JENSEN HUGHES

SWEET GRASS COUNTY

Community Wildfire Protection Plan - Update

September 9, 2024

CWPP Update

PREPARED FOR

Sweet Grass County
Big Timber, MT 59011
Project #:1AWC23003.000

PREPARED BY

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ThickTimber_SweetGrassCO_MT_JHProp_Cooper

Executive Summary

The purpose of this Community Wildfire Protection Plan is to set forth standard agreed upon procedures and responsibilities to implement cooperative wildland fire protection on all lands within Sweet Grass County.

Members of the Sweet Grass County community, in cooperation with local, county, state, and federal agencies and other interested parties, have collaboratively developed the Sweet Grass County Community Wildfire Protection Plan (CWPP). The CWPP was created according to the Montana Department of Natural Resources and Conservation (DNRC) guidelines, the National Cohesive Strategy, and the Healthy Forest Restoration Act.

The *Sweet Grass County Multi-Hazard Mitigation Plan* completed in 2021 was used as reference in the development of this plan. All additional resource materials used and referenced throughout the document are listed in the Appendix.

This CWPP provides a science and engineering-based assessment of the wildfire risk within and surrounding the Wildland Urban Interface (WUI) of Sweet Grass County, Montana. This CWPP was developed through a collaborative process involving county officials, the local fire department, county, state, and federal-land management agencies, HOAs and other community members. Technical assistance was provided by US Forest Service (USFS), Montana State DNRC, Bureau of Land Management (BLM), and Sweet Grass County Geographic Information Systems (GIS) Department. This document meets the CWPP requirements set forth in the federal Healthy Forests Restoration Act which include:

+ Identifying and prioritizing areas for fuel reduction and mitigation projects.
+ Stakeholder collaboration.
+ Addressing structural ignitability.

A science and engineering-based hazard risk, and vulnerability assessment was performed using high-resolution topography, fuels, weather, and wildfire modeling technology to assess risk across the Sweet Grass WUI. The assessment focus was to identify areas of concern throughout Sweet Grass County and prioritize areas where the wildfire threat creates the greatest risk. (Section 6.0).

This document provides a framework for identifying, prioritizing, implementing, and monitoring wildfire hazards and risk reduction activities throughout Sweet Grass County Planning Area. For the purposes of this CWPP, the planning area is defined as the area where analysis and planning are implemented to manage wildfire risks and hazards.

This CWPP for Sweet Grass County is intended to be a living document that the County will update periodically in collaboration with all identified public and private stakeholders in the Planning Area and adjacent respective fire agencies.

Sweet Grass County, in collaboration with Local, State and Federal partners, will work to reduce wildfire risk and associated hazards through the use of strategies that include those identified in Section 6.0. These items include:

- Pre-Fire Planning.
- Short-Term (1-3 Years): Public education and outreach to promote and implement fire adapted community practices. Implement a biomass removal program and initiate mitigation for critical infrastructure and values at risk.
- Long-Term (3-10 Years and Beyond): Vegetation management and fuel reduction at the landscape scale and community level, including the enforcement of defensible space standards on private lands. Secure sustainable funding and determine return intervals on mitigation projects.
- Reducing structure ignitability by promoting and enforcing building codes, ordinances, and statutes.


Landscape_Sweet Grass CO_MT_Credit_JHProp_Cooper

Revision Record Summary

Version	Date	Description of Updates
0	07/18/2024	Final Deliverable: 2024 Community Wildfire Protection Plan Update
1	09/09/2024	Corrected Final Deliverable: 2024 Community Wildfire Protection Plan Update

Signatures

The 2024 Sweet Grass County Community Wildfire Protection Plan (CWPP) was developed in accordance with the Healthy Forests Restoration Act (HFRA 2003) and the Montana State Department of Natural Resources and Conservation. The plan was developed collaboratively with County stakeholders, including the local fire department and protection districts, city officials, federal, state, local, and private landowners, residents, community groups, and neighboring fire agencies. The plan includes a prioritized list of hazardous fuel reduction strategies, measures that community members can take to reduce structural ignitability, as well as recommendations on additional studies, policy changes, educational programs, and other initiatives that can be conducted to provide a more holistic wildfire mitigation strategy in all stages of wildfire disaster risk management (i.e., prevention/mitigation, preparedness, response and recover). The undersigned have reviewed the CWPP update and accept this document as the final draft.

JV Moody, Sweet Grass County Commissioner, Chair	Date
Kris Novotny, Big Timber Volunteer Fire Department, Fire Chief	Date
Alan Ronneberg, Sweet Grass County Sheriff's Office, Sheriff	Date
Cliff Brophy, Sweet Grass County Disaster & Emergency, 911 Coordinator	Date
Levi Duncan, Custer Gallatin National Forest, AFMO – Operations, Big Timber, Montana	Date
Angie Matos, Custer Gallatin National Forest, AFMO – Operations, Livingston, Montana	Date
Greg Oyler, Custer Gallatin National Forest, Fire Management Specialist	Date
Zachary Krohn, Custer Gallatin National Forest, District Zone FMO	Date
Joe Holzworth, SLO Area Manager	Date

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List of Acronyms

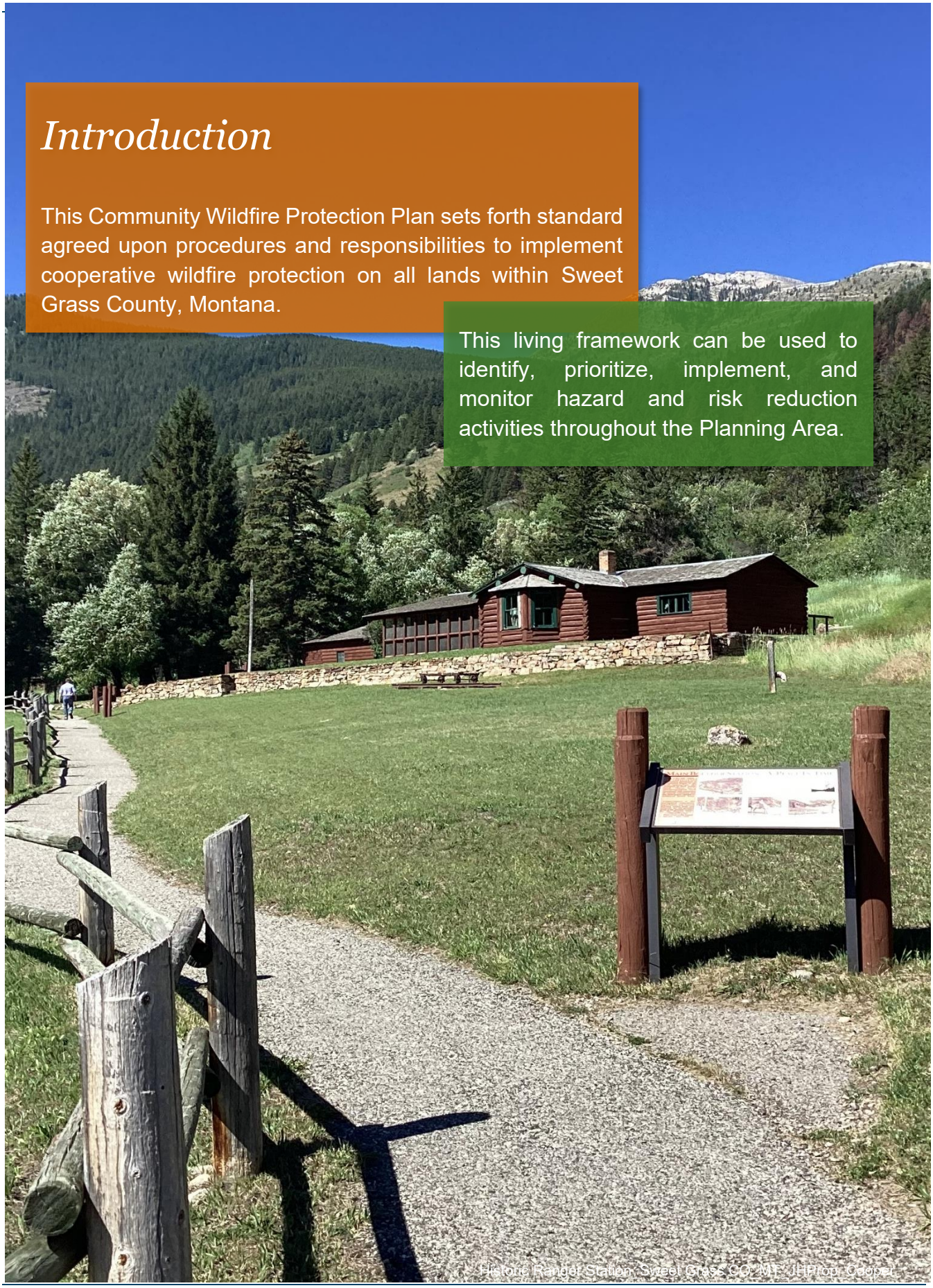
AHJ	Authority Having Jurisdiction
BAER	Burned Area Emergency Response
BLM	Bureau of Land Management
BLS	Basic Life Support
BMP	Best Management Practices
BTU	British Thermal Unit
CAP	Climate Action Plan
CAR	Communities at Risk
CWPP	Community Wildfire Protection Plan
DBH	Diameter at Breast Height
DHSEM	Division of Homeland Security and Emergency Management
EFF	Emergency Fire Funds
EMS	Emergency Medical Services
EMT	Emergency Medical Technician
ERC	Energy Release Component
ESHA	Environmentally Sensitive Habitat Areas
FAA	Federal Aviation Administration
FAC	Fire Adapted Communities
FBFM	Fire Behavior Fuel Model
FBO	Fixed Base Operator
FEMA	Federal Emergency Management Agency
FHSZ	Fire Hazard Severity Zone
FM	Fuel Model
GHG	Greenhouse Gas
GIS	Geographic Information System
GNA	Good Neighbor Authority
HFRA	Healthy Forest Restoration Act
HIZ	Home Ignition Zone
HOA	Homeowner's Associations
IBHS	Insurance Institute for Business and Home Safety

ICC	International Code Council
IRPG	Incident Response Pocket Guide
IPAWS	Integrated Public Alert and Warning System
IWUIC	International Wildland Urban Interface Code
NFP	National Fire Plan
NFPA	National Fire Protection Association
NIFC	National Interagency Fire Center
NIMS	National Incident Management System
NOAA	National Oceanic and Atmospheric Administration
NWS	National Weather Service
PIO	Public Information Officer
POD	Potential Operational Delineations
RAWS	Remote Automated Weather Station
RCP	Representative Concentration Pathway
RMACC	Rocky Mountain Advanced Computing Consortium RMACC -Rocky Mountain Area Coordination Center
SPEI	Standardized Precipitation-Evaporation Index
TL	Timber Litter
TRA	Temporary Refuge Area
USFS	United States Forest Service
UTV	Utility Task Vehicle
VPD	Vapor Pressure Deficit
WERF	Wildfire Emergency Response Fund
WFDSS	Wildland Fire Decision Support System
WIMS	Weather Information Management System
WRAP	Wildfire Risk Assessment and Portal
WUI	Wildland Urban Interface

Introduction

This Community Wildfire Protection Plan sets forth standard agreed upon procedures and responsibilities to implement cooperative wildfire protection on all lands within Sweet Grass County, Montana.

