations due to anticipated warmer and drier climatic changes and increased horizontal and vertical fuel accumulations (USFS 2017).

3.5.1.1 Forest Vegetation

USFS Region 1 classification for existing vegetation includes dominance types, which represents broad species groups of dominant vegetation (Milburn et al. 2015, Reid et al. 2016). Dominance types are classified by broad groups of existing vegetation called Region 1 cover types. Unlike potential vegetation,

which is relatively static, cover type changes through time based on successional pathways and disturbances. Presence and distribution of cover types is important to understanding ecosystem diversity and function across the CGNF. The vegetation cover types that occur on the CGNF and representation within each analysis landscape are described in **Table 3-3** (from CGNF Forest Plan Revision, USFS 2017).

Forested areas tend to be on steeper terrain intermingled with grass and shrubs providing an abundance of ladder fuels which leads to horizontal and vertical fuel continuity. These factors, when combined with arid and windy conditions characteristic of the region, can result in high intensity fires with large flame length and fire brands that may spot long distances. Rates of fire spread tend to be lower than those in the grasslands; however, intensities can escalate dramatically, especially under the effect of slope and wind. Such fires present significant control issues for suppression resources and can result in large wildland fires.

Table 3-3. Forested and non-forested vegetation cover types.

Cover Type	Description
Non-Forested	Includes non-forest dominated cover types: grass, dry shrub, riparian grass/shrub. These are further defined and discussed in the non-forested assessment (Reid 2016).
Ponderosa Pine	This cover type includes sites dominated by ponderosa pine, juniper, or limber pine. A minor component of Douglas-fir can be present. Ponderosa pine is an early seral, shade intolerant, fire resistant species that is found on a narrow elevation band between non-forested ecotones and Douglas-fir. This type usually grows on the warm dry forested habitat type group, but also on hot dry and moderately warm and dry.
Dry Douglas-fir	Dry sites dominated by Douglas-fir, with potential components of ponderosa pine, limber, or juniper. Douglas-fir is one of the most common species on the montane landscapes of Gallatin County. It is moderately shade and drought-tolerant, which enables it to function as both an early and late seral species. This type occurs commonly on warm dry, moderately warm dry, and moderately warm moderately dry habitat type group.
Mixed Mesic Conifer	Sites dominated by Douglas-fir which can be mixed with lodgepole pine, and/or subalpine fir/spruce. This type is found on more moist and productive sites than the dry Douglas-fir type. This cover type is found most commonly on cool moderately dry to moist habitat type groups but can also occur on cool moist types or moderately warm moderately dry.
Lodgepole Pine	Sites dominated by lodgepole pine with minor components of other species. Lodgepole pine is a very abundant species on the montane landscapes of Gallatin County, growing under a wide range of conditions. Where dominant it is often single-storied. Without disturbance it succeeds to Douglas fir, spruce, and/or subalpine fir. This cover type can occur on multiple habitat type groups, most commonly cool moderately dry to moist.
Aspen/Hardwood	Areas dominated by aspen, cottonwood, and birch, often with shrubs such as willow and alder. This type often occurs in association with riparian and moist upland areas. Without disturbance, conifers will eventually dominate. This cover type can be found in almost all habitat type groups.
Spruce/fir	Subalpine fir and/or Engelmann spruce dominate, with minor components of other species. These are often climax forests. Where these shade-tolerant climax species have become dominant, stands are usually multilayered and dense. This cover type can occur on any of the habitat types in the broad cool moist or cold potential vegetation groups
Whitebark pine	The whitebark pine cover type occurs at the high elevations, commonly on the cold habitat type group (where it is perpetuated by disturbance) or timberline habitat type group (where it is the most dominant). Alpine larch is a potential component but is not known to occur in Gallatin County. Minor components of subalpine fir, spruce, Douglas-fir, limber pine, or lodgepole pine may occur. Whitebark is a shade intolerant, moderately fire-resistant species. Ongoing mortality due to the exotic blister rust fungus has reduced its extent.

USFS 2017, Custer Gallatin National Forest, Forest Plan Revision Assessment, Final Fire Report, Prepared by J. Shea, February 2017.

Milburn et. al., 2015, USFS Region 1, Existing and Potential Vegetation Groupings used for Broad-level Analysis and Monitoring, Nov. 2015.

Reid et. al., 2016, Vegetation grouping for the CGNF Plan Revision and Metadata for Adjustments made to VMap, 2016.

3.5.1.2 Rangeland Vegetation (CGNF Forest Plan Revision, Non-forested Terrestrial Ecosystems Report, USFS 2017).

A variety of grasslands are associated moist (mesic) and drier (xeric) shrublands in varying patterns across the landscape. Mesic shrublands are often associated with coniferous forests and occur as large landscape patches on moister sites (e.g., northeast facing slopes) or in smaller patches in grasslands. Because of the moisture regime, these shrublands can be very productive and therefore favored by wildlife. Grasslands occur mostly on areas too dry to support trees, although a few are found on soils at mid to high elevations that are too wet during the growing season for tree growth. In the forest zone between the upper and lower timberline, areas dominated by shrubs, forbs and grasses typically include one or more of the following characteristics: convex or well-drained landforms, thin or poorly developed soils that usually are quite dry, and high winds. Fires or landslides open-up the forests in some areas, allowing early successional herbaceous and shrubby stages to flourish for a time. Above treeline in the alpine zone, the climate is too severe for trees. Grass cover type is estimated to be about 11 to 32 percent of the montane units using Region 1 existing vegetation database data. Shrublands have deeper, more developed soils and more available moisture. In the montane units, shrublands are mostly dominated by mountain big sagebrush (*Artemisia tridentata vaseyana*) with some lower elevations dominated by Wyoming big sagebrush (*Artemisia tridentata wyomingensis*). Bitterbrush (*Purshia tridentata*) is found on the Hebgen Lake unit on mid to lower slope positions of south and west-facing exposures. Shrubby cinquefoil is found in moist sagebrush communities and occasionally on the fringes of wet or moist meadows at higher elevations. Willow-dominated shrublands (*Salix* spp.) are common in riparian areas and wet meadows.

Mountain big sagebrush generally occupies open dry sites at elevations below montane forests where winters are cold and dry, spring and early summer months receive most precipitation, and drier conditions are expected from mid-summer through the fall (Welch 2005). Sagebrush steppe vegetation, dominated by mountain big sagebrush, is also characterized by the presence of native forbs and cool season perennial bunch grasses (for example, *Agropyron*, *Festuca*, *Koeleria*, *Poa*, *Stipa*). Without periodic fire, sagebrush reaches an uncharacteristic old-growth form with increased height, woody stems, and thick accumulations of leaves – all highly flammable with fire behavior that is very similar to crown fires in larger conifers. Introduction of annuals, especially cheat grass, has increased fuel loads so that fire carries easily, increasing the potential for significant and dangerous fire behavior.

3.5.1.3 Noxious Weeds

Noxious weeds and cheat grass are found across Gallatin County and present yearly challenges for residents, agricultural users, and fire suppression agencies. Cheat grass, introduced invasive annuals and other noxious weeds typically occur where the ground has been disturbed to create roads, paths, or other plantings. Once established, they return perennially and can reach heights of three feet or more creating an easily ignitable fuel bed once they dry out during summer months. Fires that occur in this type of fuel spread quickly and can direct fire to other fuels such as trees or structures.

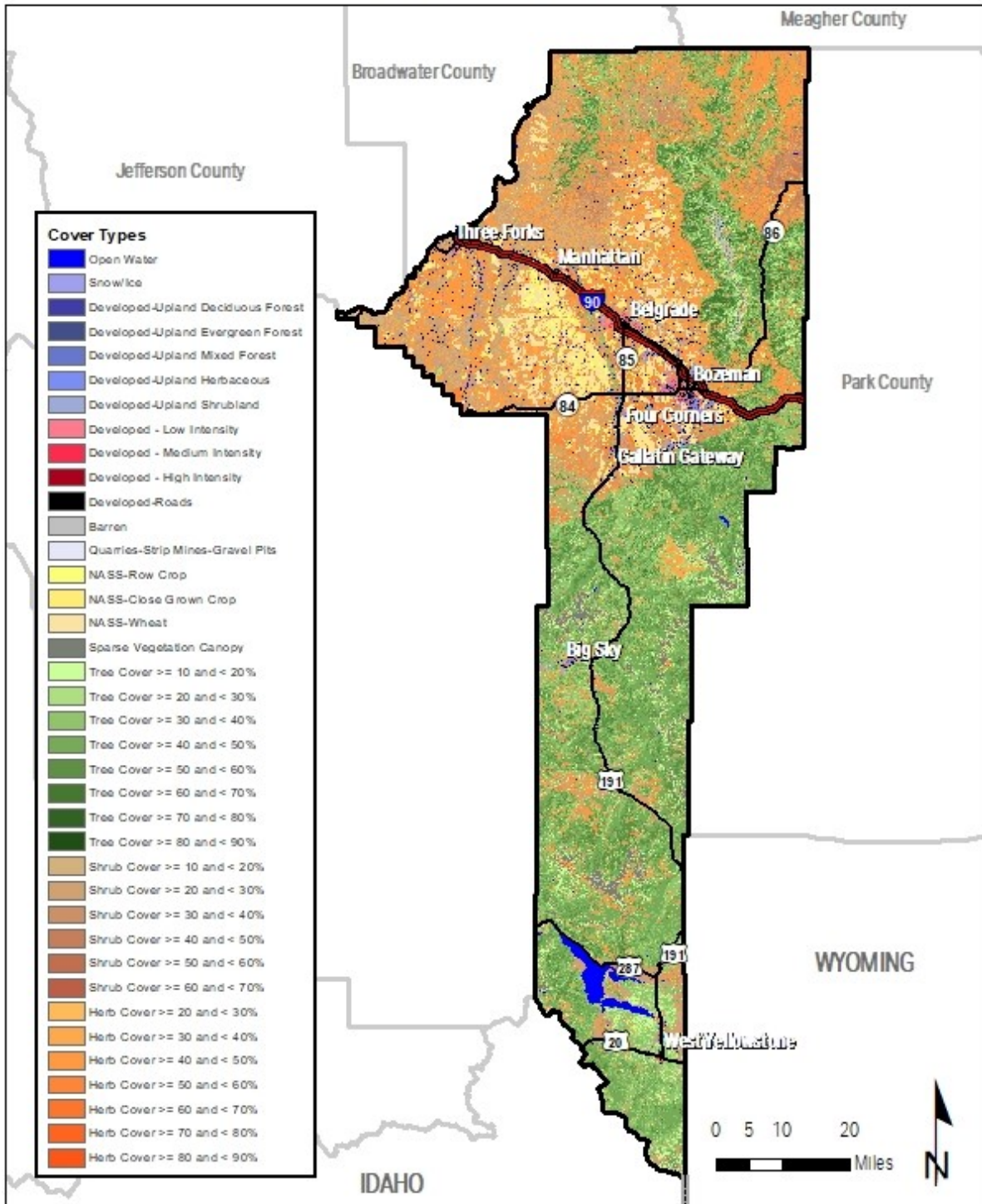
Cheatgrass provides a flammable link in the brush and forests vegetation types. It cures early in the fire season and ignites readily during dry periods because of its very fine structure that responds readily to changes in the atmospheric moisture, tendency to accumulate litter, and invasive nature. Cheatgrass promotes more frequent fires by increasing the biomass and horizontal continuity of fine fuels that persist during the summer lightning season. Its expansion has dramatically changed fire regimes and plant communities over vast areas of western rangelands by creating an environment where fires are easily ignited, spread rapidly, cover large areas, and occur frequently. Fire in these habitats can have severe effects on native species of plants and animals.

USFS 2017, Custer Gallatin National Forest, Forest Plan Revision Assessment, Final Non-forested Terrestrial Ecosystems Report, Prepared by Kim Reid, February 2017.

Welch, 2005, Getting Acquainted with Big Sagebrush, In: Big Sagebrush: A sea fragmented into lakes, ponds, and puddles. Gen. Tech. Report, RMRS-GTR-144. Fort Collins, CO: USDA-USFS Rocky Mountain Research Station: 1-46.

LANDFIRE Vegetative Cover

Gallatin County, Montana



Data Source: Wildland Fire Science, USGS
 Data Date: 2014
 Map Coordinates: NAD 1983, State Plane Montana

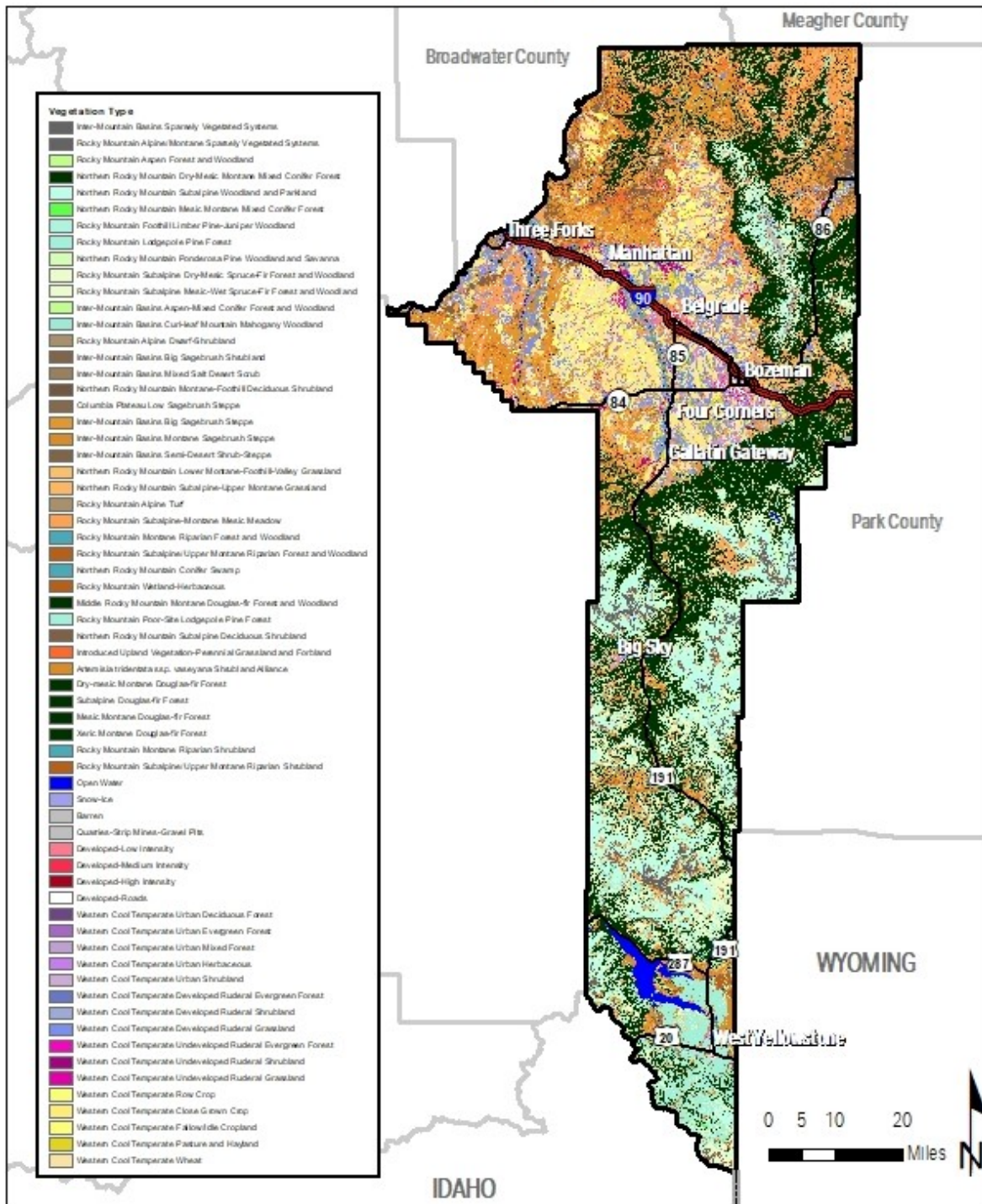
Map Updated by:
 Troy Benn
 December 2018



Figure 3-5. Vegetation Cover Map (LANDFIRE)

LANDFIRE Vegetation Type

Gallatin County, Montana



Data Source: Wildland Fire Science, USGS
 Data Date: 2014
 Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
 Troy Benn
 December 2018



Figure 3-6. Vegetation Type Map (LANDFIRE)

3.6 WILDLAND-URBAN INTERFACE

This 2018 Gallatin County CWPP update defines the concept of Wildland-Urban Interface (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.”