This living framework can be used to identify, prioritize, implement, and monitor hazard and risk reduction activities throughout the Planning Area.



Historic Ranger Station, Sweet Grass CO, MT. (JHProp Cooper)

1.0 Introduction

1.1 PURPOSE OF PLAN

The purpose of the Community Wildfire Protection Plan (CWPP) is to minimize the threat of wildfire to human life and well-being and to reduce the risk to community values. These values include residential structures, critical infrastructure, businesses, the natural environment, wildlife, watersheds, and historic/cultural resources within the Planning Area.

The CWPP is intended to serve as a guide for future actions of County officials, local fire protection districts, residents, businesses, homeowner's associations, local community groups, and other interested parties in their individual and collective efforts to reduce the potential wildfire risk to their communities and neighboring landscapes. Successful implementation and long-term sustainability are subject to available funding, collective action, engagement, and collaboration between stakeholder groups on all lands in Sweet Grass County.

The plan must meet the requirements for a CWPP established by the 2003 Healthy Forest Restoration Act (HFRA) and the Montana DNRC.

Figure 1: Fire danger sign in Sweet Grass County

1.2 GOALS + OBJECTIVES

Table 1: Goals + Objectives of the 2023 Sweet Grass County CWPP

Goals	*Objectives*
Minimize the wildfire threat to life safety.	+ Assess wildfire hazards and risks within the Planning Area and use the results to set priorities for reducing threats to life safety. + Review the existing public alert protocols and evacuation procedures for wildfires and make recommendations for enhancement, as necessary. + Develop fuel treatment methods and strategies for property owners and agencies that provide guidance on defensible space for structures and transportation routes in all types of wildland fuels. + Develop a GIS product for proposed vegetation treatments. + Improve collective action in reducing wildfire risk through enhancements to community engagement, participation, and education programs.
Reduce the wildfire threat to values/assets at risk	+ Identify values/assets at risk from wildfire in the Planning Area. + Utilize the wildfire hazard and risk assessments to develop prioritized mitigation strategies to reduce the threat to values/assets. + Identify and promote citizen-based actions that enhance structure hardening and the development of effective defensible space. + Identify strategies to reduce structure ignitibility.
Develop a community wildfire protection plan (CWPP) that sets priorities to mitigate risks and hazards identified.	+ Create a CWPP that meets the requirements of the 2003 HFRA and FEMA's local hazard mitigation plan. + Facilitate collaboration between stakeholders, land managers, residents, the County, and local fire protection districts to address potential wildfire hazards and risks. + Identify opportunities to further build community and regional partnerships for the Planning Area. + Engage communities and agency leaders using the steering committee and interested community leaders. + Develop a public education strategy to inform the public of the CWPP for guidance and implementation. + Identify initiatives to support and engage vulnerable populations in the community.

Goals	*Objectives*
Improve accountability, public trust, and efficiency in implementing action items identified in the CWPP.	+ Establish a plan to monitor and evaluate the County's progress in implementing action items and achieving the goals identified in the CWPP. + Create a method to monitor, track, and document completed action items identified in the CWPP. + Identify individuals responsible for conducting action items and establish accountability for actions through annual reporting to the County Commissioners.

A monitoring and evaluation plan has been developed and is included in Section 7.0 of this document to help manage the implementation of the action items identified above and to achieve the goals identified throughout the CWPP.

1.3 DEVELOPMENT TEAM

This section identifies the agencies, parties, or other organizations who were involved and provided input into the development of this CWPP. The roles and responsibilities are indicated in the table below.

Table 2: CWPP Development Entities + Roles/Responsibilities

CWPP Development Entities	*Roles/Responsibilities*
Sweet Grass County Office of Disaster and Emergency Services and Core Working Group (See Section 2.1.2 for specific agencies)	+ Manage CWPP development and consultants. + Grant funding for CWPP. + Coordinated public outreach. + Distribute media releases about CWPP. + Conduct direct outreach. + Coordinate with neighboring jurisdictions. + Provide general guidance, expertise, and support for CWPP.
The general public and other interested parties	+ Attend public outreach workshops. + Respond to the online survey. + Provide input on CWPP values at risk, areas of concern, community projects, and ongoing grass-roots initiatives.
CWPP Consultant: Jensen Hughes	+ Develop the CWPP. + Provide recommendations for projects. + Facilitate public engagement meetings.

1.4 POLICY + REGULATORY FRAMEWORK

The following codes, standards, policies, and regulations at the federal, state, and local levels were referenced in the development of this CWPP.

Federal	*Local*
- Healthy Forests Restoration Act -2003 - FEMA Hazard Mitigation Assistance Program and Policy Guide (HMA Guide) - Disaster Mitigation Act (2000–present) - National Fire Plan (NFP) 2000 - National Cohesive Wildland Fire Management Strategy (2023) - NFPA 1140 - National Incident Management System (NIMS)	- Office of Disaster and Emergency Services (DES) “Hazard Mitigation Plan” - Fire Restrictions - Collaborative Agreements - Annual Operating Plans

1.5 HEALTHY FORESTS RESTORATION ACT REQUIREMENTS

As part of the 2003 HFRA, there are three (3) minimum requirements for a CWPP, including:

- A CWPP must be collaboratively developed. Local and state officials must meaningfully involve federal agencies that manage land in the vicinity of the community, as well as other interested parties (particularly non-governmental stakeholders) that can work collectively to implement and manage wildfire risk mitigation measures and can help build a “culture of resiliency” at an individual and community-level.

Collaboration

- A CWPP must identify and prioritize areas for hazardous fuel reduction treatments on both federal and non-federal land, and recommend the types and methods of treatment that, if completed, would reduce risk to the community.

Prioritized Fuel Reduction

- A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the Plan.

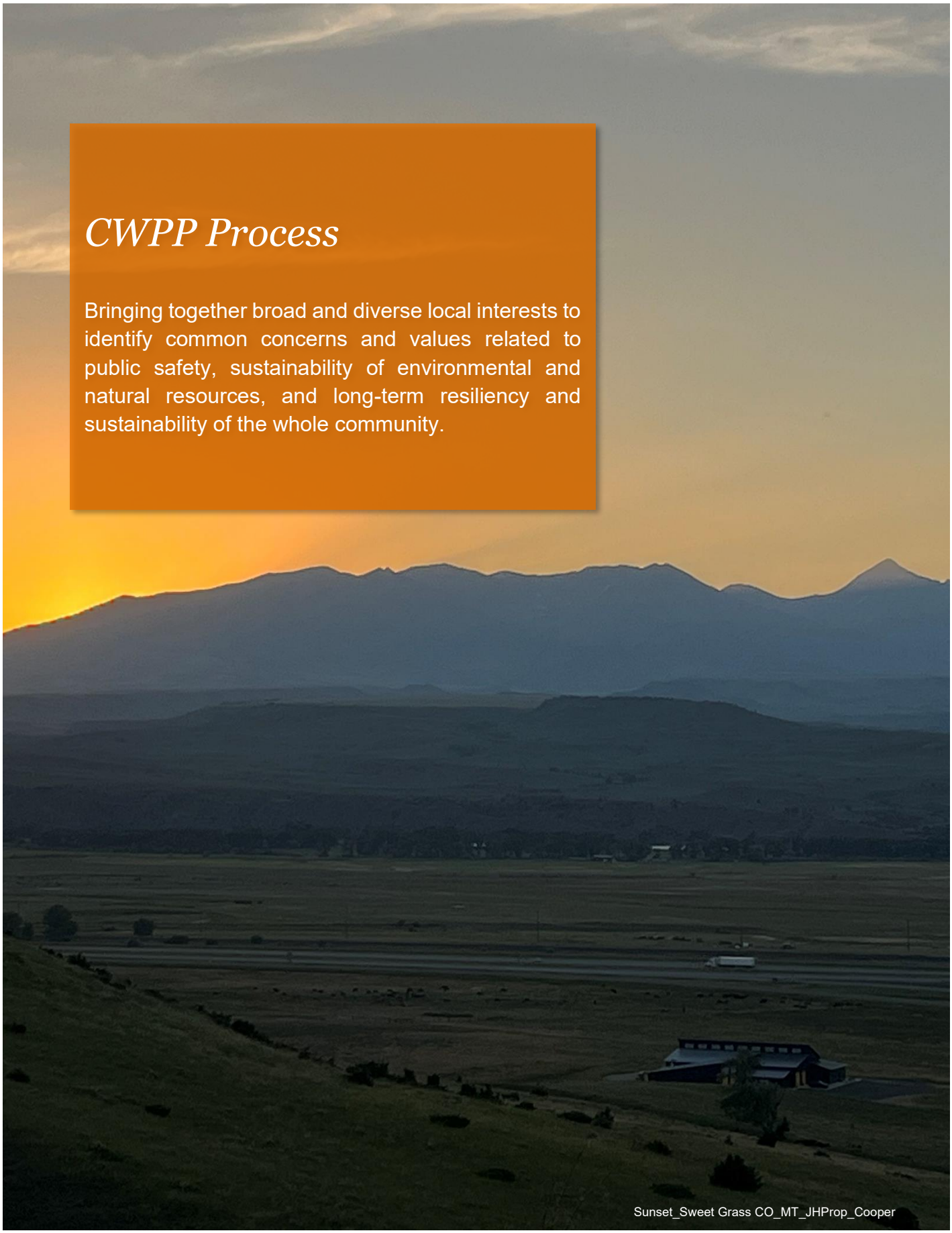
Treament of Structural Ignitability

1.6 FEMA INTEGRATED HAZARD MITIGATION PLAN ELEMENTS

FEMA hazard mitigation plans consist of four (4) core steps or elements that parallel those of the CWPP process. These steps are to organize the planning process and resources, assess risks and capabilities, develop a mitigation strategy, and adopt and implement the plan. These elements have been incorporated into this CWPP from the beginning stages of its creation, and their components can be found throughout the plan.

CWPP Process

Bringing together broad and diverse local interests to identify common concerns and values related to public safety, sustainability of environmental and natural resources, and long-term resiliency and sustainability of the whole community.



Sunset_Sweet Grass CO_MT_JHProp_Cooper

2.0 CWPP Process

2.1 COLLABORATIVE APPROACH

The development of a CWPP is a collaborative process where community stakeholders assess the wildfire threat, define the WUI boundaries, identify community values at risk, and ultimately develop prioritized mitigation measures and actions to increase community resilience. The language in the 2003 HFRA provides maximum flexibility for communities to determine the substance and detail of their CWPP action plan and the procedures they use to develop them. The CWPP planning process allows communities to create locally relevant plans that influence where and how federal agencies implement fuel treatment activities on federal land and distribute federal funds for projects on non-federal lands.

The CWPP planning process brings together broad and diverse local interests to identify common concerns and values related to public safety, environmental and natural resources, long-term resiliency and sustainability of the entire community. Since not all community members can attend workshops or meetings, it is vital to provide continuing opportunities in which the community can provide input, voice issues, and concerns, and participate in creating resilient communities.

As this CWPP is utilized and referenced annually as planning tool, the CWPP Process, below, is also important to reference regularly. This process and annual reference allow for the document to remain current and to remain a guidance tool for community members/stakeholders who value its content. Through annual meetings and maintenance of the CWPP, the effectiveness of the plan becomes part of the process to better protect the community.

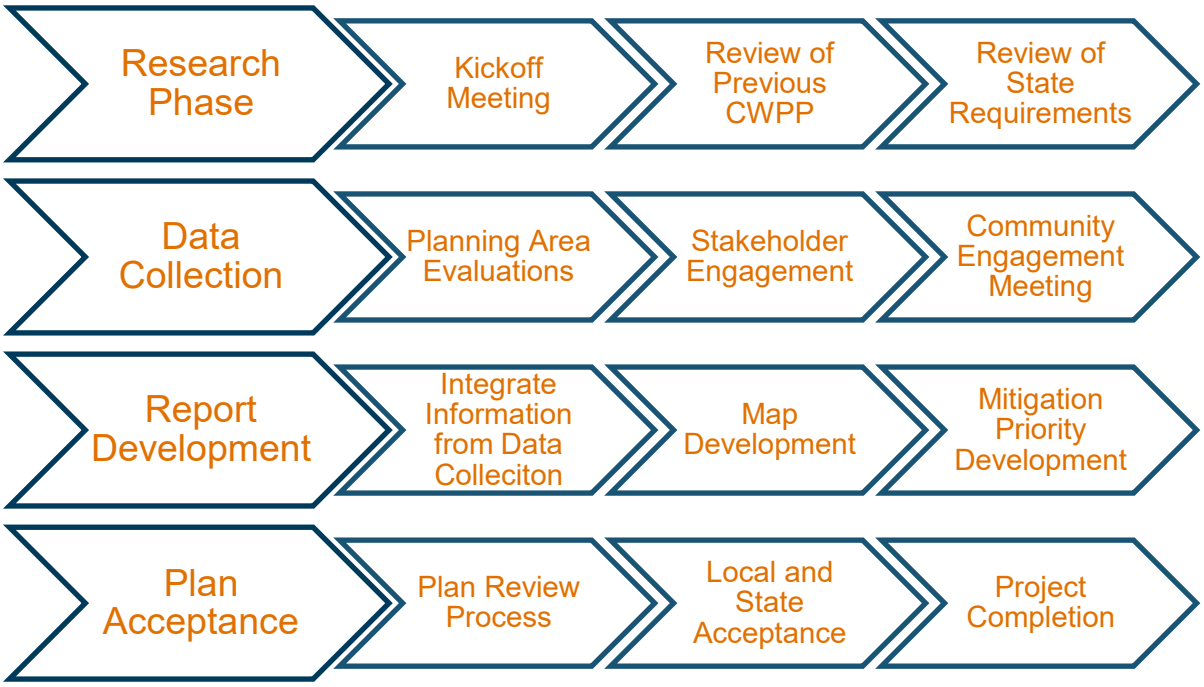


Figure 2: 2023 Sweet Grass County CWPP Process

2.1.1 Convene the Sweet Grass County CWPP Steering Committee

The CWPP update process was led by a core group of team members known as the steering committee. This committee included representatives from Sweet Grass County DES, Sweet Grass County Board of County Commissioners, and the Big Timber Fire Protection District. The steering committee was also responsible for overseeing the development, reviewing drafts, and approving the final version of the CWPP.

2.1.2 Agency and Community Organization Stakeholder Coordination

The CWPP team met with members of local agencies and interest groups, including utilities, environmental protection and sustainability groups, economic drivers, and agency representatives, to gain feedback and input on values important to the community. This information was used to reinforce and strengthen ideas presented in the CWPP.

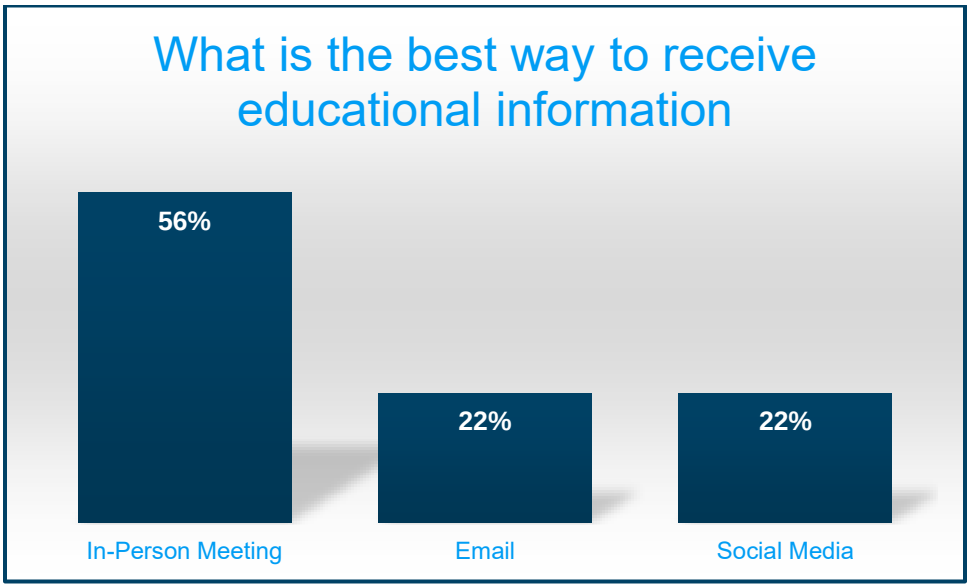
2.1.3 Community Engagement

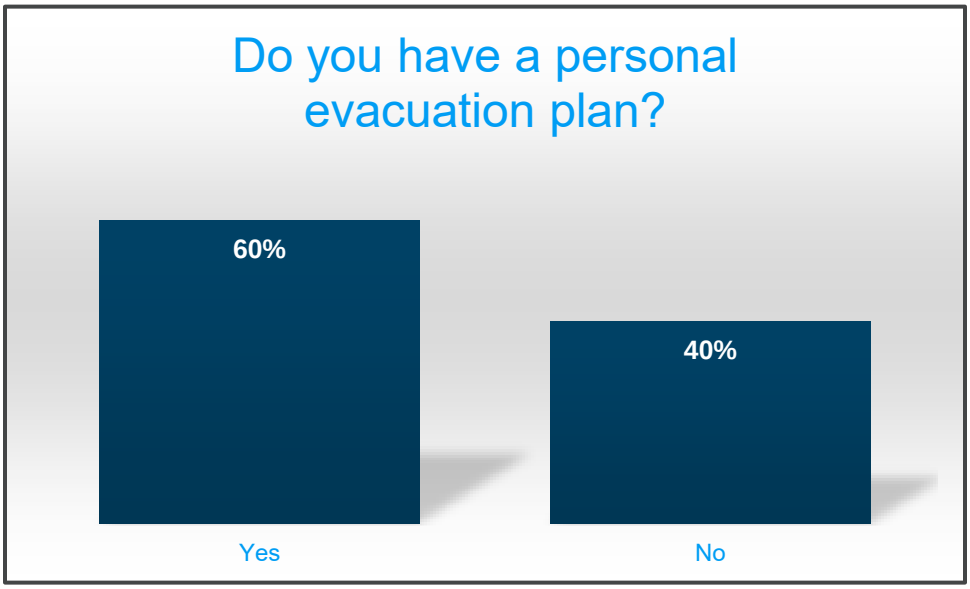
Figure 3: Sweet Grass community meeting

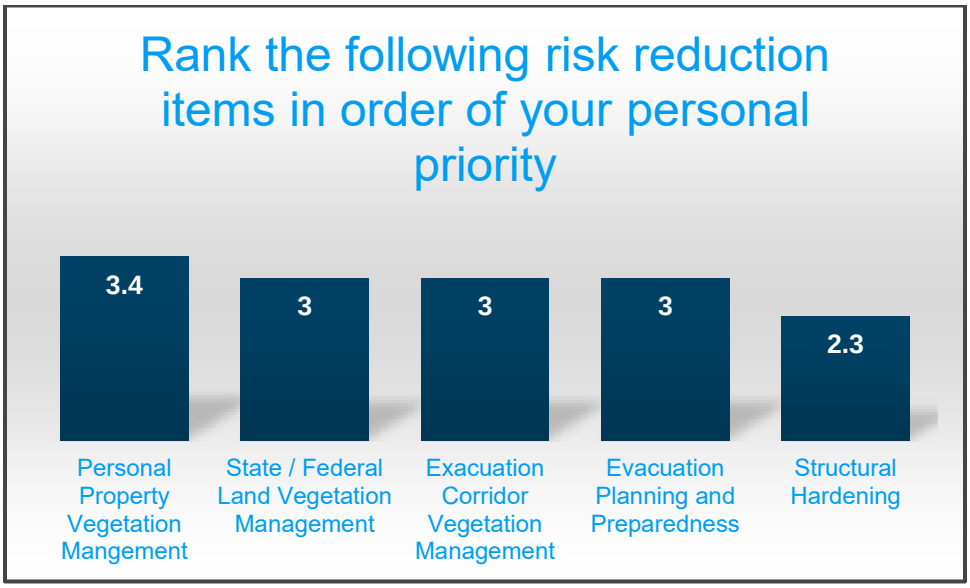
A community engagement event was held to solicit feedback from residents on the critical values at risk within the community and to gain an understanding of public awareness and perception of the wildfire problem. The meeting in Big Timber consisted of a presentation, polling/survey questions, and open discussion. The meeting was facilitated by Jensen Hughes, who had steering committee members present to engage in the discussion.