As a means of comparison, the 2017 Montana Code Annotated (MCA), Title 76. Land Resources and Use, Chapter 13. Timber Resources, Part 1. Protection of Forest Resources, has the following definition:

(16) *“The line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.”*

and, the Gallatin County Subdivision Regulations (2014) include the following definition:

“An area where improved property and wildland fuels are both present.”

The formal definition of WUI is found in the Code of Federal Regulations (CFR) and describes conditions under which vegetation and structures meet or intermix. 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 border 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 CFR guidelines for structure density are helpful, the definitions are still vague in terms of geographically defining WUI with a set of mappable criteria.

This CWPP generally adopts the approach used by the U.S. Forest Service in mapping WUI for the conterminous U.S. from 2010 U.S. Census data. Based on Federal Register definitions, this approach combines structure density data and landcover data depicting wildland vegetation to map the categories of WUI. For the Gallatin County WUI mapping, structure density was derived from county-level address point data, instead of structure density numbers at the census block polygon level used in the national mapping work. As a means of connecting WUI mapping 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 in this CWPP and the criteria used for national WUI mapping is the use of a lower structure density threshold to define WUI. In the Federal Register and the national WUI mapping, areas must have at least 6.18 structures per square kilometer (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 all areas with structure density greater than zero in the spatial definition of WUI for Gallatin County.

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

1. **WUI Intermix** = Areas with structure density > 0, and \geq 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 \geq 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 the WUI for Gallatin County based on these criteria is shown in **Figure 3-7**. The WUI map was completed by developing mapping for: (1) “at-risk communities”, as defined in the Federal Register based on structure densities, and applying methods developed by the SILVS lab (USFS – RMRS).

<https://www.federalregister.gov/documents/2001/01/04/01-52/urban-wildland-interface-communities-within-the-vicinity-of-federal-lands-that-are-at-high-risk-from>, and (2) the area surrounding the at-risk communities (using spatial criteria as defined above) <https://www.fs.fed.us/projects/hfi/field-guide/web/page22.php>. The total designated WUI area within Gallatin County (as shown on Figure 3-7) is 1,100,017 acres, of which 753,342 acres is Intermix, and 246,765 acres is Interface.

Additional high-value resources and assets that were included in the WUI mapping include the following:

1. Designated travel/egress routes with a 0.5-mile buffer on either side.
2. Other areas designated as “at-risk” (USFS-CGNF) including FS buildings, high-value recreation areas and communication sites. These assets were buffered in the same manner as the structure address points.
3. Municipal watersheds, including Bozeman, Lyman Springs and Whiskey Springs (West Yellowstone).

3.6.1 Wildland Urban Interface Planning Areas

The Gallatin County CWPP is multi-jurisdictional and addresses all lands and ownership within the boundaries of the plan area. Primary fire protection and suppression on the majority of private lands across the county are provided by local fire districts/service areas or Gallatin County Rural Fire (“County Fire”), which provides fire protection and suppression on most private lands outside of organized fire protection agencies, under a Cooperative Fire Control Agreement with the State of Montana ([“DNRC Co-op Plan”], Gallatin County, 2015) (**Figure 3-8** shows the jurisdictional boundaries for the 15 local fire districts/service areas within the county. Note that three fire jurisdictions extend outside of the county boundary (Big Sky, Three Forks, and Willow Creek). All federal lands (USFS-CGNF and Yellowstone National Park) are under wildfire protection from their respective agencies. In addition, USFS provides wildland fire protection on BLM lands (Montana Cooperative Fire Management and Stafford Act Response Agreement, 2011); and on state land on behalf of the DNRC, under an agreement known as protection offset. USFS also provides primary response/protection on some privately-owned forest parcels that are within a designated wildland fire protection district (pursuant to Title 76, Chapter 13, Part 2, MCA), and “Affidavit Land”, where wildland fire protection is requested by the landowner via assessment (USFS-CGNF, 2016). As the designated protecting agency, the USFS has primary wildland suppression responsibility on Affidavit lands; however, structure fire suppression remains the sole responsibility of DNRC, County Fire or local fire districts.

Gallatin County, 2015, Rural Fire Protection Operating Plan.

USFS-CGNF, 2016, Fire Management Plan, Chapter 4, pages 24-32.

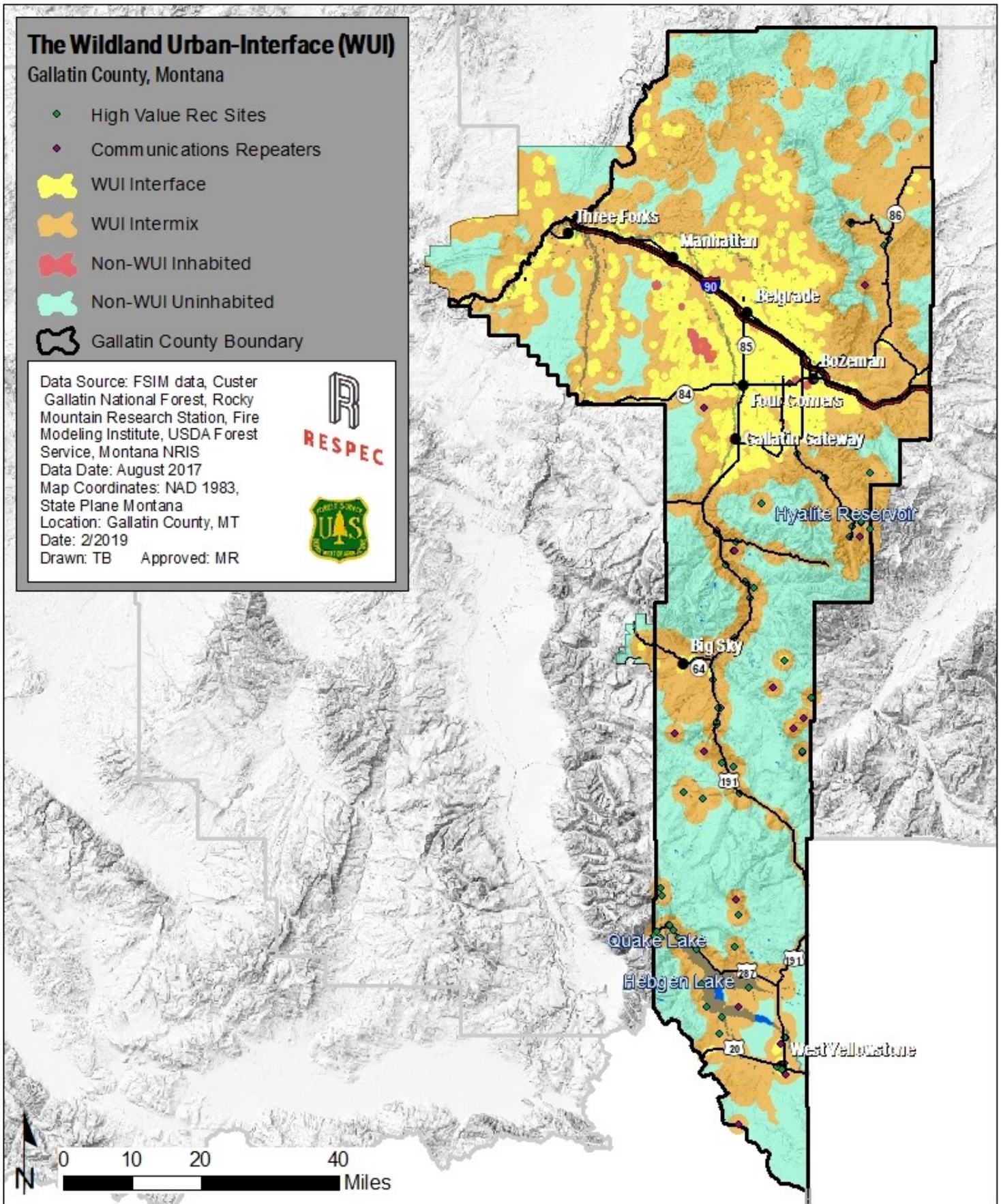


Figure 3-7. Gallatin County Wildland-Urban Interface

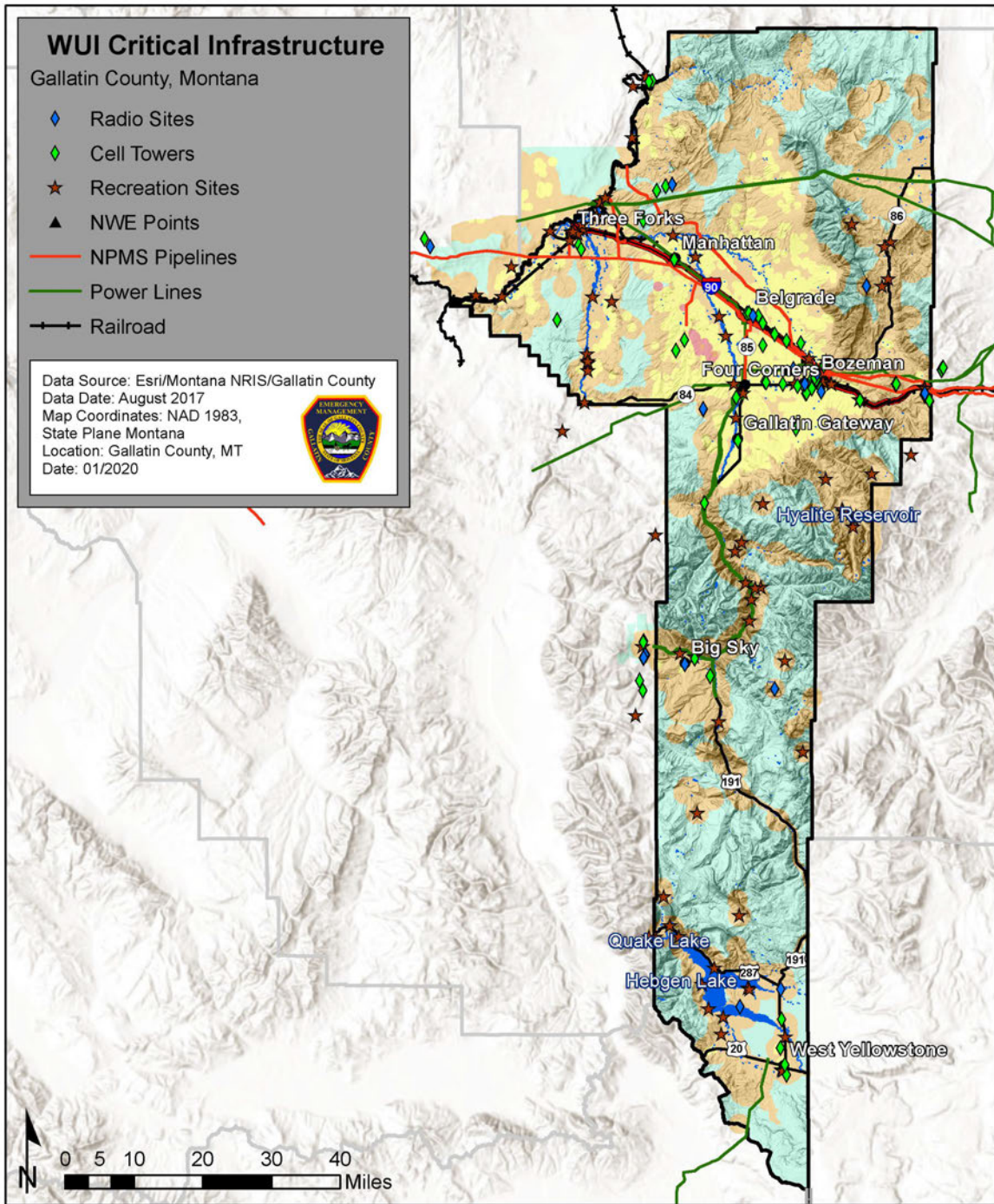


Figure 3-8. Critical Infrastructure Wildland-Urban Interface

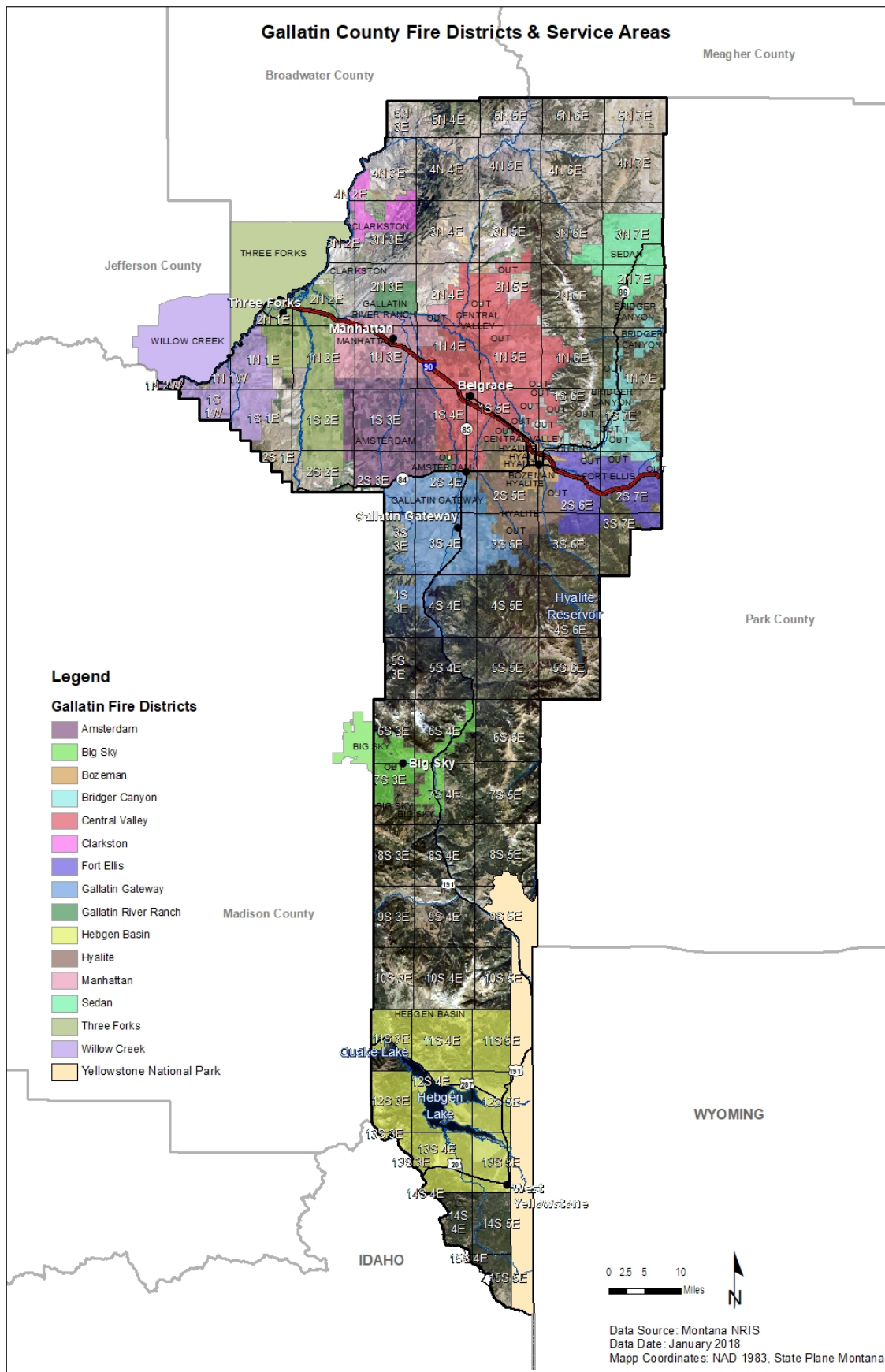


Figure 3-9. Gallatin County Fire Districts & Service Areas

Table 3-4 provides a breakdown of WUI area located within each fire district/service area jurisdiction, and Table 3-5 provides a listing of WUI area on federal and state-owned lands.