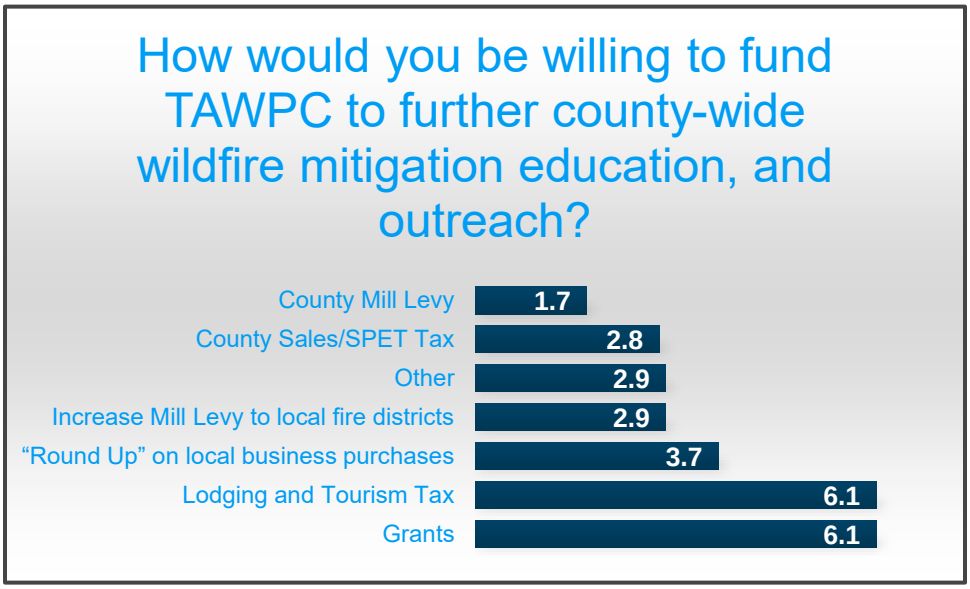
The input from the community engagement meeting polling was used to identify the community's values and where to focus efforts on fuel treatments and other risk reduction projects.

A sample of the polling results are below and found in Appendix G as well as the remaining polling outcomes.









Community Overview

Sweet Grass County is in southwestern Montana. It is the 37th largest county by size, out of 56, within the State.

Forest Clearing_Sweet Grass CO_MT_Credit_JHProp_Cooper

3.0 Community Overview

Sweet Grass County is a large and remote county covering just over 1,862 square miles, of which only 6.8 is water. The population is 3,715 (2022 census). The County is very remote with limited road access to many areas. Economic drivers and jobs include mining, agriculture, oil and gas, forestry, construction, recreation and health services. Sweet Grass County can experience fire seasons lasting from March through December. The Big Timber Volunteer Fire Department (BTVFD) oversees wildland fire protection throughout the county and has placed fire suppression apparatus in strategic locations

The Montana Department of Natural Resources, under the county co-op program, provides fire suppression to the county as well as the Department of Natural Resources and Conservation (DNRC), the Custer Gallatin National Forest, and the Bureau of Land Management. The County has experienced numerous lightning caused fires and has been experiencing increasing development in the WUI, potentially increasing the number of human-caused fires. This development also brings an increased demand for access/egress that already has limited capability. As the community growth continues, community leaders, stakeholders and residents must be proactive in managing increased wildfire risk.

Diamond Fire 2024, located just south of Greycliff and consumed about 650 acres.

Figure 4: Diamond Fire 2024

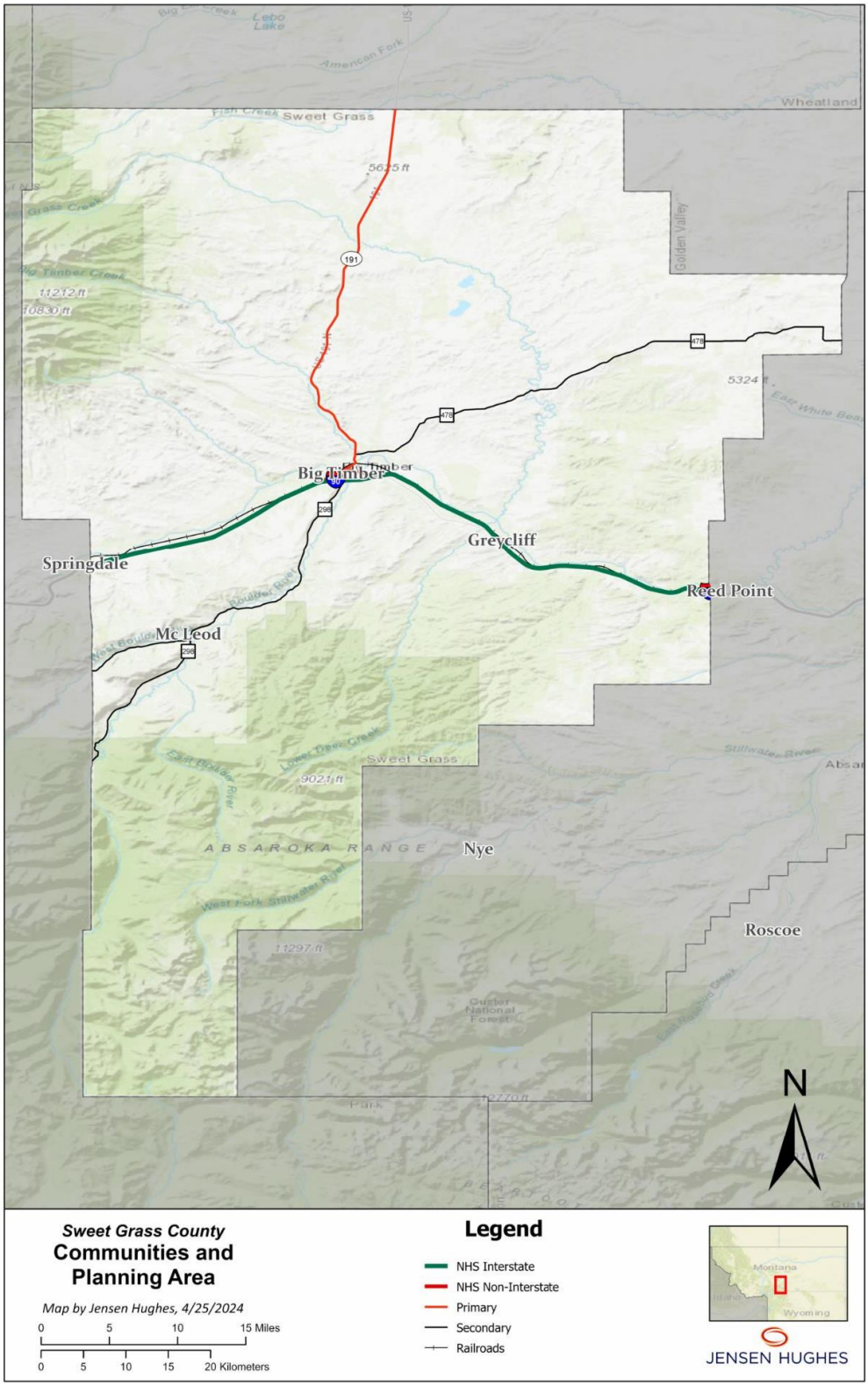


Figure 5: Communities and Planning Area map

3.1 WILDLAND URBAN INTERFACE

The WUI is defined as “A geographical area where structures and other human development meet or intermingle with wildland or vegetative fuels, resulting in the potential for ignition of the structures within the area from flames or firebrands from a wildland fire.”

3.1.1 Criteria for Mapping the WUI Areas

Sweet Grass County updated its WUI based on the formula of having at least 2.386 structures per square miles set forth as a guideline. Sweet Grass used this as a minimum reference in determining the WUI boundary for the county. As the boundary is defined, there are certain areas within Sweet Grass County where this minimum standard is insufficient based on past wildfire history and conditions unique to the areas within the County. Local authorities have identified less populated areas that are equally as important to protect as are those with higher populations and/or structures. These areas are referenced in this section and are covered more in-depth throughout this document. These areas were identified based on factors such as geographical terrain, single road access, and egress, extended travel times on narrow roads due to remoteness, narrow valleys and tall mountains hindering visibility, and extended response times by emergency services due to the aforementioned conditions.

3.1.2 Rationale for Mapping Additional WUI Areas

Additional areas were mapped and included in the WUI defined boundary. During community engagement meetings, members of the public expressed concern or comments and emergency response agencies also identified additional areas of risk. These include road access and egress limitations for evacuations and emergency response. Additionally, a concern for a wildfire threat to specific subdivisions and infrastructure were identified. These areas have been included in the expanded WUI mapping. See Appendix G for more information regarding community engagement.