Table 3-4. Designated WUI Area by Fire District/Service Area and Gallatin County Rural Fire (County Fire)

Fire District or Service Area	WUI Area (Acres / % of total)	Description
Amsterdam	44,604 / 79%	primarily cropland, bench/draw terrain (Camp Ck. Hills, Madison Plateau)
Big Sky	32,751 / 88%	mid-elev. meadows, steep forested/mountain terrain, Gallatin R. canyon
Bozeman	12,169 / 95%	urban Gallatin Valley, Bridger/Bangtail foothills, Bozeman Ck./E. Gallatin R.
Bridger Canyon	25,855 / 99%	E. flank of Bridger range, Bridger canyon (broad valley), W. flank of Bangtails
Central Valley	116,559 / 99%	rural/urban Gallatin Valley, cropland, W. flank Bridger range, Dry Creek hills
Clarkston	15,333 / 100%	Missouri River valley, Horseshoe Hills
Fort Ellis	37,244 / 96%	southeast Gallatin Valley, Mt. Ellis, Bear Canyon, Bozeman Pass, Trail Creek
Gallatin Gateway	58,300 / 86%	Gallatin R./Canyon (Lava Lake to mouth), S. Cottonwood canyon, High Flat
Gallatin River Ranch	7,475 / 100%	Gallatin River, Horseshoe Hills
Hebgen Basin	64,572 / 51%	southern Madison range, Hebgen Lake, Quake Lake
Hyalite	29,366 / 100%	Middle Ck., mouths of Hyalite, Leverich & Sourdough canyons, Triple Tree bench
Manhattan	33,032 / 88%	primarily cropland, Gallatin/E. Gallatin Rivers, Camp Creek
Sedan	29,701 / 92%	northeast flank of Bridger range, north Bangtail Mountains
Three Forks	85,097 / 79%	cropland, Gallatin/Madison/Jefferson R., Madison R. valley/bluffs, Camp Ck. Hills
Willow Creek	50,847 / 67%	Jefferson River valley, Madison plateau
County Fire	141,033 / 53%	mainly northern extent of County (Clarkston, Horseshoe Hills, N. Dry Creek, Maudlow, N. Bridgers, Norris Rd., Madison R. valley, and isolated land parcels N & E of Bozeman)

Table 3-5. Designated WUI Area on Federal, State, and Municipal Property

Agency or Department	WUI Area (Acres)	Description
U.S. Forest Service, CGNF	255,124	Bridger and Bangtail ranges, Gallatin, Hyalite & Madison ranges
U.S. Bureau of Land Management	3,549	Dry Creek Hills, Horseshoe Hills, Madison Plateau, other
U.S. Fish and Wildlife Service	174	Bozeman Fish Technology center, other
National Park Service	13,227	Yellowstone National Park
FEDERAL LAND TOTAL	272,075	
State of Montana	149	various property within county
Montana State Trust Lands	32,041	distributed throughout county
Montana Fish, Wildlife & Parks	4,385	Region 3 headquarters, various fishing access sites
Montana University System	2,062	MSU-Bozeman, Post agronomy farm, Ft. Ellis research farm
Montana Dept. of Transportation	156	Nelson Rd. maintenance facility, various sand storage areas
MT-DNRC State Water Projects	73	Hyalite Reservoir
Gallatin County	1,144	various county infrastructure, road/bridge dept., Logan landfill
Municipal (incorporated cities/towns)	4,197	Belgrade, Bozeman, Manhattan, Three Forks, W. Yellowstone
STATE/MUNICIPAL TOTAL	44,207	

3.6.2 Wildland Urban Interface Risk in the West

According to a customized report prepared using the Economic Profile System (Headwaters Economics, 2019), Gallatin County ranks in the 73rd and 88th percentile, respectively, of existing WUI risk (amount of forested land where homes have already been built next to public lands), and future WUI risk (the area of undeveloped, forested private land bordering fire-prone public lands) throughout the West (413 western counties) in 2010. A higher percentile represents a greater relative risk, with the 100th percentile being the highest. Within the entire state of Montana, Gallatin County ranks in the 82nd percentile for existing risk, and 88th percentile for future potential risk, based on 2010 data. While home construction is not the only contributor to the rising cost of fighting fires, it is an important factor and one that is expected to rise with continued development, particularly in the absence of proper land use planning. A warming climate is likely to exacerbate these costs even further, continuing or even increasing the established risk rankings.

3.7 FIRE WEATHER

Fire weather is a combination of conditions that set the stage for the rapid spread of wildfires. The critical weather metrics that determine fire weather severity include temperature, relative humidity, winds, and atmospheric instability. Fire behavior specialists utilize specific indices that combine multiple weather parameters to predict the potential for fire ignition, spread rate, and heat release. The Energy Release Component (ERC) is a number related to the available energy (BTU) per unit area (square foot) within the flaming front at the head of a fire. Daily variations in ERC are due to changes in moisture content of the various fuels present, both live and dead. The ERC for fuel model G (short-needle, heavy dead) is often used in predictions of fire danger and large fire activity. The ERC-G has been shown to be strongly correlated with area burned in the western United States (Riley et al. 2013). Predictive Service Areas (PSAs) which integrate weather data from several Remote Automated Weather Stations (RAWS) are delineated to predict fuels and fire danger for given regions. The CGNF-Bozeman/Hebgen Lake Ranger Districts are within PSA-NR12, covering forested areas south of the Gallatin Valley to the southern extent of the county.

Figure 3-9 provides two graphs showing maximum, average and 83rd percentile ERC values over 11 years (2008 – 2018), and ERC traces for the 2008 and 2012 fire seasons. ERC values greater than 83% indicate potential for large fire growth. The average (blue line) plot shows a typical pattern of low ERC values in the spring, rising steadily through initial snow melt and green-up in April and May, then falling in late-May into June due to higher precipitation amounts that are common during that period. Dry, summer conditions begin to prevail in late-June and ERC values increase rapidly, typically exceeding the 83% threshold between mid-July and mid-September. Periodic fall moisture, coupled with steadily decreasing solar insolation, results in rapidly decreasing ERC values in late-September through early November, and diminished potential for wildfire. Notably, the maximum plot (black line), which represents the maximum ERC recorded for a particular date during the 11-year period, shows that ERC values can exceed 83% in early-May and remain above that threshold as late as November.

The years 2008 and 2012 are significant during the 11-year period, representing very different fire seasons. 2008 was a relatively mild fire season with less than two months where ERC values exceeded 83%. Conversely, 2012 saw nearly four months where ERC values exceeded 83%; the Millie Fire occurred in late-August of 2012 with ERC values at the 98%-level of the 11-year period (2008 – 2018).

Headwater Economics, A Profile of Development and the Wildland-Urban Interface (WUI). Generated for Gallatin County, MT using the Economic Profile System (EPS), April 2019.

EPS Data Sources:

Gude, P.H., Rasker, R. and van den Noort, J. 2008. Potential for Future Development on Fire-prone Lands. *Journal of Forestry* 106(4):198-205; U.S. Department of Commerce, 2011. TIGER/Line 2010 Census Blocks and 2010 Summary File 1, Washington, D.C.

Riley, K., et al., 2013, The relationship of large fire occurrence with drought and fire danger indices in the western USA, 1984-2008: the role of temporal scale.

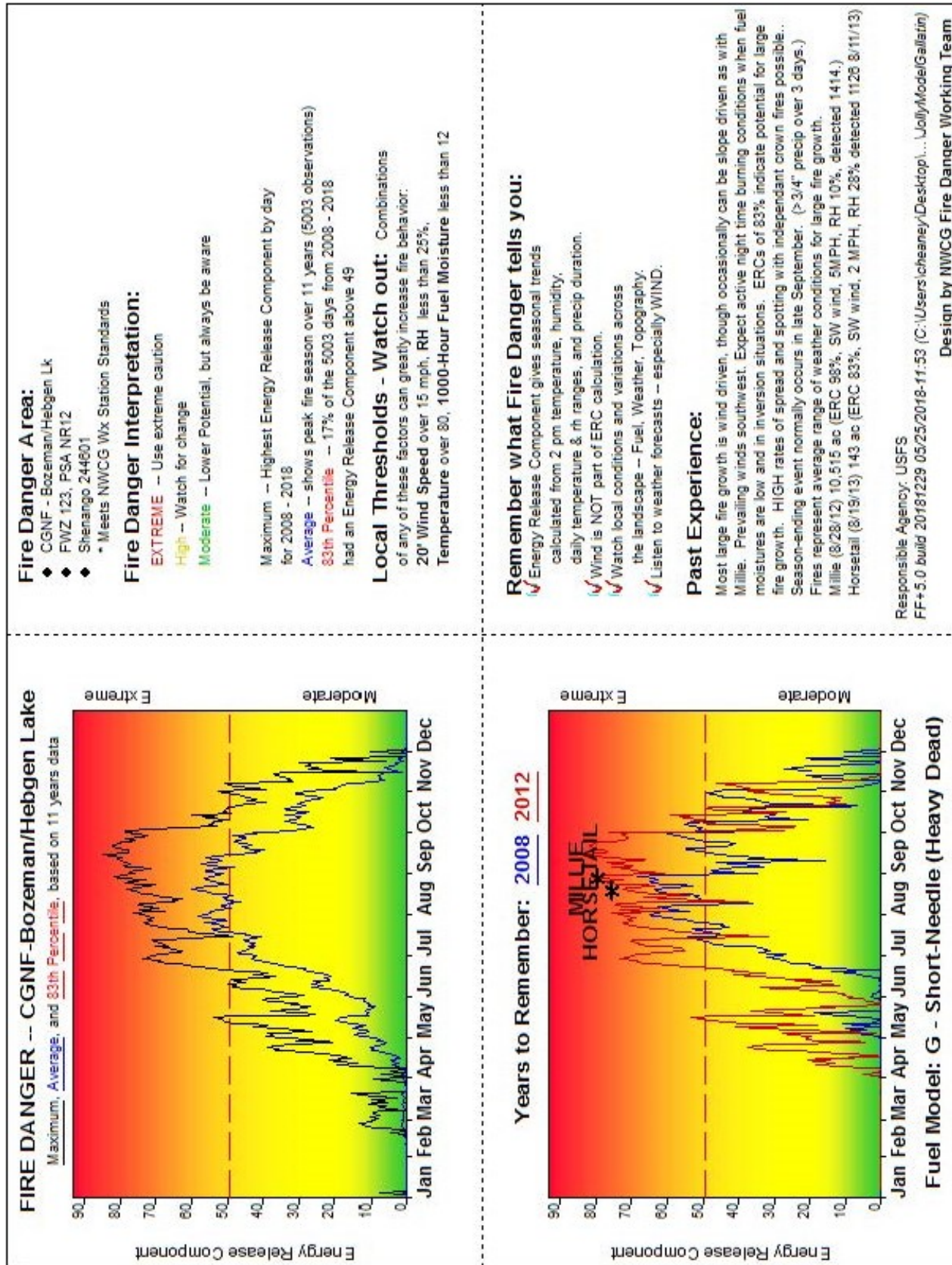


Figure 3-10. Graphs of Energy Release Component (ERC) for CGNF-Bozeman/Hebgen Lake Ranger Districts (2008 – 2018) [USFS, National Wildfire Coordinating Group-NWCG, Fire Danger Working Team]

3.8 WILDFIRE HISTORY

Gallatin County has a long history of wildfires from small to large. The extent of damages often depends on the proximity to the WUI, fire spread rates, and the effectiveness of suppression and mitigation measures. The history of wildfires can be difficult to compile because the various firefighting entities involved and a variety of recordkeeping measures over the years. The following list chronicles several of the critical / severe wildfire events that have occurred in the county over the last 30 years.

June – November 1988 - Greater Yellowstone Fires. Numerous fires throughout Yellowstone National Park raged through the entire summer and well into the fall of 1988. Some of these fires extended into portions of Gallatin County. The fires covered 2.3 million acres, employed an estimated 25,000 firefighters, and cost nearly \$120 million for fire suppression. One firefighter, and one pilot, were killed and structure losses were estimated at \$3 million, mostly within Yellowstone National Park.

August 2001 – Fridley Fire. Lightning ignited the Fridley Fire on August 19 near Fridley Creek in the Custer-Gallatin National Forest. The fire doubled in size on August 22 and displayed "extreme" behavior on August 23, when high winds caused it to double in size again. Montana Executive Order 20-01, issued on August 25, 2001, declared a state of emergency in Gallatin County and other locations across the state and mobilized state resources and the National Guard to fight the wildfires. On August 31, three members of a firefighting helicopter crew were killed on a maintenance flight when a bucket line tangled with a rotor, causing the helicopter to crash three miles south of Emigrant in Park County. The Fridley Fire was contained on September 13, 2001. In all, 26,373 acres burned from this fire and firefighting costs totaled over \$11 million with 1,261 personnel, 50 pieces of heavy equipment, and 14 helicopters used. Fortunately, no structures were lost. This was a significant fire for Gallatin County because the City of Bozeman watershed, which is the primary the drinking water supply for th city, was threatened.

September 2001 - Purdy Fire. Following the Fridley Fire by just a few weeks, the Purdy Fire ignited on September 26th in the upper Wilson Creek drainage southeast of Gallatin Gateway. By September 28, the fire had burned over 4,000 acres and caused the evacuation of over 50 homes.

September 2009 - Flaming Arrow Fire. Winds re-ignited the remnants of a controlled burn into a fast-moving grass fire in the Flaming Arrow subdivision just south of Bridger Bowl. The fire burned mostly on private land and threatened about 25 homes. The fire was 100 percent contained after burning approximately 250 acres over a four-day period.

June 2012 - Bear Trap Fire. A human-caused fire that was later determined to be arson, burned 15,500 acres in the Bear Trap Canyon area along the Madison River west of Bozeman. The estimated value of property lost in the fire, including one home, crops, pastures, fences, a vehicle, eight horses and electrical transmission lines totaled more than \$3.8 million. Approximately \$1.25 million was spent in suppression costs and involved over 200 firefighters.

August – September 2012 – Millie Fire. Burned 10,515 acres in the Storm Castle Creek drainage, approximately 20 miles southwest of Bozeman. The fire was not fully contained for nearly one month, and initially threatened to cross over into the Hyalite Creek drainage where it could potentially have affected a drinking water source for the City of Bozeman as well as other impacts to the heavily used Hyalite Reservoir recreation area. The fire caused closures of Hyalite Canyon, Leverich Canyon, and Sourdough Canyon (Bozeman Creek) for much of its duration.

October 2015 - Cottonwood Gulch Fire. This fire was accidentally started by a landowner's vehicle in the Cottonwood Gulch area north of Manhattan. The fire burned approximately 8,300 acres and one outbuilding before being fully contained.

August 2016 -Maple Fire. The Maple Fire was detected on the evening of August 8, 2016 by smoke jumper aircraft flying over Yellowstone. The cause was determined to be lightning. The southwest perimeter of the fire burned within 3.5 miles of West Yellowstone. Over 230 personnel were assigned to the fire at its peak. The fire burned over 45,000 acres of timber and short grass. While the Maple Fire threatened a small portion of Gallatin County, including West Yellowstone and areas immediate north along Highway 191, it did not burn any land within the county.

July – October 2018 – Bacon Rind Fire. The Bacon Rind Fire was detected on July 20th and continued to burn for over two months at varied intensity. The 5,232-acre fire was located approximately 20 miles south of Big Sky along the west side of Highway 191, within both Yellowstone National Park and CGNF-Lee Metcalf Wilderness, in an area that had not burned in the last 150 years. There are numerous meadows and forest breaks in the fire area, which, along with favorable weather and climatic conditions and lack of drought, reduced the potential of strong fire behavior and spread. The incident management approach allowed the fire to potentially clean out dead and downed trees and help restore a healthy ecosystem. Post-fire conditions will be conducive to new growth and create great habitat for wildlife, while reducing the potential for a future large fire.

September 2018 - Horseshoe Fire. This fire burned 1,223 acres in the Horseshoe Hills east of Clarkston. The fire began on Monday afternoon, Sept. 10th and was declared 100% contained on Saturday, Sept. 15th. Several structures were lost to this fire including three primary residences, two secondary residences, and several outbuildings [GCEM website, Horseshoe Fire Update, 9/14/18 – 9:30am].

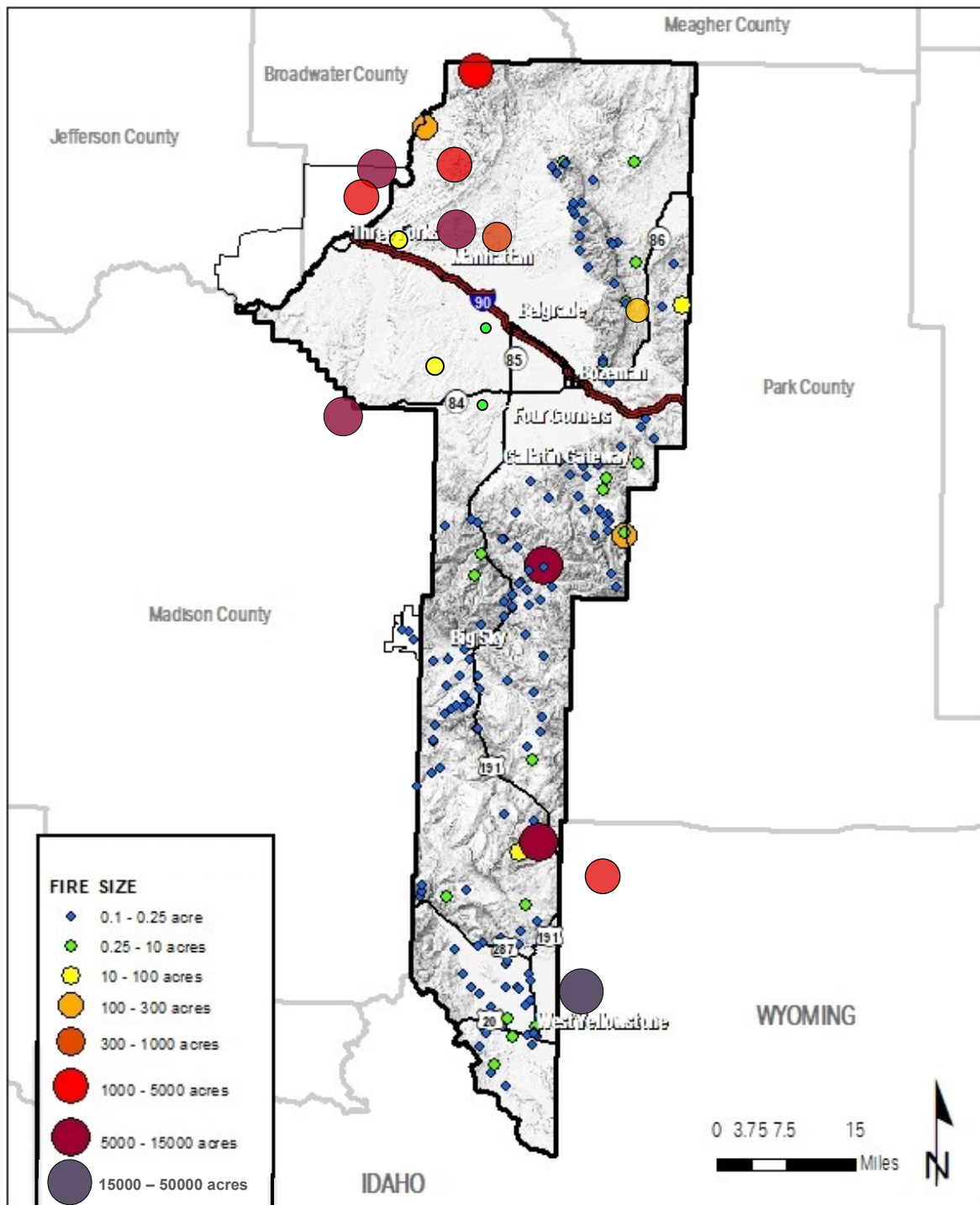
Within the last decade (2008-2018), the vast majority of wildfires in Gallatin County were less than 10 acres in size (**Class C** and smaller, NWCG). In fact, there were only five fires larger than 1,000 acres (**Class F**, NWCG) in the county during this period: Millie Fire (2012), Bean Canyon Fire (2012), Cottonwood Gulch Fire (2015), Bacon Rind Fire (2018), and Horseshoe Fire (2018). There were, however, five additional fires that exceeded 1,000 acres in size just outside the county boundary: Bear Trap 2 Fire (Madison County, 2012; the east boundary of this fire extended into Gallatin County), Copper City Fire (Broadwater County, 2013), Eustis Fire (Broadwater County, 2015), Fawn Fire (Yellowstone National Park, 2016), and Maple Fire (Yellowstone National Park, 2016).

Figure 3-10 provides a map of wildfire history in Gallatin County for the period 2008-2018. Some of these mapped events are not actually wildfires but rather local incidents that became extended fire events (e.g., Bear Trap Fire, 2012). Generally, across the CGNF land base, which includes Gallatin County, less than five percent of unplanned ignitions grow into larger fires (**Class F**: 1,000 acres or more, but less than 5,000 acres; and **Class G**: 5,000 acres or more), primarily due to extreme weather and wind conditions driving fire growth. Many occurrences of the smaller fire sizes (0.1 acre – 10 acres) shown on Figure 3-10 were not actual wildfires but rather unplanned ignitions that were reported by USFS and/or contained by initial attack resources, as documented by USFS-CGNF in the Wildland Fire Decision Support System (WFDSS).

The National Wildfire Coordinating Group (NWCG), Glossary of Terms, Accessed from website April, 2019:
<https://www.nwcg.gov/term/glossary/size-class-of-fire>

Fire History, 2008-2018

Gallatin County, Montana



Data Source: USDA Fire Program Analysis Fire Occurrence Database (2008-2015)
 FAMWEB Data Warehouse (2016-2018)
 Data Date: December 2018
 Map Coordinates: NAD 1983, State Plane Montana

Map Updated by:
 Troy Benn
 December 2018

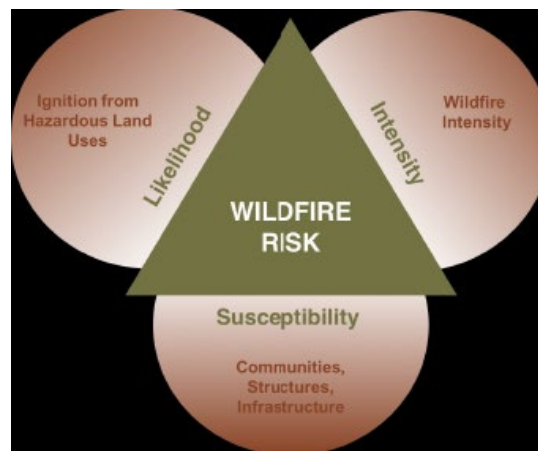


Figure 3-11. Location and Fire Size Class of Wildfires in Gallatin County, 2008-2018

4 WILDFIRE RISK ASSESSMENT

4.1 OVERVIEW

Wildfire risk is a measure of both the probability and consequences of uncertain future wildfire events (Thompson et al., 2016). For any location within Gallatin County, wildfire risk depends on the likelihood of a fire occurring there, the expected intensity of the fire, and the vulnerability of resources or assets of value at that location. Fire scientists describe these three components of risk using a triangle where the sides are likelihood, intensity, and susceptibility. These three factors, and the resultant wildfire risk, vary across the county. This section of the CWPP describes tools currently used to assess wildfire risk in Gallatin County. The results of the risk assessment provide spatial context and inform where different wildfire management and mitigation strategies are most effective.



Components of the wildfire risk triangle (from Scott et al., 2013)

With an understanding of the components that contribute to wildfire risk and application of a coordinated and collaborative planning effort, Gallatin County and other stakeholders 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.

4.2 LANDSCAPE LEVEL RISK ASSESSMENT

The methodology used for wildfire risk analysis utilizes data that is representative of landscape-scale processes. Maps of fire *likelihood* and *intensity* can be used together to represent relative wildfire *hazard* for a given location. Computer simulation modeling of hypothetical wildfires provides a sound and scientifically defensible means of mapping wildfire likelihood and potential intensity. Fire models use weather data from long-term stations in the county, 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. Simulations can be run for a plethora of statistically possible weather scenarios and thousands of iterations of a whole fire season using a model called **FSim** (Finney et al., 2011).

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/treearch/pubs/50912>

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>

Finney, Mark A.; McHugh, Charles W.; Grenfell, Isaac C.; Riley, Karin L.; Short, Karen C. 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.fed.us/rmrs/publications/simulation-probabilistic-wildfire-risk-components-continental-united-states>

The outputs from FSim include maps of the annual probability of fire occurrence and the most likely intensity at a very fine scale. This information can be used to support decisions related to wildfire suppression, fuel management planning, and resource allocation decisions. It is also critical for developing land and resource management plans.

4.2.1 Wildfire Simulation and Mapping

A regional, landscape-level risk analysis, completed by Pyrologix LLC (Gilbertson-Day, J., et al., 2017) using the Fsim model, was utilized to evaluate wildfire likelihood and intensity. Specific results of this modeling work for Gallatin County were made available for use in this CWPP by USFS Region 1 (Jessica Haas, personal comm.). The raw outputs from the model are raster, or pixel-based, datasets that divide the landscape into evenly sized square cells, each 180 meters (583 ft) on a side.

To summarize the raster FSim results and the corresponding fire hazard indices to a common mapping unit, fine-scale watershed polygons, referred to as catchments, were utilized from the US Environmental Protection Agency (USEPA) and US Geological Survey (USGS) National Hydrography Dataset Plus, version 2 (<https://www.epa.gov/waterdata/nhdplus-national-hydrography-dataset-plus>). Displaying the results by summary polygons improves data understanding and allows for broad-scale patterns to emerge that may otherwise be missed in raw pixel datasets. There are 4,864 catchments that intersect the Gallatin County boundary plus the extra-county areas included to capture the Big Sky, Three Forks and Willow Creek fire jurisdictions. The resulting catchment and partial catchment summary unit polygons range in size from 0.0009 to 96.39 km², and average 1.67 km².

4.2.1.1 Fire Likelihood

Fire likelihood, or burn probability (BP), is the Fsim-modeled annual likelihood that a wildfire will burn a given point or location. It is calculated as the number of times a given pixel burns during a simulation divided by the total number of iterations and represents a true annual burn probability that considers all possible weather scenarios. This methodology provides a long-term perspective on the relative likelihood of fire for any location in the county in any given year.

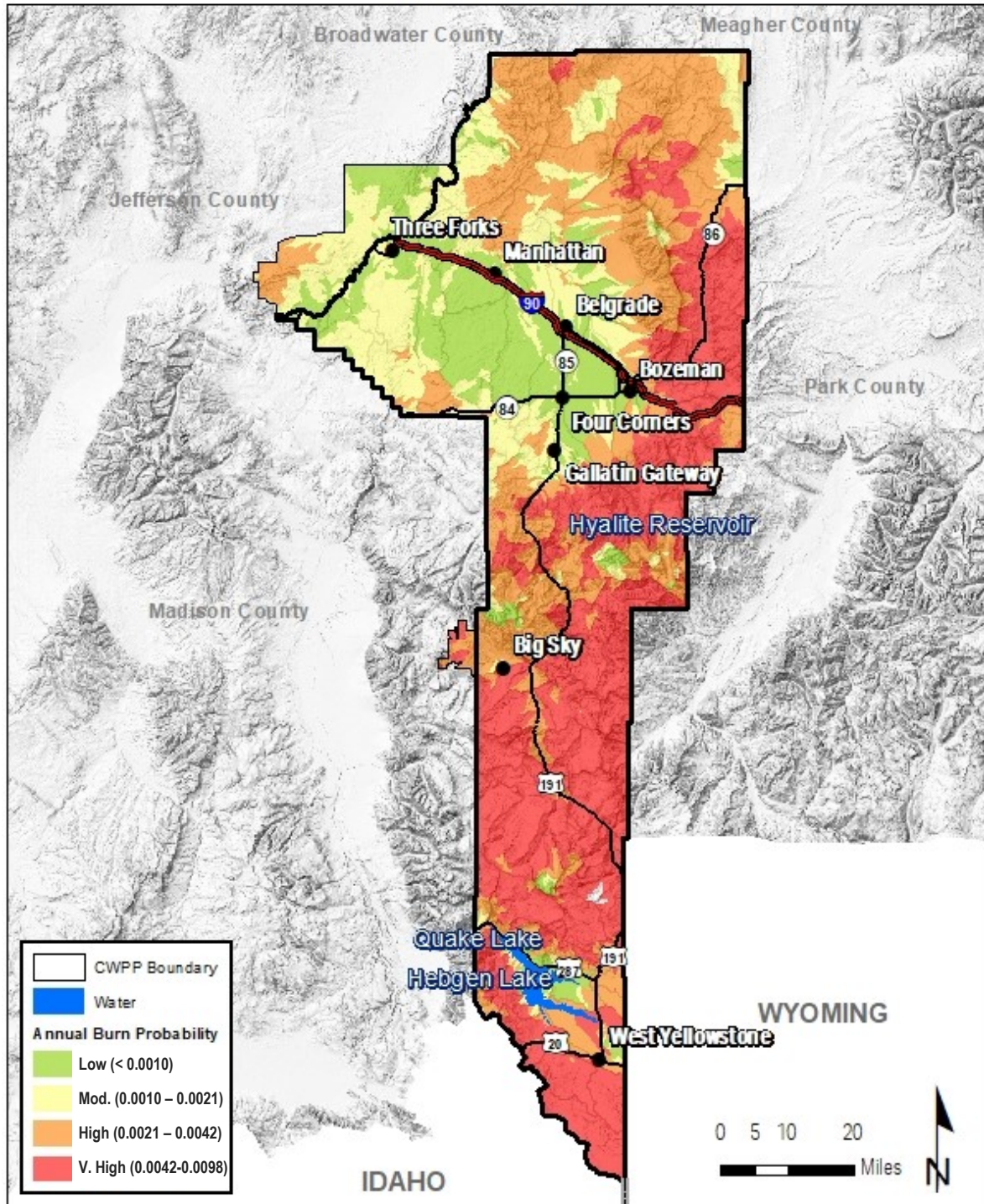
To produce a map of relative wildfire likelihood for Gallatin County, the average BP for each catchment was calculated, and those averages were classified those into four classes of low, moderate, high and very high (**Figure 4-1**). The classes are relative to the distribution of catchment averages only within Gallatin 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 BP for catchments ranges from 0 to 0.0098, with a mean of 0.0021. Thus, a given catchment has about a 1 in 476 chance of burning in any given year.

In general, wildfire likelihood is highest on forested, middle- to upper-elevation sites including: 1) the east flank of the Bridger Mountains across Bridger Canyon to the east and into the Bangtail Mountains; 2) the Gallatin Front along the south end of the Gallatin Valley; and 3) the southern portion of the county, including the Gallatin and Madison ranges and areas around Big Sky, extending south to Hebgen Basin and the area southwest of West Yellowstone. Areas with low burn probability include: 1) irrigated agricultural lands within the Gallatin Valley, predominantly south of I-90; 2) small areas above treeline in the Hyalite Mountains and Spanish Peaks; and 3) part of Hebgen Basin, particularly the northeast side of Hebgen Lake.

Gilbertson-Day, J., Scott, J.H., Vogler, K.C., and Brough, A. 2017. *Northern Region Wildfire Risk Assessment: methods and results*. Internal report to USFS Region 1; unpublished.