Figure 6, identifies the WUI, throughout Sweet Grass County.

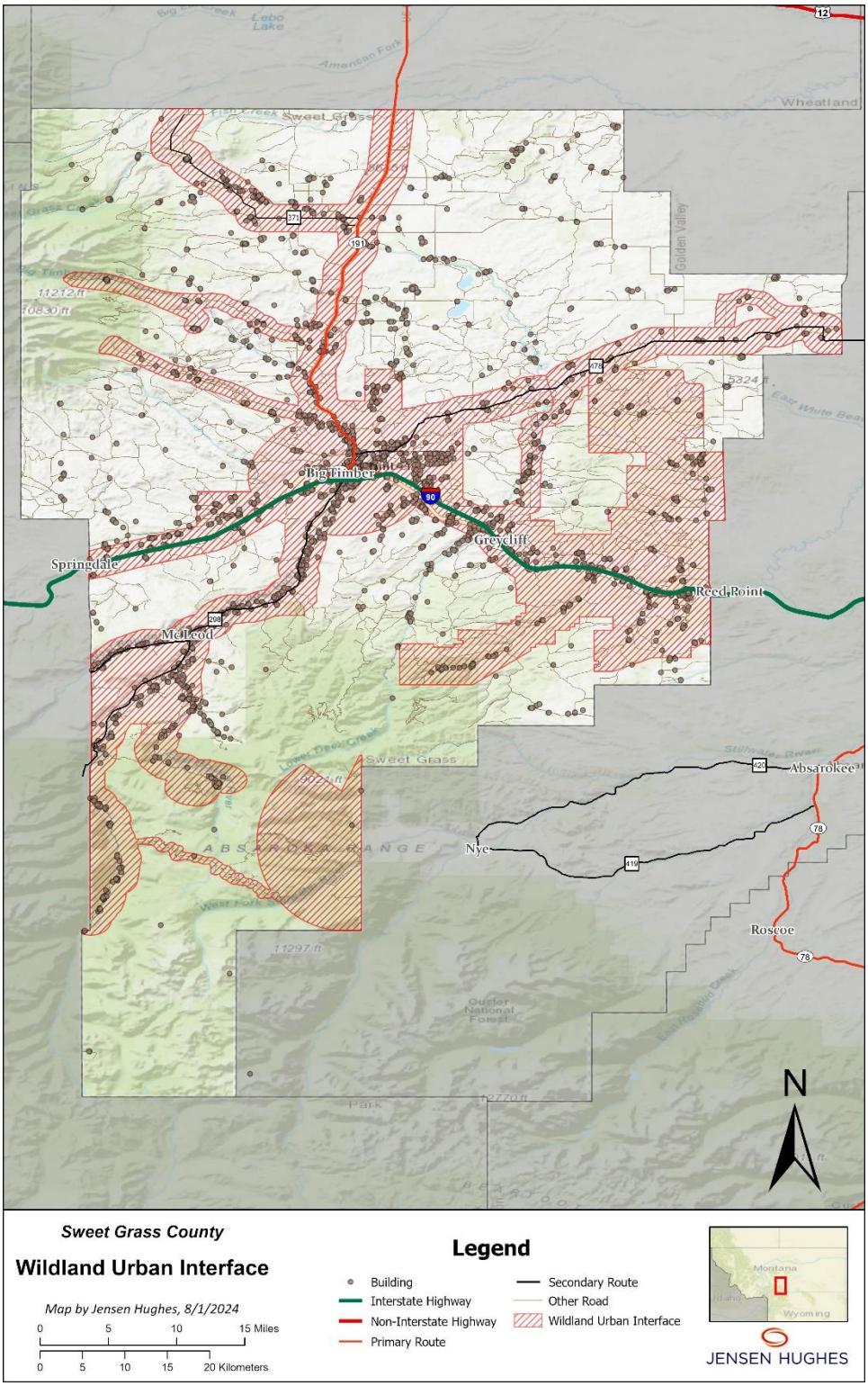


Figure 6: Wildland Urban Interface

3.2 VALUES AT RISK

Sweet Grass County thrives on recreation, agriculture, and timber harvesting. In addition, a large mining operation and several summer camps provide economic value to the county. Private property and forest health are also values at risk that are considered in the priority recommendations.

Figure 7: East Boulder Mine entrance

3.2.1 East Boulder Mine

The East Boulder Mine is an underground platinum and palladium mine that has operated since 2002. In addition to the underground operation, the property contains infrastructure and support buildings critical to the operation of the mine. The mine is accessible from two (2) portals. The mine infrastructure is resilient to wildfire due to the nature of the operation; however, life safety is a significant concern. Given the remote nature of the operation and limited access and egress, there is potential for workers to become trapped during a wildfire event and the mine to become filled with smoke. Special consideration should be given to protect the area surrounding the mine and employees.

3.2.2 Scenic Views and Visual Quality

Residents choose to live in locations like Sweet Grass County due to the natural environment's opportunities and beauty. Several participants in the community engagement meetings noted that they consider the environment a valued asset needing increased protection, particularly mitigation and hazard fuel treatments.

Figure 8: Sweet Grass County scenery

3.2.2.1 Recreation and Campgrounds

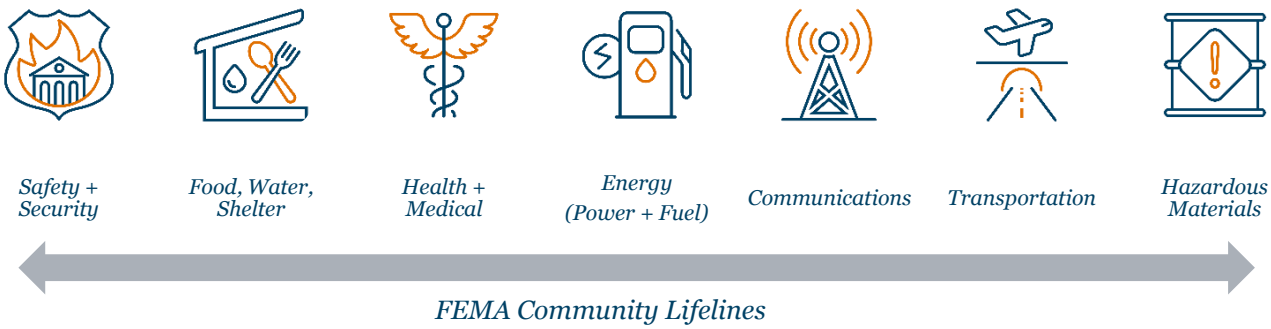
Numerous campgrounds and recreation areas exist throughout the county. These areas present a particular heightened threat to life safety. Many of these areas are remote, with little cell reception and limited access/egress. Special consideration should be given to developing a comprehensive list of these locations for future use. These areas are also critical for evacuations and should be treated as such.

Recreational and day-use activities (picnicking, fishing, hunting, hiking, mountain biking, skiing, etc.) are important to the area's economy. In addition to the recreation opportunities and camping on public lands, four active camps are situated on a dead-end road in the county's southern end. The camps are vulnerable to wildfire and should be a priority in mitigation efforts to protect the lives of campers and staff. Shelter-in-place planning may be a preferred alternative to evacuation, given the high population densities and limited access and egress to these camps. Consultation between the camp managers and mitigation actions should be discussed and considered.

Figure 9: Clydehurst Christian Ranch

3.3 FEMA LIFELINES

The FEMA Community Lifelines construct was used to identify values at risk within Sweet Grass County to establish planning and operational priorities. These lifelines are critical for the continuity of operations during and after an emergency event.



3.3.1 Safety and Security

- Law Enforcement Facilities: The Sweet Grass County Sheriff's Department provides law enforcement for the county and the City of Big Timber under an inter-local agreement. The department includes the Sheriff, Undersheriff, five (5) full-time Deputies, five (5) full-time Dispatchers, two (2) part-time Dispatchers, and 15 reserve officers for enforcement at special events. The Sheriff and Deputies are all stationed in Big Timber and an officer is on duty at the courthouse 24-hours per day. The 9-1-1 emergency number serves the entire county.
- Fire Protection: Federal, state, and local agencies support fire protection in Sweet Grass County. The Big Timber Volunteer Fire Department (VFD) oversees fire protection throughout the county. Refer to Section 3.5 for more details on specific station information and firefighting resources.
- Search and Rescue: Search and Rescue is provided by volunteers for minor incidents and is managed by the Sweet Grass County Sheriff's Office. There are currently eight (8) volunteers and one volunteer coordinator who supports the county.
- Government Services: Continuity of government functions is critical during and following a wildfire event. Government facilities and infrastructure are a significant component of maintaining continuity during an event. These facilities include the Office of Disaster and Emergency Services (DES), the Clerk and Recorder Office, the Assessor, Coroner, Motor Vehicle Registration, courts, the Regional Building Department, other government administration offices, both local and county, maintenance and equipment centers, schools, and historical and cultural resources.

  Sweet Grass County Disaster and Emergency Services (DES) supports emergency response agencies such as law enforcement, fire, and ambulance services for the county. DES supports and manages the Emergency Operations Center (EOC) during emergency events and provides public information to the community and responders. DES also supports grant funding that manages pre and post disaster funding opportunities for government services and respective emergency preparedness.

- Community Safety: Threats to the community from a wildfire event can include flooding, utility interruption, and infrastructure loss. Additional community components, such as protective actions, are included in the other FEMA Lifelines in this section. All emergency response agencies and volunteers support community safety. Through cohesion, cooperation, and coordination the Sweet Grass County can maintain increased community safety.

3.3.2 Food, Water, and Shelter

- Food: Commercial food distribution and supply chains are critical to maintain during and following a wildfire event. This is heavily dependent on the transportation corridors remaining open and viable. Section 3.3.6 will provide more information, including identifying transportation modes, corridors, and protection regarding transportation.
- Water: Big Timber obtains municipal water from two (2) sources, both from the Boulder River drainage. The primary source is an infiltration gallery with a peak supply rate of 2.1 million gallons per day, approximately seven (7) miles south of Big Timber. The water flows by gravity to a chlorinator house, where an automatic chlorinator adds chlorine. A seven-mile-long transmission line of a 14-inch pipe conveys the water by gravity from the chlorinator to a storage tank located south of the city. The gallery was originally constructed in 1934 and refurbished in 1959 and 1965.