Relative Wildfire Likelihood

Gallatin County, Montana



Data Source: FSIM data, Custer Gallatin National Forest, Rocky Mountain Research Station, Fire Modeling Institute, USDA Forest Service, Montana NRIS
 Data Date: June 2018
 Map Coordinates: NAD 1983, State Plane Montana

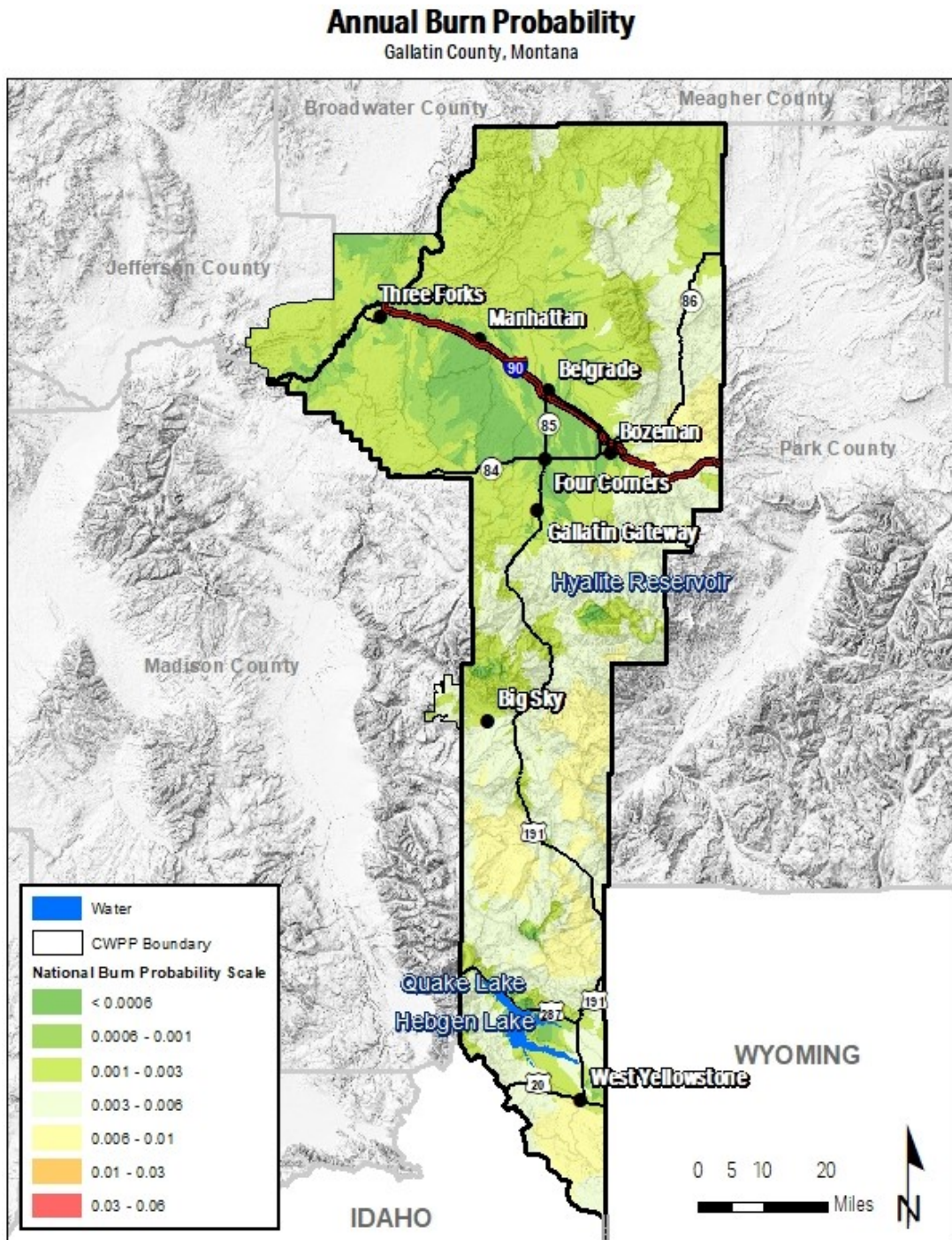


Map Updated by:
 Libby Ellwood
 June 2018
 Benn, 2/2019



Figure 4-1. Relative Wildfire Likelihood for Gallatin County

It is important to restate that the four wildfire likelihood classes represent a relative distribution within the county. When mapped on a standard national scale for burn probability (Figure 4-2), it is apparent that the entire county has a low to moderate burn probability (mean BP values < 0.01 for all catchments).



Data Source: FSIM data, Custer Gallatin National Forest, Rocky Mountain Research Station, Fire Modeling Institute, USDA Forest Service, Montana NRIS
 Data Date: June 2018
 Map Coordinates: NAD 1983, State Plane Montana



Map Updated by:
 Libby Ellwood
 June 2018
 Benn, 2/2019



Figure 4-2. Annual Burn Probability – National Scale for Gallatin County

4.2.1.2 Fire Intensity

The FSim model can be used to distribute burn probability into wildfire intensity levels and generate probability estimates of a specific flame length class when fire burns a given pixel. Conditional Flame Length (CFL) represents the average fire intensity for each pixel from many simulated fires. An averaged CFL value is calculated for each catchment from individual, pixel-level CFL values. The map of relative wildfire intensity for the county was created by grouping the averaged catchment CFLs into four classes (**Figure 4-3**). 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 to 41 feet, with a mean of 3.87 feet.

Areas with the highest potential fire intensity in the county are primarily mid-elevation watersheds with higher fuel loads. Within Gallatin County these areas include: the Clarkston/Horseshoe Hills; much of the Bridger Mountain range, Bridger Canyon, and the Bangtail Mountains; Bear, Hyalite and Sourdough Canyons south of Bozeman; Trail Creek Rd. area; and portions of the Madison and Gallatin ranges south of Big Sky. Conversely, high elevation areas generally have lower fire intensity due to lesser fuel loads (e.g., areas at or above treeline), and maintenance of higher soil and vegetation moisture levels into the summer season. Most of the Gallatin Valley also exhibits lower fire intensity due to limited fuel loads (brush, grasses) and the presence of large areas of irrigated crops.

4.2.1.3 Relative Wildfire Hazard

The likelihood and intensity sides of the wildfire risk triangle can be integrated to represent wildfire hazard. Thus, relative wildfire hazard is calculated by multiplying burn probability by the conditional flame length. Hazard values were determined at the pixel scale and then summarized by determining an average hazard value for each catchment. Following a similar approach as fire likelihood, the average hazard values for catchments were grouped into four classes based on quartiles of the hazard distribution across the county. The actual numeric values of hazard are less directly interpretable than BP or CFL, however they do provide a relative measure of fire hazard at a landscape scale. **Figure 4-4** provides a map of relative wildfire hazard for Gallatin County.

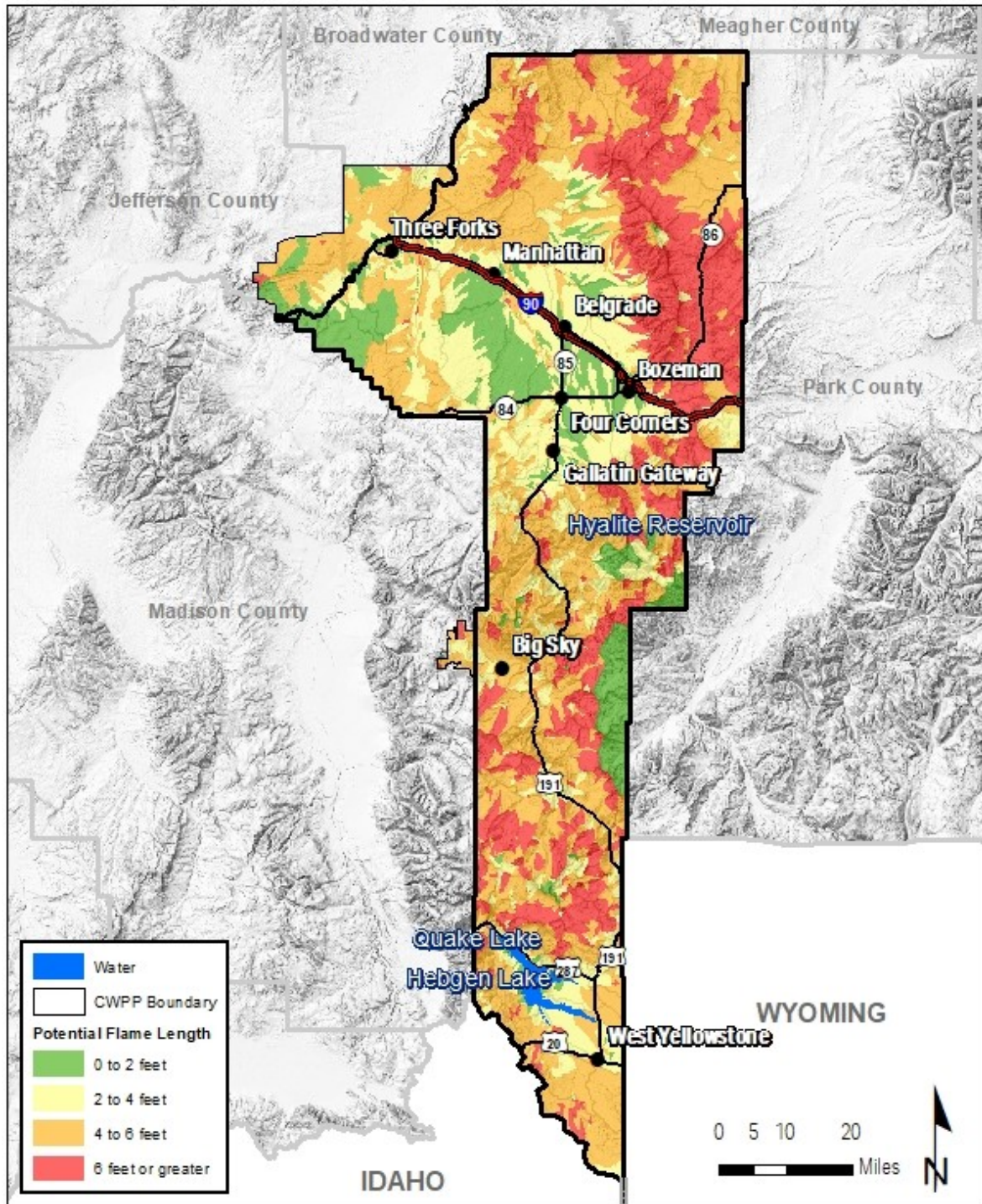
When comparing all three wildfire risk mapping products, the influence of both fire likelihood and fire intensity are evident in the relative wildfire hazard map. Similar to the likelihood mapping, the greatest wildfire hazard is found in the mid- to upper-elevation, forested areas of the county including: Horseshoe Hills; nearly the entire Bridger Mountain range, Bridger Canyon, and Bangtail Mountains; the Gallatin Front and Trail Ck. area south/southeast of Bozeman; and most of the county from the Big Sky area south, with the exception of some areas immediately surrounding Hebgen Lake.

4.2.2 Susceptibility and Risk

Information about susceptibility (or vulnerability) of specific assets is more difficult to map. The Fsim analysis completed by Pyrologix does not provide enough information to adequately represent the susceptibility of communities to wildfire. This analysis 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.

Potential Flame Length

Gallatin County, Montana



Data Source: FSIM data, Custer Gallatin National Forest, Rocky Mountain Research Station, Fire Modeling Institute, USDA Forest Service, Montana NRIS
 Data Date: June 2018
 Map Coordinates: NAD 1983, State Plane Montana



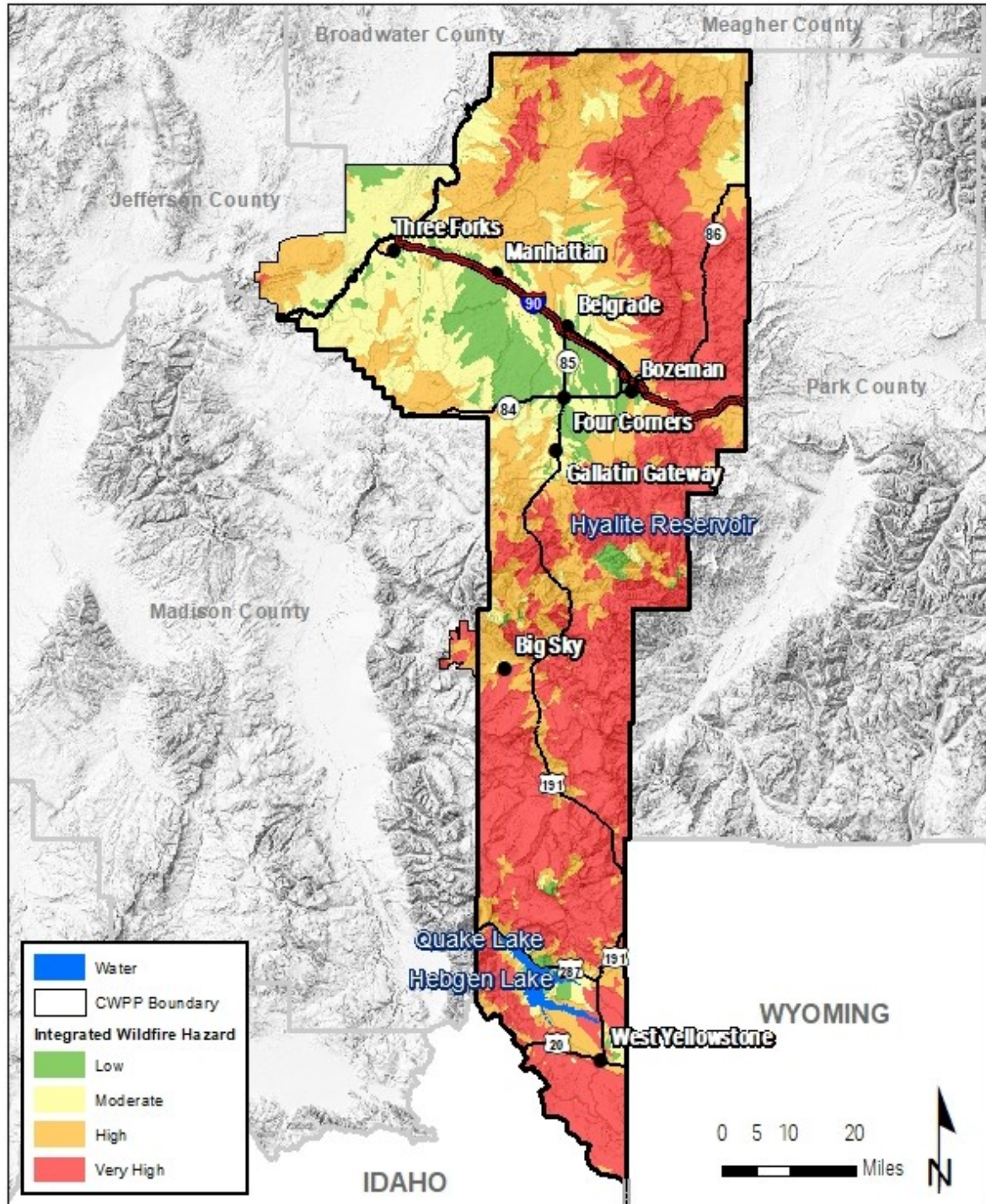
Map Updated by:
 Libby Ellwood
 June 2018
 Benn, 2/2019



Figure 4-3. Burn Intensity based on Potential Flame Length for Gallatin County.

Relative Wildfire Hazard

Gallatin County, Montana



Data Source: FSIM data, Custer Gallatin National Forest, Rocky Mountain Research Station, Fire Modeling Institute, USDA Forest Service, Montana NRIS
 Data Date: June 2018
 Map Coordinates: NAD 1983, State Plane Montana



Map Updated by:
 Libby Ellwood
 June 2018
 Benn, 2/2019



Figure 4-4. Relative Wildfire Hazard for Gallatin County.

The response functions 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 this information provides some insights into wildfire risk, it does not facilitate a thorough mapping of risk across the county.

In future efforts, susceptibility could be evaluated at multiple scales 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 Pyrologix assessment could be used to develop community-level susceptibility ratings. The rating areas could be watersheds, like the catchments used to determine and map fire hazard indices; however, the areas could be more meaningful if they represent 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, storage tanks/hydrants), and structure density could inform integrated ratings of community susceptibility to wildfire of different intensities.

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

Combined with susceptibility information at either of the scales described above, the likelihood and intensity data can be used to calculate relative wildfire risk to entire communities or individual parcels. With spatial data for all three sides of the wildfire risk triangle, a metric called Net Value Change 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 Net Value Change 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.

4.2.3 Improve Risk Assessment Information

The importance of high quality, current risk assessment information is critical to the success of this planning effort. Data used in the risk assessment must have adequate quality and resolution to facilitate accurate modeling of the risks. Assessment of wildfire risk also requires detailed, accurate information on development patterns in the WUI, changes in fire suppression resources and methods, and the effects of recent fires. The following steps should be taken to improve the risk assessment analysis and information:

1. Resulting landscape changes from the 2018 wildfire season should be incorporated into an updated wildfire risk assessment. This would require extensive field work and data analysis.
2. Compile parcel-level assessment data to inform and complete risk assessment, increase first responder information, and encourage public engagement. Parcel-level assessment data would not only provide the susceptibility information required for a complete risk assessment, but also provide valuable information for fire districts and residents to guide private property mitigation efforts.

<http://dnrc.mt.gov/divisions/forestry/fire-and-aviation/fire-prevention-and-preparedness/home-fire-risk>

4.2.4 Risk Assessment Summary

The 2017 wildfire season was one of the worst fire seasons in Montana history, with the highest number of acres burned in over a century. In 2017, a total of 1,366,498 acres burned in Montana (NIFC, 2018, www.nifc.gov). Gallatin County was fortunate in 2017 and did not experience a major wildfire that season. Nonetheless, fuels mapping should be updated to facilitate analysis of current wildfire risk based on the most recent information.

5 A COHESIVE STRATEGY APPROACH IN GALLATIN COUNTY

5.1 OVERVIEW

The National Cohesive Wildland Fire Management Strategy “Cohesive Strategy” (USDA, USDO, 2014) is a strategic push to work collaboratively among all stakeholders and across all landscapes, using best science, to make meaningful progress towards the three goals:

- / Resilient Landscapes
- / Fire-Adapted Communities
- / Safe and Effective Wildfire Response

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, to live with wildland fire.

The planning process for this CWPP includes integration with the National Fire Plan, HFRA, Disaster Mitigation Act, and Cohesive Strategy, all of which promote local collaborative processes. Goals for restoring resilient landscapes, improving wildland fire response, and creating fire-adapted communities must work within the bounds of local budgets, personnel, and equipment. The efforts and success of the Gallatin County CWPP hinge on the funding and expertise of the local fire management districts and agencies as well as the cooperative efforts of landowners to empower local communities and citizens to pursue and implement projects that protect people, property, and infrastructure from wildland fire without diminishing the private property rights of land/asset owners within Gallatin County.

The guiding principle for this strategy is: to engage Gallatin County residents, communities, businesses, non-profits, and local, state, and federal governments to empower each other to prepare for wildfire through:

- / Community engagement and develop awareness of community roles in preparing for wildfire;
- / Effective administration of wildfire hazard mitigation grant programs that leverage additional resources for implementation;
- / Hazard risk assessments; and,
- / Strategic, efficient, and effective fuels treatments.

5.1.1 Objectives

The following objectives are presented to define the Cohesive Strategy in Gallatin County and provide a roadmap for implementation.

1. Engage citizens in the challenges of wildfire preparedness in Gallatin County using the tools and guiding principles set forth by the Fire Adapted Communities Learning Network (FACLN).
2. Seek out, encourage, and empower local community leaders in the wildfire preparedness roles of business, fire response, homeowners, land managers, and local government at multiple scales across Gallatin County.

3. Determine areas at risk to wildfire and establish/prioritize mitigation projects that utilize both conventional and alternative treatment methods to protect people, homes, infrastructure, state and federal listed species, and natural resources throughout Gallatin County.
4. Improve the ability of fire departments/districts/service areas to provide emergency fire response for the residents of Gallatin County through improved resources, training, and equipment.
5. Through strategic planning, develop and implement policies or protection measures that discourage further unmitigated development in high fire risk areas.
6. Implement vegetation management and other types of projects that promote the natural fire regime appropriate to the location for the benefit of the ecosystem and to lessen the risk of uncharacteristic wildland fire occurrences.
7. Promote recognition and utilization of the Gallatin County CWPP, empower local leadership and help leverage resources and opportunities to achieve shared goals without reducing the autonomy of individual communities and residents.
8. Provide direction through specific wildland fire prevention or protection action items to all members of the community to encourage individual responsibility including residents and homeowners, fire and emergency responders, forest and land managers, civic and community leaders, and designers and developers.

Each of the following sections provides an overview of the topic, local information, and strategies and resources to address the goal. Specific actions are provided in the Action Table (Section 6.3).

5.2 RESTORING AND MAINTAINING RESILIENT LANDSCAPES IN GALLATIN COUNTY

Through fire suppression and human development, coupled with a changing climate, the interaction of terrestrial ecosystems and wildland fire has 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. An ecosystem-based approach to fire management that incorporates prescribed fire, mechanical thinning, and other vegetation management practices in overall land management planning objectives is important to both achieve desired fire effects and mitigate undesirable fire effects on the ecosystem and the built environment. Post-wildfire recovery is an important component in resiliency to ensure that any negative fire effects that impact the ecosystem and community can be minimized. With a diverse land ownership across the county, restorative land management will require a collaborative effort among multiple stakeholders.

5.2.1 Ecology/Ecosystem-Based Fire Management

Restoration and maintenance strategies should align with the Cohesive Strategy, as outlined below, and integrate the following goals:

- / 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, which are also under-represented, across the landscape.
- / Control and eradicate invasive and noxious weeds.

5.2.2 Fuel Treatments for Landscapes (Public and Private)

Healthy, thriving ecosystems are less vulnerable to extreme wildfires that can devastate watersheds, destroy wildlife habitat, and risk lives. Healthy ecosystems can adapt to climate change, invasive species, and insect infestations. In many areas, aggressive fire suppression has limited the extent wildland fires leaving forests and grasslands crowded with flammable vegetation. Climate change has made fire seasons longer and droughts and insect infestations worse. Entire landscapes are now vulnerable to devastating, extreme wildfires. Thinning, prescribed fires, and managing naturally caused wildfires to achieve natural resource management objectives can help prevent extreme wildfires with minimal impacts to air quality while smoke from extreme wildfires may pose significant risks to public health and safety.

The USFS is working with partners to restore healthy, resilient, fire-adapted ecosystems. Restoring ecosystems includes thinning crowded forests and using prescribed fire to prevent the buildup of flammable vegetation that feeds extreme wildfires. Assessments of more than 1,400 fuel treatments since 2006 have shown that they are effective in reducing both the cost and damage from wildfires. In certain locations, when and where conditions are right, naturally caused wildfires can be managed to perform their natural role in controlling fuel buildup, rejuvenating vegetation, and restoring ecosystems that benefit from fire. **Table 5-1** provides a list of proposed and recently completed USFS fuels reduction projects in Gallatin County. The USFS will continue to work with partners to identify additional areas for fuels treatment that meet the goals of this CWPP.

Table 5-1. Proposed and Recently Completed USFS Fuels Reduction Projects (USFS, Custer-Gallatin N.F. ¹)

Project Name	Proposed Areas (Acres)	Legal Location	Burn (Y/N)	Implementation Date
Gallatin Canyon East				2022
South Plateau				2021
North Bridgers Forest Health Project	2,560	T1N, R6E & R7E; T1S, R6E & R7E	Y	July 2019
Bozeman Municipal Watershed Project	4,700	T3S, R5E & R6E	Y	late-2019 (tentative), continue 5 – 12 yrs.
North Hebgen Multiple Resource Project	5,900	T11S, R4E & R5E; T12S, R4E & R5E; T13S, R5E	N	begin 2019, continue for 8 – 12 years
Lonesome Wood Vegetation Mgmt. 2 Project	2,575	T11S, R3E; T12S, R3E; T12S, R4E; T13S, R4E	Y (potential on 325 ac.)	began 2017, to continue for 6 - 8 years
Rendezvous Ski Trails Forest Thinning Project	250	T13S, R5E; T14S, R5E	N	2015 (fall) – 2018 (fall)
South Bridger Interface Project	250	T1N, R7E; T1S, R7E	N	2015 (completed)
Hebgen Basin Fuels Reduction Project	1,610	T12S, R5E; T13S, R5E	Y	2011 (completed)

¹ Accessed from [Custer-Gallatin National Forest Project Archive](https://www.fs.usda.gov/wps/portal/fsinternet/cs/projects/custergallatin/landmanagement/projects?archive=1&sortby=1) list on Jan. 8, 2019. URL: <https://www.fs.usda.gov/wps/portal/fsinternet/cs/projects/custergallatin/landmanagement/projects?archive=1&sortby=1>

Lands owned and managed by state (DNRC) and municipal (City of Bozeman) entities have also been proposed for forest health and fuels reduction projects. **Table 5-2** provides a list of proposed and recently completed projects on state and municipal land.

Table 5-2. Proposed and Recently Completed Fuels Reduction Projects on State and Municipal Land

Project Name	Proposed Areas (Acres)	Legal Location	Burn (Y/N)	Implementation Date
Limestone West Timber Sale Project (DNRC-Bozeman Unit)	448 (proposed in Final EIS, modified Alternative A)	T2S, R6E; T3S, R6E	N	<i>Conservation license and 25-year logging deferral issued by DNRC in April 2019, effectively cancelling the project</i>
Bear Canyon Timber Sale Project (DNRC-Bozeman Unit)	674	T2S, R6E; T3S, R6E	N	2011
Sourdough Creek Municipal Watershed Fuels Management Project (City of Bozeman)	400	T3S, R6E	N	2019

The 2006 Gallatin County CWPP recommended that fuels mitigation work be conducted on private property, and suggested the county identify landowners that are willing to create defensible space or a general wildfire mitigation area as a demonstration project. It was further suggested that efforts be coordinated with the CGNF and the DNRC. No specific areas or projects were identified on privately-owner lands; however, moving forward the following general fuel treatment guidance is recommended:

- / Design and prioritize fuel treatments (prescribed fire and mechanical treatments) to reduce fire intensity, structure ignition, and negative wildfire impacts to identified assets.
- / 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.

5.2.3 Prescribed Fire

Prescribed fire is a planned fire used to meet management objectives. Following many years of fire exclusion, an ecosystem that needs periodic fire becomes unhealthy. Trees are stressed by overcrowding; fire-dependent species disappear; and flammable fuels build up and become hazardous. The right fire at the right place at the right time:

- / Reduces hazardous fuels, protecting human communities from extreme fires;
- / Minimizes the spread of pest insects and disease;
- / Removes unwanted species that threaten species native to an ecosystem;
- / Provides forage for game;
- / Improves habitat for threatened and endangered species;
- / Recycles nutrients back to the soil; and
- / Promotes the growth of trees, wildflowers, and other plants.

The USFS manages prescribed fires and even some wildfires to benefit natural resources and reduce the risk of unwanted wildfires in the future. The agency also uses hand tools and machines to thin overgrown sites in preparation for the eventual return of fire.

5.2.4 Post-Fire Effects and Recovery

Several post-fire outcomes can result from either wildfire or prescribed burn events. Prescribed fire planning goals and objectives are typically defined by desired ecosystem or hazard reduction results. 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 conditions.

Wildfire events can result in significant post-fire impacts – both positive and negative. Risk assessments can provide guidance in anticipating post-wildfire impacts, 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.

5.3 PROMOTING A FIRE-ADAPTED GALLATIN COUNTY

Promoting fire-adapted communities focuses on preventing, preparing for, and protecting lives and properties during wildfire events and ensuring a full recovery. The National Wildfire Coordinating Group defines a fire-adapted community as “A human community consisting of informed and prepared citizens collaboratively planning and taking action to safely coexist with wildland fire.” More fully, a fire-adapted community is a knowledgeable, engaged community where actions of residents and agencies in relation to infrastructure, buildings, landscaping and the surrounding ecosystem lessen the need for extensive protection actions and enable the community to safely accept fire as part of the surrounding landscape.



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 USA™ and Ready, Set, Go!, develop a CWPP, enhance local capacity, conduct fuel reduction and forest management activities, and use codes and ordinances to regulate development in fire-prone areas. In Gallatin County, the Montana State University (MSU) Extension office administers several projects that are targeted at creating fire-adapted communities and provides information, materials and short-courses designed to reduce wildfire risk and promote forest stewardship. Wildfire Preparedness Kits are available to provide individuals and agricultural producers with several resources regarding preparing for, responding to, and recovering from wildfire. Through education, fire-adapted communities realize that living with wildfire is an ongoing process, not an event, and continually work in their areas to manage vegetation, improve response for first responders, and be ready to evacuate at any time.

The more actions a community takes, the more fire-adapted it becomes. However, because communities have limited resources, strategic identification of actions is necessary to best leverage fire adaptation at the local level. Promoting a fire-adapted Gallatin County also requires alignment with activities for restoring resilient landscapes and improving wildfire response.

5.3.1 Community Values

Gallatin County has many community values that could be vulnerable to wildfire. These values at risk, which should be considered when devising plans for fire-adapted communities, include:

- / Homes, businesses, and commercial areas;
- / Communication and power generation facilities and power transmission lines;
- / Transportation corridors and airports;
- / Community water supply areas (watersheds), creeks, rivers, and lakes;
- / Forested areas and open space;
- / Aquatic and terrestrial wildlife;
- / Air quality, public health and life safety;
- / Local, state, and federal recreational lands;
- / Historic sites and cultural areas; and,
- / Critical infrastructure and facilities (i.e., hospitals, schools, etc.).

Gallatin County's values at risk are further detailed in other local plans, including the 2018 update to the county's Hazard Mitigation Plan (HMP), which is the parent document to this CWPP. The Gallatin County Growth Policy and the City of Bozeman Community Plan discuss local values at risk, including public infrastructure, parks, trails, wildlife, fisheries and cultural resources.

5.3.2 Community Development and Growth Trends

Over the last decade, Gallatin County has experienced unprecedented growth, resulting in rapid changes in land use, ownership, and development patterns. The county's population has increased 25% between 2010 and 2018 (U.S. Census, 2019), and it has more than doubled since 1990. To address current and anticipated changes, the county must consider how wildfire can be further integrated into planning and development decisions. The following examples of growth trends and patterns highlight these issues:

- / Transition of agricultural, forest and riparian lands to developed land is expanding the WUI. Development that is proposed in hazardous areas (as shown on the wildfire hazard maps) should incorporate strategies that reduce risk to structures and life safety.
- / Continued growth in seasonal and second-home markets, particularly in amenity and/or vacation-driven areas, including Big Sky, Bridger Canyon/Brackett Creek, Jackson Creek, Hebgen Basin, and edges of the Gallatin Valley (Gateway, Hyalite/Sourdough Canyon areas, Bear Canyon and Springhill area), 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, population changes, or varying levels of awareness regarding wildfire concerns.

Figure 5-1 (Headwaters Economics, 2018) shows changes in home construction within Gallatin County from 1990 – 2016. A quick review of these maps shows that home construction has increased substantially not only near population centers, but also in less-developed areas such as Big Sky, Bridger Canyon, and the Clarkston area. In the five-year period (2013-2018), the number of building inspections within the City of Bozeman more than doubled from 18,627 to 37,583 (City of Bozeman, 2019). This substantial increase in building activity within Bozeman is indicative of continued outward expansion of the city towards undeveloped lands and, due to potential increases in the building approval process timeline within city limits, may also result in increased development pressure in more rural areas of the county.