  The second water source is an infiltration gallery located at the south end of McLeod Street. This source is rarely needed to meet Big Timber's demand rates. Chlorine is added by a chlorinator that operates with two (2) vertical turbine pumps, which pump the water into the distribution system. The original gallery was constructed near the turn of the century, and new galleries were built in 1981. The steel storage tank, with a capacity of 650,000 gallons, was built in 1981 and refurbished in 2006.

Figure 10: Boulder River

Groundwater wells are the primary source of domestic water for residents outside of Big Timber. Groundwater is readily available and usually good quality in the Yellowstone and Boulder River valleys.

The Sweet Grass County water supply, including water storage facilities and dams, could be similarly impacted by wildfires. Large acreage fires have demonstrated the importance of protecting watersheds. Heavy rains over the burned areas can potentially create significant flooding and runoff. This runoff damages roads and deposits extensive debris downstream from the burn scar. These damages include, but are not limited to, carbon particulate from burn scar runoff that can lead to damage to water treatment and filtration systems, heavy metal nutrient contamination, aquatic ecosystem damage to fisheries, and invasive plant species near waterways.

- Shelter: The county has identified several temporary shelter locations to be used in the event of an evacuation due to wildfire. Shelter sites should be hardened against wildfire and maintained in conditions suitable for sheltering. During emergency events, these shelters can consist of various locations. Follow DES or emergency manager instructions for all shelter locations.
- Animals and Agriculture: Agriculture is a significant part of Sweet Grass County's economy, contributing roughly 30 million dollars annually. In addition to loss of revenue and land, livestock evacuation can create challenges during a wildfire event. Plans should be reviewed and improved as needed to account for livestock and large animal evacuations.

3.3.3 Health and Medical

- Medical Care: Sweet Grass County has several medical facilities, including Pioneer Medical Center, Crazy Mountain Family Medicine, and South Sweet Grass Public Health Department. In addition to hospitals, facilities such as pharmacies, long-term care centers, and even home health care can be threatened by wildfire. Special attention should be given to health clinics, labs, behavioral health, and the medical supply chain. Shipping routes and supply lines are essential and will be discussed further in Section 3.3.6.
- Patient Movement: Due to limited staffing and resources across the county, patient movement in a wildfire event will become compromised. Sweet Grass County should identify strategies and plans for patient movement and what resources would be needed to move patients when needed effectively. One option to increase resilience would be to harden hospitals and implement shelter-in-place procedures. This alleviates patient movement strain, provided shelter-in-place can be accomplished safely and effectively.

3.3.4 Energy

- Electric Transmission & Distribution: Private companies provide electricity, gas, telephone, and broadband in the county. Park Electric and NorthWestern Energy are the primary providers of electricity. NorthWestern Energy also provides natural gas. Electric power is not immediately available in two-phase and three-phase service configurations in all parts of the county. Telephone service is provided through Triangle Telephone and several mobile phone providers. Internet services are available from several providers. Wildfire directly threatens electrical infrastructure due to issues with mitigation standards and proximity to hazardous fuels.
- Fuel: There are no refineries within the Planning Area. However, consideration should be given to pipelines, fuel storage, and fuel distribution. These components are critical to everyday life and fire suppression efforts should consider the impact a fire would have on fuel distribution and supply.

3.3.5 Communications

+ Infrastructure: Communications infrastructure includes two (2) fixed tower sites, East and West, and two (2) portable repeaters. Emergency communications are provided on VHF frequency, which provides the best coverage across the county. If the county is working on an interagency response, it can access USFS frequencies to maintain effective communications. The east tower is resilient to wildfire, but the west tower should be hardened to avoid communication loss.

3.3.6 Transportation

+ Transportation Corridors: The ability of the public to travel throughout Sweet Grass County is limited due to the rural nature of the area and the lack of improved roads. Access and egress, particularly during a wildfire evacuation, present a significant challenge for residents and recreators. The primary routes for travel include Interstate 90 and State Highway 191. The remainder of the road system consists of U.S. Forest Service, County, neighborhood, and private roadways, many being unpaved, narrow, one-way, or a combination thereof.

Figure 11: Main Boulder Road

These conditions contribute to congestion and limited capacity. This presents a significant challenge to incoming first responders and evacuating residents. Additionally, many roads have adjacent hazard fuels that are receptive to fire.

If these receptive fuel beds become involved with fire, egress routes have the potential to become compromised.

Protecting the viability of road systems in the Planning Area is critical to the safety of the public and emergency responders. The maintenance of roadside rights-of-way and prevention of neighborhood landscape vegetation fires from encroaching onto the road networks will be imperative for the resiliency of protecting the physical transportation network and the capacity to provide access and egress to the first responders and the public during a major wildfire event.

- Aviation: Sweet Grass County operates a general aviation airport three (3) miles southwest of Big Timber. The 5,285-foot-long strip is paved, lighted, and can accommodate light aircraft and business-class jets. The paved runway serves approximately 7,200 flights annually. The airport has ten (10) hangers and a paved tie-down apron for aircraft.
- Railway: A single rail line runs east and west along Big Timber's north border. Montana Rail Link (MRL) provides freight service to Big Timber, primarily grain and log shipments. Burlington Northern/Santa Fe Railway operate trains through the county but do not provide local freight service. On average, 14-24 freight trains travel through Big Timber daily.

Figure 12: Big Timber Airport

3.3.7 Hazardous Materials

- Facilities storing or producing hazardous materials are prone to unintentional release during wildfire. These facilities can create environmental challenges in addition to damage from wildfires. Hazardous materials facilities should be identified for preplanning consideration for emergency responders during a wildfire and post-fire if hazardous materials could become impacted.

3.4 LAND USE / ZONING

The Sweet Grass County Zoning and Subdivision Regulations regulate land use, development, and subdivisions within unincorporated areas of Sweet Grass County. Land use resources are essential for the implementation of the Master Plan goals and policies. Planning staff maintains, updates, and administers these regulations. These community plans address land use designations, distributions, locations, and extent, as well as specific goals, policies, and actions relating to community development. These land use designations are intended to preserve the existing rural character of the community, protect natural resources, and minimize the overburdening of local infrastructure. This also allows reasonable residential and commercial development within the local geological (e.g., steep hillsides, unstable soil, subsurface conditions, extreme fire hazards) and land use density constraints. These land use and development codes provide for some wildfire hazard mitigation and implementation activities.

3.5 FIRE PROTECTION RESPONSIBILITY

An element of this CWPP is to address the values at risk and the capability of resources available to adequately respond to a wildland fire event. Within Sweet Water County, Federal, State and local response agencies have recognized that they are co-dependent and force multipliers for each other. Most of the agencies throughout the county have routinely provided emergency support during wildland fire suppression activities through mutual aid and intergovernmental agreements.

These relationships in Sweet Grass County for fire response are reviewed and updated annually in the Operating Plan (OP). Included in the AOP annual update are the Sweet Grass County Sheriff, Sweet Grass County Board of County Commissioners, USFS, and USBLM.

3.5.1 Big Timber Volunteer Fire Department

Big Timber Volunteer Fire Department (BTVFD) is the primary fire department and only fire district in Sweet Grass County and is located in the City of Big Timber. There are satellite departments under the control of the BTVFD in the unincorporated areas including Mcleod, Melville, and Greycliff/Bridger Creek.

The BTVFD consists of thirty-five (35) volunteer personnel and one (1) part-time administrative assistant. The station's apparatus includes (2) Type I engines, (1) Type 1 aerial, (2) Type 3 engines, (1) Type 2 tactical tender, (1) Type 6 engine (county-owned), (1) Type 6 engine (DNRC-owned), (1) Type 5 engine (DNRC-owned), (1) Type 2 tender, (2) command vehicles, and (1) support vehicle. There is also (1) motor grader and (1) D7 dozer with a pump and a transport vehicle. BTVFD is the only group with full structural firefighting capabilities.

Figure 13: BTVFD Station

The McLeod satellite station is on East Boulder Road and has a staff of nineteen (19) local area residents. Apparatus stationed in Mcloed include (1) Type 6 engine (county-owned), (1) Type 5 engine (DNRC-owned), and (2) Type 2 tactical tenders.

Most of the Melville satellite group apparatus is housed on ranches in the area. The Melville personnel roster includes forty-seven (47) local residents. The apparatus consists of (1) Type 5 engine (DNRC-owned), (4) Type 6 engines (county-owned), and (1) Type 2 tender.

The Greycliff/Brider Creek group consists of eleven (11) members. Apparatus consists of (1) Type 5 engine (DNRC-owned) that is housed at a ranch on Bridger Creek, and (1) Type 2 tactical tender housed on a ranch near Greycliff.

The BTVFD has mutual aid agreements with Park and Stillwater Counties. There is also an agreement with the USFS (Custer Gallatin National Forest) for initial attack on federal lands. The BTVFD provides direct protection for all State of Montana lands through the '*Montana State-County Cooperative Fire Control Agreement'.*

3.5.2 Additional Fire Protection and Collaborative Agreements

A focus of the CWPP is the number of resources available to respond to a wildland fire. Because of the limited availability of first response resources, cooperation between agencies is required. Several guiding documents ensure response capability including the AOP, the CWPP, Mutual Aid Agreements, Intergovernmental Agreements (IGAs), and Memorandum of Understanding (MOU).

Additional fire protection efforts should include grant funding, perform mitigation efforts, provide standardized public education, training, and communications. Sweet Grass County has been successful in the past and should continue to engage in the following efforts:

+ **Grant Funding:** Aggressively pursue grants through collaborative partnerships.
+ **Mitigation:** Adopt and implement a strategic plan based on the wildfire threat assessment and values at risk.