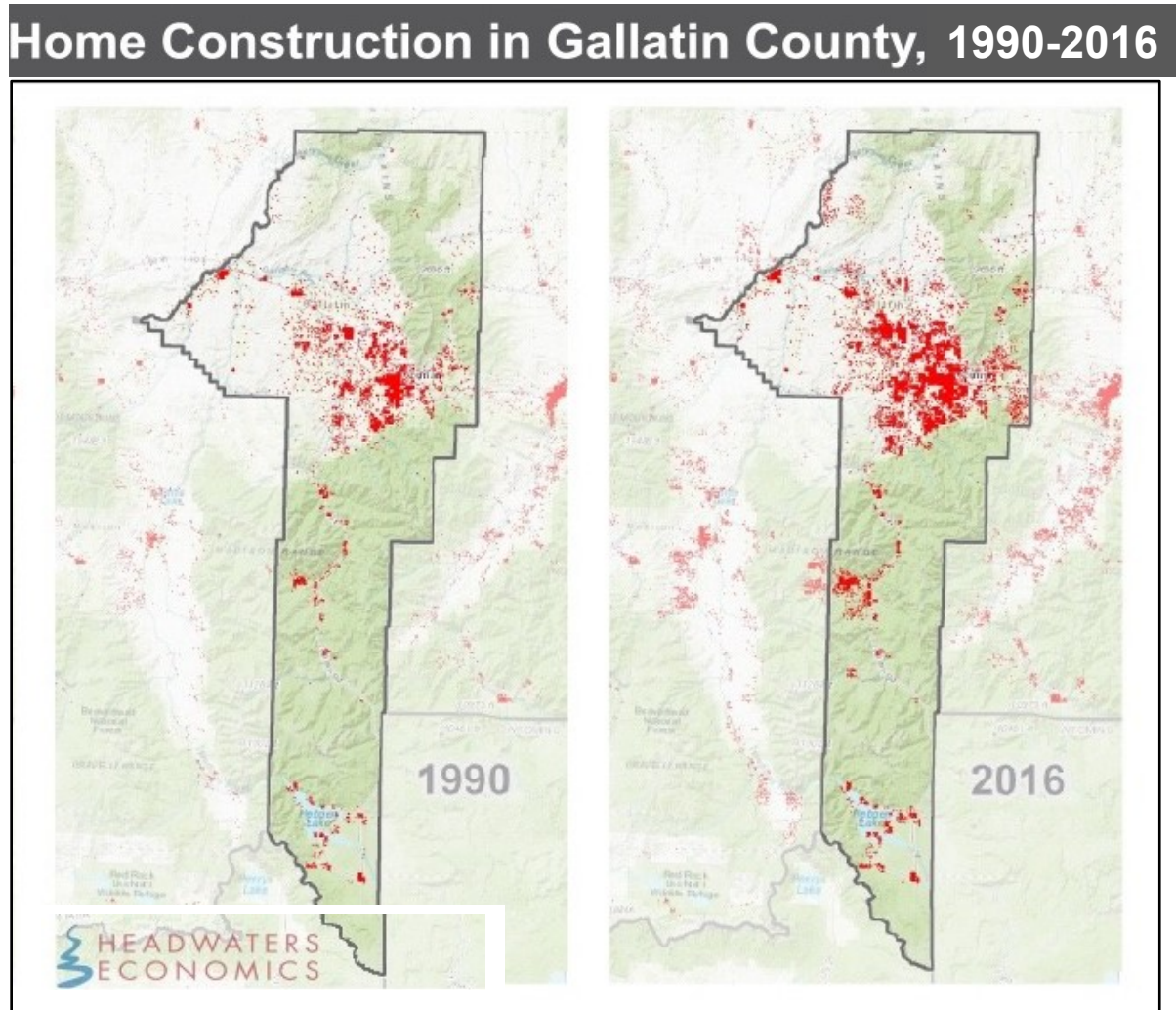


Figure 5-1. Change in home construction within Gallatin County, 1990- 2016 (Headwaters Economics, 2018).

5.3.3 Increasing Community Fire Adaptation and Reducing Structural Ignitability

Recent and future development changes, combined with an increase in wildfire risk, highlight the need for Gallatin County to develop strategies to plan for and adapt to wildfire. Strategies must consider a range of current and future community values, including existing and new homes, vulnerable populations, critical facilities and infrastructure, recreational amenities, and businesses. Strategies can take the form of new policies and regulations, education and outreach activities, or other actions that encourage community members to prepare for, and adapt to, future wildfire events.

Headwaters Economics, 2018, Gallatin County’s Economy, Growth, and Open Space. <https://headwaterseconomics.org/wp-content/uploads/Report-Gallatin-Countys-Economy.pdf>. Accessed April 2019.

The following strategies are focused on leveraging existing county documents and programs to increase their visibility across the county. The actions listed are also captured in the Action Table (Section 6.3).

5.3.3.1 Promote Implementation of WUI Policies and Regulations

Important county and city planning documents already incorporate wildfire topics into their goals and actions, including the Gallatin County Growth Policy, City of Bozeman Community Plan, Belgrade Growth Policy, Gallatin Triangle Planning Study, and the 2018 update to the Gallatin County HMP. For example:

- / The Gallatin County Growth Policy, Chapter 3.14, **Goal #1: Protect Human Life and Property from Natural Hazards**, includes a policy to, “*Consider the adopted Gallatin County Community Wildfire Protection Plan when reviewing development proposals.*” Development is discouraged in areas prone to wildland fire, and mitigation of fire hazards such as creation of defensible space for each structure is encouraged prior to final plat approval. Section 5.2 of the Growth Policy also provides guidelines for the **Evaluation of Subdivisions According to Primary Criteria**, one of which includes the proposed subdivision’s susceptibility to wildfire.
- / The Bozeman Community Plan (2009) mentions the potential for increased risk of wildfire due to climate change. **Appendix G: Environmental Quality and Critical Lands** includes a section that discusses the WUI (**Section G.1.8**). It promotes an understanding of fire behavior, including fire intensity, vegetation characteristics, and building materials, and the need to keep these factors in mind when building structures in wildfire-prone areas. References are provided for preparing a CWPP. The Bozeman Fire Department coordinates with other fire departments in the valley through mutual aid agreements to address issues of regional concern such as the WUI. The City of Bozeman has been a participating jurisdiction in hazard mitigation planning and preparation of a countywide HMP since the initial plan was completed in 2006. The City was also a key participant in development of the initial Gallatin County CWPP in 2006. The Community Plan describes how planning mechanisms, such as subdivision regulations, can address future development parameters including defensible space, access, and water supply. Local codes also provide improved opportunities for public health, first-responder and community safety, and welfare.
- / The 2018 HMP update contains a goal to **Reduce Impacts from Wildfire (Goal 1)**. The objectives under Goal 1 focus on: 1) reducing private losses in the WUI, 2) increasing the understanding of wildfire hazard areas, and 3) assisting property owners in completing mitigation measures. Specific projects identified include: 1) fuels mapping and reduction, 2) conducting individual WUI assessments, 3) developing defensible space requirements and subdivision regulations for wildfire/WUI areas, and 4) creating fire-adapted communities through implementation of programs such as Firewise. This CWPP update (2018) has been closely tied to the 2018 HMP update and is designated as an official Attachment (**Attachment A**) to the HMP.

This CWPP leverages existing HMP goals to advance risk reduction by providing more detailed implementation guidance. CWPP actions are designed to build on current WUI community actions in the Growth Policies/Plans and 2018 HMP update.

Specific CWPP actions to address development include:

1. Update the Gallatin County Growth Policy land use maps and local area plans, as needed and appropriate, using wildfire hazard area information to steer growth away from more hazardous areas.

- / Incorporating tools such as the updated WUI map and wildfire hazard assessment maps during growth policy updates and implementation ensures consistency of information among plans and informs future policy decisions.
- 2. Utilize zoning and zoning districts to implement land use map updates and 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.
- 3. 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.
- 4. Adopt development/subdivision 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.

5.3.3.2 Promote Wildfire Mitigation Strategy Education and 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, many of the local fire departments/districts host a variety of community outreach functions during the year (e.g., barbeques, pancake breakfasts) where a wide range of educational materials regarding wildfire preparation and safety are often available. Outside experts from various local (Gallatin County Extension), state (DNRC), and federal (USFS) agencies are often available at these functions to provide additional outreach to the public. These activities and types of information available can include:

- / Conducting free property assessments to help residents identify hazards;
- / Displaying up-to-date maps that show wildfire hazard areas and the WUI;
- / Providing current fire season forecasts or updates on any active wildfire events;
- / Promoting participation in Fire-Adapted Community programs to encourage neighborhood activities and local recognition;

- / Delivering Ready, Set, Go! program messages to residents to help them prepare for wildfires and evacuations; and,
- / Working with local schools on youth education programs.

Both the HMP update and various Growth Policy/Planning documents can also be used to message and promote the use of educational materials to residents and landowners in hazardous areas.

Specific CWPP actions to enhance outreach and education include:

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 in educating other audiences in community fire adaptations. Working with these groups by providing specific resources and messaging materials can accelerate local efforts to reduce wildfire risk.
2. Update County Extension and Emergency Management websites with best practice wildfire education resources and materials.
 - / Gallatin County Extension and Emergency Management can post the latest wildfire planning, protection and mitigation 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 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 USA or Ready, Set, Go! (supported through local agencies), and the development of local CWPPs or similar fire plans.

5.4 INCREASING WILDFIRE RESPONSE THROUGHOUT GALLATIN 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.

In addition to fire suppression resources available within the fire protection districts, seasonal wildland firefighters are available through USFS, DNRC, and the National Park Service (NPS). 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.

5.4.1 Emergency Preparedness/ Evacuation

Emergency evacuation procedures are the responsibility of local law enforcement agencies. 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.

5.4.2 Ready, Set, Go! Program

The Ready, Set, Go! Program seeks to develop and improve the dialogue between fire departments and the residents they serve. The program helps the fire service teach individuals who live in high-risk wildland fire areas—and the WUI—how to best prepare themselves and their properties against wildland fire threats. The program’s tenets help residents be Ready with preparedness understanding, be Set with situational awareness when fire season begins, and to Go early, when necessary, as fire threatens. The Ready, Set, Go! Program works in complementary and collaborative fashion with the Fire Adapted Communities Coalition and existing wildland fire public education efforts and amplifies their message to individuals about emergency preparedness and evacuation. Ready, Set, Go! provides educational and outreach materials to limited English speakers, standardizing the message and ensuring that information is accurate across languages.



Figure 5-2 Ready, Set, Go! Infographic.

5.4.3 Primary Stakeholders and Response Areas

5.4.3.1 Fire Departments, Districts and Service Areas

Most communities within Gallatin County are within the jurisdiction of one of the legally recognized, community-based rural fire districts, fire service areas, or a municipal fire department (refer to **Table 5-3**). Within the WUI Intermix areas there is often concurrent fire protection, with a local fire agency and the USFS both having jurisdiction. Of the 15 fire protection agencies across Gallatin County, only the Bozeman Fire Department has an all-paid staff. Big Sky, Central Valley, Hebgen Basin and Hyalite fire districts 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.

Table 5-3. List of fire departments, districts, and service areas in Gallatin County.

Fire Dept., District or Service Area	Communities Served	Response Area (acres)
Amsterdam	Amsterdam, Churchill, Camp Ck. Road, area north of Hwy. 84 (MM 17-26)	56,795
Big Sky	Big Sky Meadow/Mtn. Village, Moonlight/Spanish Peaks Clubs, Hwy. 191 (MM 43-61)	37,293 (incl. area in Madison Co.)
Bozeman	within city limits of Bozeman, I-90 (MM 304-309), Montana State University	12,873
Bridger Canyon	Bridger Canyon (Hwy. 86 MM 4-17), Bridger Bowl, parts of Jackson Ck/Brackett Ck Rds.	26,071
Central Valley	City of Belgrade, Hwy. 85 (Jackrabbit Ln.), I-90 (MM 292-304), Springhill/Rocky Mt. Rd., Gallatin R. (4 Corners-Central Park), E. Gallatin R. (Riverside-Dry Ck.), Dry Creek Rd., Bozeman-Yellowstone International Airport	117,718
Clarkston	Clarkston, E. side of Missouri R. (Eustis north to Lombard), west side of Horseshoe Hills	15,333
Fort Ellis	I-90 E. of Bozeman (MM 309-322), Bozeman Trail Rd., Bear & Kelly Canyon, Trail Ck Rd.	38,810
Gallatin Gateway	Gallatin Gateway, Hwy. 191 (MM 61-Four Corners), area south of Hwy. 84 (MM 20-29), Cottonwood Rd. east from Hwy. 191 to Cottonwood Canyon, portions of Gooch Hill Rd.	67,917
Gallatin River Ranch	residential ranch community in Horseshoe Hills, north side of Gallatin/E. Gallatin Rivers	7,475
Hebgen Basin	W. Yellowstone, Hebgen & Quake Lakes basin with approx. borders of Hwy. 20 (south), Hwy 191 (east), Township 10-11S line (north), Madison Co. (west), & Idaho (southwest)	126,666
Hyalite	areas south/west of Bozeman, from Triple Tree to Four Corners; also responds into Sourdough/Leverich/Hyalite Canyons and numerous county “islands” within Bozeman	29,431
Manhattan	Town of Manhattan, I-90 (MM 283-292), Gallatin R./E. Gallatin R. north of T1N/T1S line	37,597
Sedan	Sedan, Hwy. 86 (MM 22-31[Park County line]), east side of Flathead Pass	32,248
Three Forks	City of Three Forks, Madison R. valley south to Black’s Ford, Headwaters St. Park, I-90 (MM 272-283), Note: district extends NW into Broadwater County from T3N to south	108,403 (incl. area in Broadwater Co.)
Willow Creek	Willow Creek, south/east side of Jefferson R., Sappington Jct., Note: district extends NW into Jefferson County	75,510 (incl. area in Jefferson Co.)
County Fire	All lands (private and state) outside of local fire districts/service areas or a municipal department, and which is not protected by the federal government (USFS or NPS)	268,344

5.4.4 Additional Stakeholders

In addition to fire suppression resources available within the fire protection districts, wildland firefighters are available through the USFS and NPS. 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.

5.4.5 Suppression Responsibilities

When an unplanned wildland fire (wildfire) is discovered in Gallatin County, a fire response crew from a local fire response jurisdiction or a USFS ranger district may respond, depending on its location. The Gallatin County 911 Communications Center is the Public Safety Answering Point (PSAP) for the county. For wildfire incidents occurring on federal lands, the Bozeman Interagency Dispatch Center (BZC) leads communication with response resources. Each dispatch center utilizes 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.

5.4.6 Interagency Agreements

Through pre-established mutual aid agreements, all fire suppression resources in Gallatin 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 South Central Montana Zone Multi-Agency Coordinating Group (MAC), within the Northern Rockies Coordinating Group (NRCG), which allows all responsible jurisdictional agencies to coordinate resources and priorities throughout the South-Central Montana Zone during fire season. The South Central Zone MAC Group consists of representatives from:

- / CGNF;
- / National Park Service;
- / Gallatin County Fire Warden;
- / Montana DNRC; and,
- / Park County (MT).

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

5.4.7 Current Suppression Challenges and Limitations

5.4.7.1 Areas without Organized Fire Response

Approximately 268,300 acres of private land in Gallatin County are located outside of an organized fire protection agency (i.e., local fire district or service area), a DNRC-mandated wildland fire protection district, or Affidavit lands. 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 for purposes of this CWPP) 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 Cooperative Fire Control Program (Co-op Program). Lands without fire protection are located throughout Gallatin County (Rural Fire Protection Operating Plan, 2015). Some of the larger examples include the following areas, where specific Response Plans have been developed: Spanish Creek, Norris, Horseshoe, Maudlow, Sedan, and islands of unprotected land surrounded by, or adjacent to, Bozeman city limits (primarily off Griffin and Bridger Drives).

5.4.7.2 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 department that rely on volunteer responders. 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.

5.4.7.3 Response Area Commitment

Many of the local fire jurisdictions 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 heavy, multiple fire load scenarios that these resources are relied upon for mutual aid will be over-committed.

5.4.8 Improving Response

Specific CWPP actions to improve wildfire response capabilities are:

1. Promote and support fire departments/districts to increase capacity and funding. Stakeholders and all levels of government should work together in developing a coordinated approach to increasing capacity and funding with respect to wildfire response.
2. Develop local Pre-Suppression Plans (“Pre-Plans”) to improve wildfire response effectiveness and strategy. A Pre-Plan is an intelligence packet that assists incident commanders, operations section chiefs, structural protection specialists, division supervisors, group supervisors, taskforce leaders, and strike team leaders in formulating a plan based on current conditions, forecast weather conditions, locations and maps of fixed resources (e.g., water supply, safety zones), and listings of additional resources and contact information. The main objective of the plans is to have a well-thought out strategy based on the conditions and deployment of resources before the fire occurs. Wildland firefighting and structural protection/defense requires judgment based on many years of actual firefighting experience, and must be responsive to actual, on the ground conditions. No amount of classroom training or simulations can prepare an individual for the leadership required during large, fast-moving fires, but preparing the available information in ways that can facilitate that leadership is key to effective wildfire response.

6 CWPP ACTION PLAN

6.1 OVERVIEW

This chapter of the document focuses on putting the CWPP into action. The first section provides an overview of stakeholders associated with this CWPP to promote an understanding of the roles and responsibilities for each entity. The second section provides an action plan to guide stakeholder implementation activities. This ensures the CWPP process continues to move forward in a meaningful way. Finally, additional guidance on plan maintenance outlines key considerations to ensure the plan stays current and is updated regularly, so that it remains relevant into the future.

6.2 STAKEHOLDER ENGAGEMENT

Each stakeholder in the CWPP shares a role, whether it be agency-, landowner-, or non-governmental organization-affiliated. The success of this CWPP requires the participation of all stakeholders to engage in understanding of their role and taking appropriate actions.

6.2.1 Residents and Homeowners

Gallatin County's local fire protection agencies cannot always protect everyone from wildfire, especially if homeowners haven't taken responsibility for ensuring firefighters can safely work in the area. By creating a defensible space around individual homes and communities, reducing hazardous fuels in the surrounding area, and ensuring that access routes will support fire apparatus, homeowners can greatly increase the likelihood that their property will survive a wildland fire event. It is imperative that homeowners work with their neighbors and communities to increase safety and reduce risk for the greater protection of all.

6.2.2 Fire and Emergency Responders

There are several resource and capability enhancements identified by the fire and emergency responders in Gallatin County that are related to response and treatment of defensible space, egress/ingress, capacity, equipment, and planning efforts (see **Appendix A: Fire District and Department CWPP Surveys**). Implementation of response action items will rely on either the isolated efforts of the rural fire districts or a concerted effort by Gallatin County to achieve equitable enhancements across all districts.

6.2.3 Civic and Community Leaders

Wildfire mitigation efforts must be supported by a set of policies and regulations, where appropriate, as well as guidelines at the county and community levels that maintain a solid foundation for safety and consistency. They must also be supported by the public infrastructure, economy, and value system. Critical infrastructure refers to the communications, transportation, power lines, and water supply that service a region or a surrounding area. All these components are important to southwest Montana and to Gallatin County specifically. These critical networks are, by definition, a part of the WUI in the protection of people, structures, infrastructure, and unique ecosystems. Without supporting infrastructure, a community's structures may be protected, but the economy and way of life lost.

6.2.4 Forest and Land Managers

There are many land management issues associated with wildfire that can have lasting effects on natural resources as well as communities and local economy. In addition to the immediate responsibility of wildfire suppression, land managers at all levels; local, state, and Federal, must also be aware of and plan for the

long-term impacts and implications of wildland fire on the landscape. Undeveloped private and public lands serve many purposes and are highly valued for their ability to provide habitat for animals, recreational and hunting opportunities, timber resources, etc. Wildfire affects each of these values in different ways some of which are very direct such as loss of timber assets, but some are subtle and take place over long periods of time such as the loss of native seed sources due to repeated burning. Increasing cohesiveness of land management across boundary jurisdictions will reduce risk and increase efficiency. **Table 6-1** identifies roles that community members at the local, state, and federal levels play in Gallatin County’s resilience to wildfire and risk reduction.

Table 6-1. Overview of CWPP Stakeholder Roles

Stakeholder Group	Overview of Roles
City, County, and Local Partners	
Elected Officials	<ul style="list-style-type: none"> <li data-bbox="833 680 1448 772">/ Gallatin County Commission has jurisdiction and power to represent the county and has care of county property, management, and business concerns. <li data-bbox="833 779 1448 871">/ Gallatin County Sheriff is an elected position that has responsibility to enforce state and county laws and statutes. <li data-bbox="833 877 1448 999">/ The Bozeman city commission, and the city and town councils and mayors of Belgrade, Manhattan, Three Forks, and West Yellowstone are elected to represent citizens of those jurisdictions.
Gallatin County Planning Department	/ County Planning and Community Development is responsible for long-range planning, administration of subdivision, zoning, and floodplain regulations, and coordination of community and economic development efforts.
Local Fire Depts. and Fire Districts/Service Areas	/ Responsible for community fire response and protection services for local jurisdictions across Gallatin County.
Gallatin County Rural Fire (“County Fire”)	/ Responsible for fire response and protection services on county lands that are outside of local fire agency (local fire dept./district/service area) or federal jurisdiction.
Gallatin County Emergency Management	/ Coordinates interagency emergency response within Gallatin County and provides outreach, planning, and training for “all hazards” and all phases of emergency management – mitigation, preparedness, response, and recovery.
Gallatin City-County Health Department	/ Protects and promotes the health of county citizens and the environment, including air quality.
Gallatin County residents, landowners, and community organizations	<ul style="list-style-type: none"> <li data-bbox="833 1707 1448 1766">/ Responsible for personal property and engaging in community projects. <li data-bbox="833 1772 1448 1864">/ Community councils participate in planning process by facilitating communication between communities and local government. <li data-bbox="833 1871 1448 1940">/ Includes private landowners; and citizens/entities with large land holdings (e.g., Turner, Yellowstone Club)

Non-governmental stakeholders	<ul style="list-style-type: none"> / Includes stakeholders from Southwest Montana Building Industry Association, Gallatin Association of Realtors, and other industry professionals. / Volunteer organizations, resource conservation groups (e.g., Gallatin Conservation District, Greater Gallatin Watershed Council, Gallatin River Task Force), community development groups (e.g., HRDC, Big Sky Community Organization), Chambers of Commerce, utilities (Northwestern Energy), Gallatin Valley Land Trust, university partners, and other business entities.
MSU Extension – Gallatin County	<ul style="list-style-type: none"> / MSU Extension – Forestry, Natural Resources / Fire Adapted Communities Learning Network
State Partners	
Montana Dept. of Natural Resources & Conservation	/ Protects lives, property, and natural resources from wildfire by providing safe and effective services to Montana’s citizens as well as leadership, coordination, and resources to the state’s wildfire organizations.
FireSafe Montana	/ Private, non-profit organization coordinates and supports a statewide coalition of diverse interests working together to help Montanans make their homes, neighborhoods, and communities fire safe.
Federal Partners	
U.S. Forest Service (USFS)	<ul style="list-style-type: none"> / Manages land in Gallatin County within Custer-Gallatin National Forest (CGNF), Bozeman and Hebgen Ranger Districts, and a small portion of the Helena National Forest (HNF), Townsend Ranger District, in the northernmost extent of the county. Also manages USFS lands bordering Gallatin County: in Park County (CGNF, Bozeman, Gardiner and Yellowstone Ranger Districts); in Broadwater County (HNF, Townsend Ranger District); in Madison County (CGNF, Bozeman Ranger District, and Beaverhead-Deer Lodge National Forest, Madison Ranger District), and in Idaho (Caribou-Targhee National Forest, Ashton/Island Park Ranger District).
U.S. Dept. of Interior, Bureau of Land Management	/ Manages public lands out of the Butte 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.
National Park Service, Yellowstone National Park	/ Manages land within Yellowstone National Park, a portion of which is located in southern Gallatin County.

6.3 ACTION PLAN

The proposed action plan consists of categories that correspond to the three emphasis areas of the Cohesive Strategy, including 1) fire adapted communities; 2) fire resilient landscapes; and 3) response. Natural vegetation and habitat restoration activities are incorporated into fuels reduction projects. As part of the Cohesive Strategy and intent of the CWPP, an additional category was added, 4) Risk Assessment.

Recommendations are organized into categories and listed in order of priority. Projects that address human safety issues will be of a higher priority than projects that benefit homes. No home is worth a life. Creation of a proactive, knowledgeable community through education and outreach was identified as one of the most important tools to be included in the plan. The objective of this portion of the plan is to provide information to landowners and visitors to increase knowledge and understanding of fire related issues. The creation and maintenance of fire resilient landscapes, both around homes and across the landscape, is also a priority. Implementing defensible space around homes is a priority for fuels reduction, as well as fuels reduction across the general landscape.

The following Action Plan (**Table 6-2**) 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 6-2. Action Plan

Action	Lead(s)	Priority	Timeframe	Notes
Risk Assessment				
1. Develop the Gallatin County Risk Assessment, including WUI mapping.	County, USFS	High	2019 (as part of CWPP update)	
2. Compile parcel-level assessment data to inform and complete risk assessment, increase first-responder information and encourage public engagement	Fire Districts, County	High	2020/ongoing	/ Utilize Situation Analyst Montana system for standardization
3. Creation of a Cohesive Strategy Working Group (CSWG) in Gallatin County	USFS, Custer Gallatin Working Group (CGWG), Gallatin Forest Partnership	High	2020	
4. Update risk assessment information annually to include changing development patterns, changes in fire suppression resources and methods, effects of recent fires, and other information to facilitate risk modeling and project prioritization	CSWG	Medium	Initiate in 2021	/ A high-quality, current risk assessment is important to facilitate good decision making. Annual updates would aid in project planning, depending on data availability, and staff and financial resources.

Action	Lead(s)	Priority	Timeframe	Notes
Resilient Landscapes				
5. Review and identify priority landscapes, and design and prioritize potential treatment options, to reduce fire intensity, structure ignition, and negative wildfire impacts to identified assets.	CSWG	High	2021	/ To follow after creation of CSWG
6. Advance prescribed fire activities.	CSWG	Medium	2022	
Fire Adapted Communities				
7. Update County Growth Policy and land use map and local area plans, as needed and appropriate, using wildfire hazard information to steer growth away from more hazardous areas.	County Planning	High	To occur according to Planning Dept. timelines for Growth Policy updates	/ Update growth policies and develop future land use maps and local area plans, using wildfire hazard information to steer growth away from more hazardous areas
8. Implement land use map updates using zoning to guide growth to more appropriate areas and away from more hazardous areas	County Planning	Medium	Occurs in conjunction with land use mapping updates	
9. Use land conservation tools such as the open space bond to buffer developed areas from wildfire.	County Planning	Medium	Ongoing (dependent on availability of Open Space funds)	
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 development regulations that incorporate best practices, including changes to building code, zoning code, or subdivision regulations.	County Planning	Medium	Timeframe based on future growth and development patterns	/ Consider inclusion of structural building or WUI codes in the County Growth Policy update that is currently in progress
11. Engage with industry professionals on mitigation programs, activities, and opportunities to improve public education and outreach across neighborhoods and communities.	County Planning, All Hazard All Discipline (AHAD) Group	Medium	Initiate in 2020	/ Engage realtors, insurers, developers, and builders to provide info. on fire-safe const. and landscaping

Action	Lead(s)	Priority	Timeframe	Notes
12. Update GCEM website with wildfire education, resources and material.	GCEM	Medium	Ongoing	
13. Promote neighborhood and community development activities and evacuation plans through programs such as Fire Adapted Communities and Ready, Set, Go!	GCEM	High	Ongoing	/ Meet with and provide neighborhood groups with risk assessments, educational materials, and fuels reduction cost-sharing to assess conditions and assist with improvement and mitigation at the neighborhood scale
14. Apply for and administer cost-sharing grants to assist private landowners with fuels reduction, structural improvements, and other projects designed to lessen risk from wildfire.	CSWG	Medium		/ Work with private landowners on fuels reduction and ‘hardening’ of homes with fire resistant roofing, siding, vents, and other improvements to reduce loss potential
Improved Response				
15. Promote and support local fire districts to increase capacity, funding opportunities, and volunteer firefighter recruitment and retention.	GCEM	High	Ongoing	/ Provide support through County Fire Program with RFA and other financial programs
16. Develop pre-suppression action plans – Improve response by planning wildfire suppression tactics, first responder and community safety and preparedness.	County Fire, local fire districts	High	Ongoing (several pre-plans are already in-place)	/ Develop fire district-level wildfire pre-plans for Incident Management teams and local fire response

Action	Lead(s)	Priority	Timeframe	Notes
17. Improve response by widening and/or resurfacing roads or adding second egress to communities that have only one egress/ingress route.	Local RIDs, HOAs/subdivisions	High	Based on available funding and scheduled maintenance activities	/ Identify communities' egress/ingress on a case by case basis and recommend actions to improve road access and provide safer response Refer to Appendix A for CWPP questionnaire responses regarding egress/ingress issues
18. Improve response by implementing addressing at a neighborhood level	Local communities, neighborhoods, and fire districts			
19. Establish, maintain, and update wildland fire response agreements (mutual aid) between the county, local fire districts, and state and federal agencies.	GCEM, County Fire, local fire districts	Medium	Ongoing	

6.4 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 significant 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 Hazard Mitigation Plan (HMP) 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; and,
- / 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 Gallatin County increases its capacity for resilient landscapes, fire adapted communities, and efficient response capabilities.

Appendix A:

Stakeholder and Public Engagement during CWPP Update Process

The CWPP update began in September 2017 and occurred over the course of 20 months. During this update process, two separate CWPP drafts were shared with stakeholders and the public via the Gallatin County Emergency Management (GCEM) website. Input and comments were requested from the public. The process was coordinated by the project consultant, RESPEC, who worked with the GCEM Director, Mr. Patrick Lonergan, to develop the document. The CWPP update occurred concurrently with the 5-year update of the Gallatin County Hazard Mitigation Plan (HMP), and many of the stakeholder meetings and presentations addressed content and planning for both the CWPP and HMP updates. This appendix provides an overview of the CWPP engagement process.

Initial Stakeholder Outreach (September 2017)

An initial set of 120 stakeholders were contacted to inform them about the CWPP and HMP updates and invite their participation in the update process. Stakeholders represented county and city departments, local elected offices, federal and state agencies, fire departments/districts/service areas, and nonprofit organizations.

Stakeholder Kick-Off Meetings (October 2017)

Stakeholders had the opportunity to meet face-to-face with representatives from the project consultant, Mr. Mike Rotar and Ms. Libby Ellwood of RESPEC, at kick-off meetings held at seven different locations across Gallatin County, October 12 – 24, 2017. Meeting locations included: Bozeman, Belgrade, Manhattan, Three Forks, West Yellowstone, Big Sky, and Gallatin Gateway. A kick-off presentation of the project was also provided at the bi-monthly, All Hazards All Discipline (AHAD) meeting in Bozeman on October 26, 2017. The purpose of the kick-off meetings was to introduce the update process for the two documents. Specific to the CWPP, discussion focused on the value of CWPPs and their local application, guiding documents and legislation, and status of Wildland-Urban Interface (WUI) mapping in the county.

Approximately 40 different stakeholders attended one or more of these kickoff meetings.

Stakeholder Meeting, AHAD Group (June 27, 2018)

A presentation describing progress with the CWPP update was given by RESPEC at a regular AHAD meeting on June 27, 2018. The primary purpose of this meeting was to discuss several topics specific to CWPP development, including WUI definitions, and review of several wildfire risk assessment mapping products. These risk assessment maps (Wildfire Intensity, Probability, and Relative Hazard) are developed based on existing physical parameters (weather data, topography, and vegetation) combined with computer simulation of fire starts and potential growth development. The resulting output and mapping provide spatial context and information regarding where different wildfire management and mitigation strategies are likely to be most effective.

15 stakeholders attended this meeting.

Stakeholder Webinar, WUI Discussion (November 27, 2018)

A webinar was held to discuss an initial draft of the WUI Mapping with stakeholders. WUI mapping was presented and the methodology for developing the map was explained. A further refined map of the Relative Wildfire Hazard was also presented.

Approximately 12 stakeholders attended this webinar.

Public Review and Comment Period (January - June 2019)

Initial drafts of both the CWPP and HMP documents were made available for public and stakeholder review in early January 2019. Draft documents were posted to the GCEM website and comments and comments and input requested.

A final draft of the combined document (HMP update, with CWPP update included as an Attachment) were made available for public and stakeholder review in late May 2019. Documents were posted to the GCEM website and input and comments requested from the public.

Stakeholder Meeting (January 22, 2019)

A presentation describing progress with the HMP and CWPP updates was provided by RESPEC on January 22, 2019. For the CWPP update topics included a final review of the WUI definition to be used, draft final WUI mapping and wildfire hazard mapping, and including WUI definitions, and a discussion of the Cohesive Strategy approach to be used to develop the CWPP Action Plan. A schedule was presented that outlined milestones throughout the coming months for completion of the document updates.

A **CWPP Questionnaire** was developed and sent to all local fire departments/districts/service areas to solicit input regarding identification of existing conditions within their jurisdictions, and to identify strategies for mitigation of wildland fire risk and to improve response capabilities. Copies of the returned questionnaires are provided in this Appendix.

12 stakeholders attended this meeting.

CWPP Questionnaires were returned by 5 local fire jurisdictions, and by the Custer-Gallatin National Forest

NOTE: Comments received during the public review and comment period in June 2019 will be reviewed, and incorporated into the CWPP update, as appropriate, prior to final CWPP adoption.