- **Public Education:** Continue to implement Firewise, Home Ignition Zone (HIZ), and Ready-Set-Go programs. Continue with community engagement meetings, improve interagency cooperation, and standardize messaging.
- **Training:** Continue interagency training, sustain NFPA and NWCG firefighter qualifications, and conduct annual interagency exercises.
- **Communications:** Increase interagency dialogue, interaction, and public contact. Standardize the wildfire message through public education contact hours, including increased Public Service Announcements.
- **ICS:** Ensure all agencies are well-versed and comfortable with the use of Incident Command Systems (ICS), continue to train and certify first responders building depth and capability for all ICS positions, and improve the sustainability of the Type 4/Type 3 Incident Management Teams (IMT).

Montana Department of Natural Resources and Conservation (DNRC)

The Montana Department of Natural Resources and Conservation Southern Land Office is in Billings, Montana, and manages approximately 7.3 million acres of state and private land across seven (7) different counties through the County Cooperative Program. The Southern Land Office (SLO) is one of six (6) Land Offices in Montana. Within these seven (7) counties, it works with over 30 fire departments through the County Cooperative Program, an agreement that the counties will provide basic fire protection.

In contrast, the Agency provides support in the form of organizational and technical assistance/advice, fire equipment, training, and direct fire control assistance when needed or when a fire exceeds the capacity of the County.

The Southern Land Office also works directly with several other Federal fire agencies to support fire protection and is comprised of an Area Fire Management Officer, Assistant Fire Management Officer, Rural Fire Coordinator, Aviation Officer, two (2) Helicopter Managers, a Fuel Truck Driver, a Mechanic, two (2) dispatchers at Billings Interagency Dispatch Center. During the summer months the office has a pre-positioned Type 2 Helicopter for Initial and Extended Attack fire response.

U.S. Forest Service (Yellowstone and Gardiner Ranger District)

The Yellowstone and Gardiner Ranger Districts on the Custer Gallatin National Forest manage approximately 1.2 million acres of public lands out of three (3) locations: a district office in Livingston, MT, a district office in Gardiner, MT, and a work center in Big Timber, MT. A Fire Management Officer (FMO) and an Education/Prevention Officer serve at all duty locations along with two (2) Assistant Fire Management Officers of Operations (Ops AFMO), one (1) assigned to the Livingston and Gardiner District offices, and one (1) to the Big Timber workstation.

The agency maintains and staffs (3) Type 6 Engine modules, each comprised of four (4) permanent employees in addition to 2-3 seasonal temporary

employees. Two (2) of these modules are located in Livingston, and one (1) is in Big Timber. Also located in Big Timber is a (1) Type 2 Wildland Fire Module staffed with four (4) permanent employees and 2-3 seasonal, temporary employees. These resources provide initial response on USFS lands and assist partners in initial response through mutual aid agreements. In addition, a Fuels program consisting of a Zone Fire Management Specialist (Prescribed Fire and Fuels), two (2) Fuels Assistant Fire Management Officers, and four (4) Fuels Technicians staff the Yellowstone and Gardiner Ranger Districts.

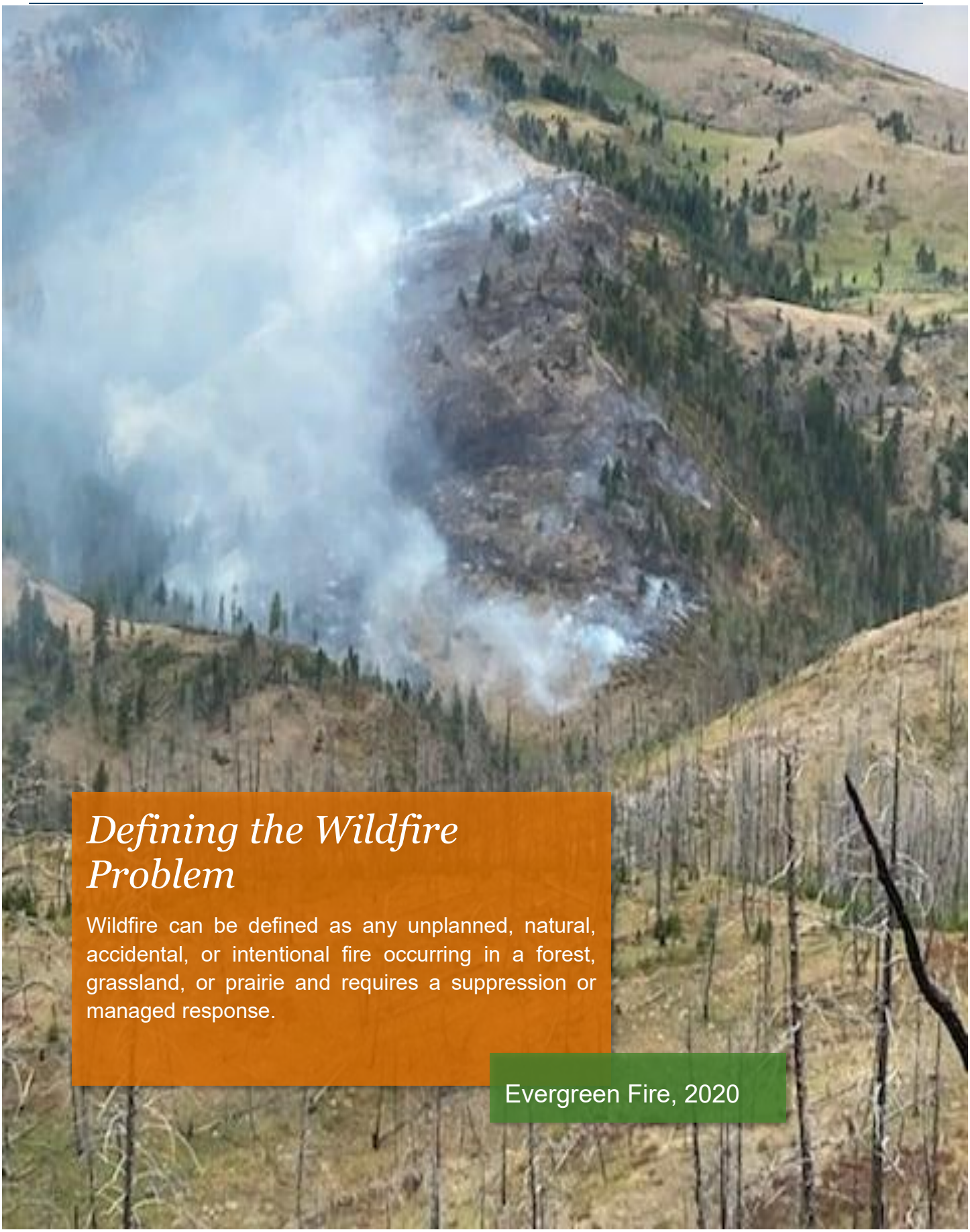
The fuels program focuses on mitigating hazardous fuels through various treatments, including prescribed fire, hand thinning, mechanical treatments, and commercial timber. These treatments intend to reduce wildland fire impacts to critical values, increase forest health and resiliency, and allow fire to play a natural role in the landscape when feasible.

In addition to the Yellowstone and Gardner Ranger Districts, the Beartooth Ranger District, located in Nye, has a protection area that encompasses a portion of Sweet Grass County.

BLM (Eastern Montana Dakotas District)

The Bureau of Land Management Eastern Montana Dakotas District (EMDD) manages approximately 3.4 million acres of public lands. The agency maintains and staffs (10) Type 6 engines and (2) Type 4 engines, which are distributed across five BLM fire stations in Billings, Miles City, Jorden, Ft. Howes, Camp Crook, and Ekalaka. Additional district fire resources include a Type (2) 20-person hand crew based in Billings and a helicopter module based in Miles City.

BLM resources provide initial response on federal lands, including BLM and USFS, and assist partners on initial attacks through mutual aid agreements. The district maintains a robust fuels program with staff in Billings and Miles City. The district utilizes prescribed fire and mechanical treatments to reduce hazardous fuels on BLM lands. Additionally, the BLM partners with local and state cooperators to reduce hazardous fuels across the landscape through cooperative agreements and grant funding.



Defining the Wildfire Problem

Wildfire can be defined as any unplanned, natural, accidental, or intentional fire occurring in a forest, grassland, or prairie and requires a suppression or managed response.

Evergreen Fire, 2020

4.0 Defining the Wildfire Problem

The frequency of wildfires is on the rise. Wildfires that usually occurred during the "traditional summer fire season" are now being reported throughout the calendar year. Unhealthy forests, climate change, and the frequency of fires, whether human-caused or by lightning, have contributed to increased civilian and first responder fatalities and injuries, infrastructure damage, property damage, and impacts on watersheds, natural resources, and wildlife habitats.

There are several reasons why a small number of fires reported annually become significant destructive events. Large fires are usually the result of environmental conditions that align with each other, including dry fuels, wind, and low humidity. A delay in the fire being discovered and reported or local resources unable to suppress and contain the fire during an initial or extended attack allow these wildfires to become significant events. In rare instances, a wildfire may be managed and left to burn naturally.

Effective development of a mitigation strategy that addresses the potential adverse effects of a wildfire within the Planning Area requires understanding the fire history, fire ecology, climatology, and human interactions with these various facets.

4.1 FIRE HISTORY

Fire history provides an understanding of fire frequency, season, behavior, characteristics, and significant ignition sources and identifies portions of the most vulnerable landscape. Sections 4.2 through 4.5 provide detailed information regarding these specific topics. This data may aid in securing grants and other funding sources as well as better prepaire for future wildfires.

Large fires are events that require active fire suppression for more than two (2) operational periods. Before 1985, these were rare events. Beginning in 1994, Sweet Grass County experienced more large fires and at a more frequent level. Since then, the large fire workload has averaged 1.5 fires annually. Sweet Grass County is not alone in having to deal with this issue. Rural fire districts throughout eastern Montana are experiencing increasing fire workloads. Below (Table 3) is a list of some of the larger wildifres in Sweet Grass County history.

Table 3: Wildfires within and adjacent to the CWPP Planning Area

Fire Name	Date	Fire Size (acres)	Fire Name	Date	Fire Size (acres)
Diamond	2024	650	Beaver	2015	1,540
Green Mountain	2023	1,300	Tumble Creek	2008	371
American Fork	2021	21,892	Chichi	2007	30,000
Ohearn Creek	2021	750	Hicks Peak	2007	2,520
Whistle Creek	2020	143	Derby	2006	208,222
Blacktail	2017	5,354	Jungle	2006	31,745
Mendenhall	2017	1,205	Hobble	2003	38,367
Diamond1	2016	800	Monument	2001	1,580

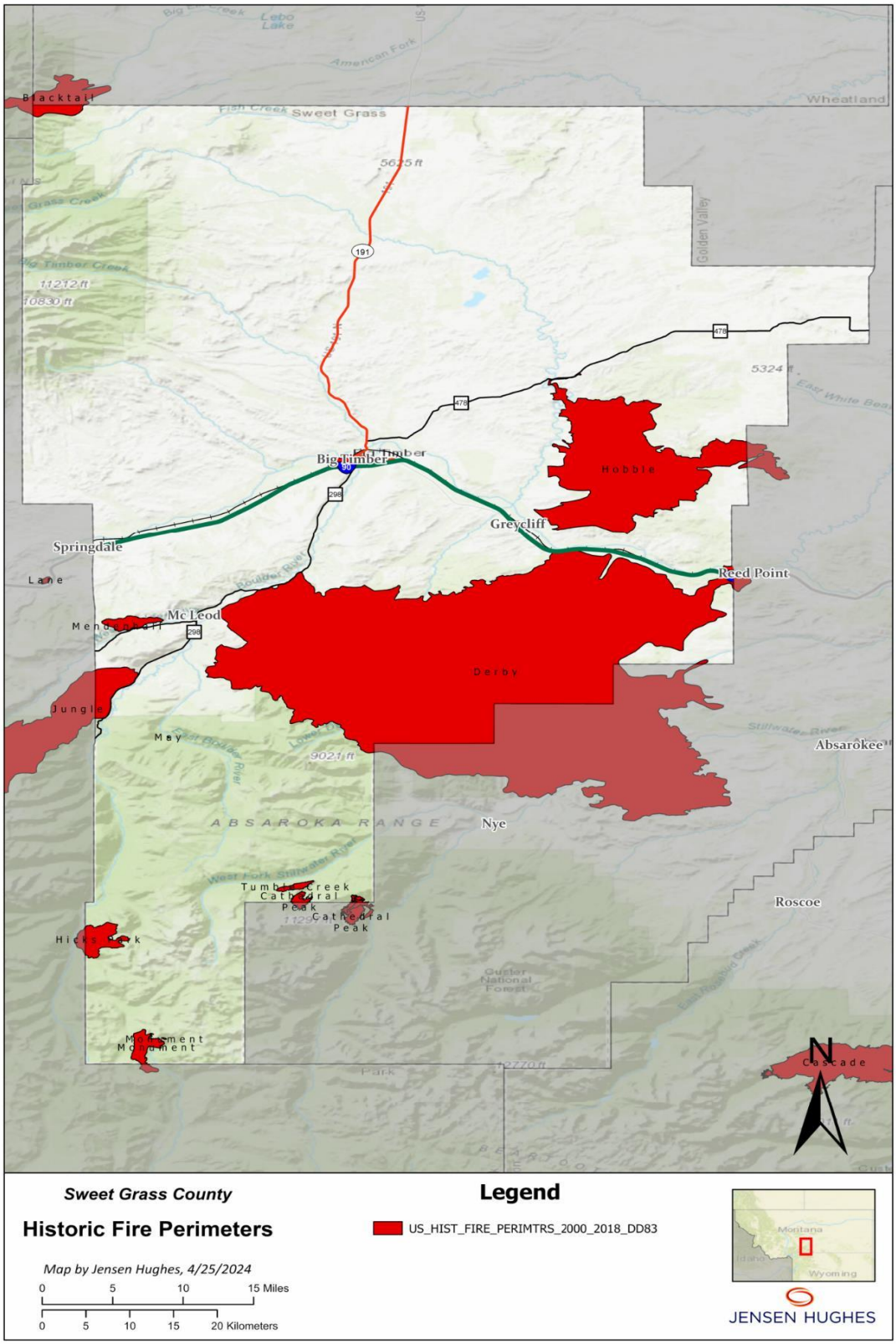


Figure 14: Sweet Grass County historic fire perimeters

4.2 FIRE ECOLOGY

Throughout history, wildfire has been a dominant occurrence in various ecosystems' structure and composition. Fire, along with topography, and climate play a vital role in the successional stages of these ecosystems. As a result, fire frequency and severity have been critical links in determining which plant species exist and grow within a landscape.

The sagebrush grass range is relatively extensive within the county. Silvertip Sagebrush is the predominant species. The predominant trees in Sweet Grass County include Ponderosa and Limber pine. There are some smaller stands of Douglas-fir and Engelmann spruce. Pine such as the Ponderosa, is a fire-adapted species that has developed natural mechanisms to survive most fires. They have a thick, corky bark that insulates the tree's cambium from heat generated by wildland fires. These species are also considered to be self-pruning of lower branches. This enables the lower branches of the tree to naturally die and fall off, keeping smaller flame length surface fires from burning upward into the canopy of the tree.

Many decades of fire suppression throughout the western states have altered fire regimes, and Sweet Grass County has not been impervious to these changes. Suppression activities, combined with the lack of forest management, the public's misunderstanding of forestry and fire ecology, and the introduction of people into this fire ecology, have resulted in years of fuel accumulation. Combined with the increasing number of individual homes and communities in these forested areas, a significant wildfire problem has been created. As years pass without these issues being addressed, the potential for disaster continues to increase.

4.3 FUELS

The most common fuel type in Sweet Grass County is grassland. Included are Fescue, Ryegrass, Wheatgrass and Bluestem. Fires in grass will generally be of a lower severity as the burn quickly but have high rates of spread and may be hard to control in windy conditions. Ponderosa pine and Limber pine is prevalent adjacent to and in the foothills of the mountain ranges in Sweet Grass County. The Ponderosa and limber Pine forests cover thousands of acres and has the greatest potential for supporting large, intense fires. In stands where fire has been absent for several decades, ladder fuels, slash and ground litter have provided heavy fuel loading and increase the risk for a fire to become unmanageable.

Areas where Silver Tip Sagebrush is the dominant vegetation, the potential for large, intense fires is likely under wind-driven conditions. Thousands of acres of this fuel type are in the county.

Figure 15: Fuel type examples

4.4 CLIMATE AND CLIMATE CHANGE

4.4.1 Sweet Grass County Climate

The Sweet Grass County climate is generally dry and cool, classified in the DRC zone (Koppen Climate Classification), with 15 inches of annual precipitation falling primarily in the summer months. Average temperatures peak in July in the mid-70s °F, with the winter mean low of approximately 22°F (see Figure 16). Extreme temperatures, such as the record high of 107°F in 2002, occur primarily during the summer months and are often associated with exceptional drought conditions.

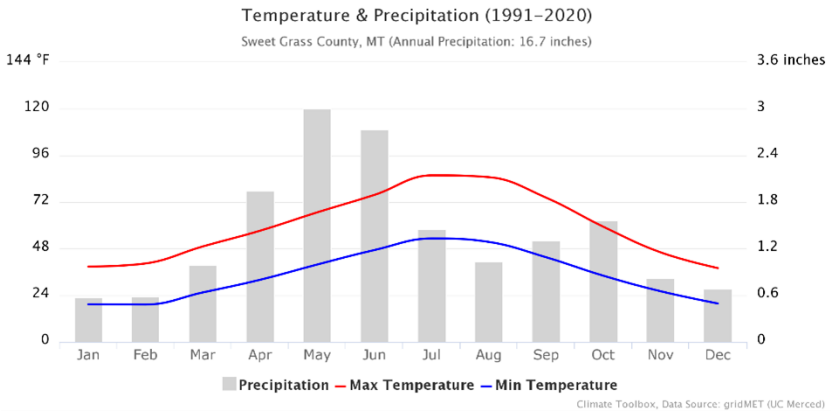
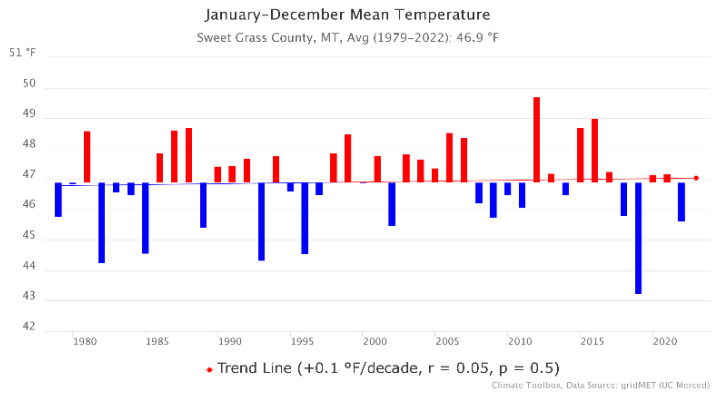


Figure 16: Temperature and precipitation trends

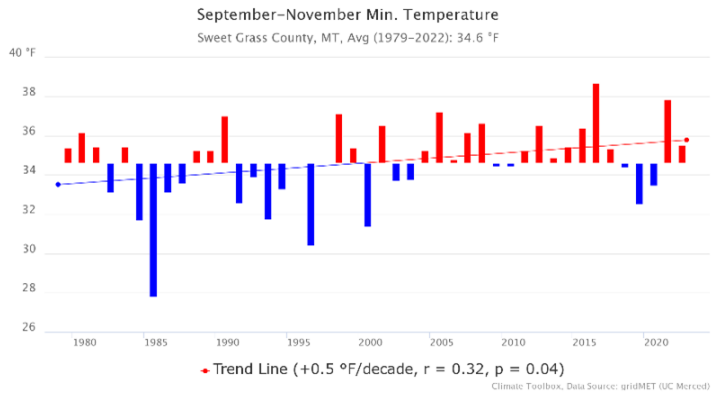
4.4.2 Evidence of Climate Change

Wildfires easily become unmanageable during extreme weather conditions, such as extreme heat, high winds and dry fuels. Therefore, it is critical to understand how climate change impacts the frequency and intensity of these extreme weather events through temperature, precipitation, drought, and vapor pressure deficit changes. The information below identifies the trend of climate variables over the past thirty (30) years.



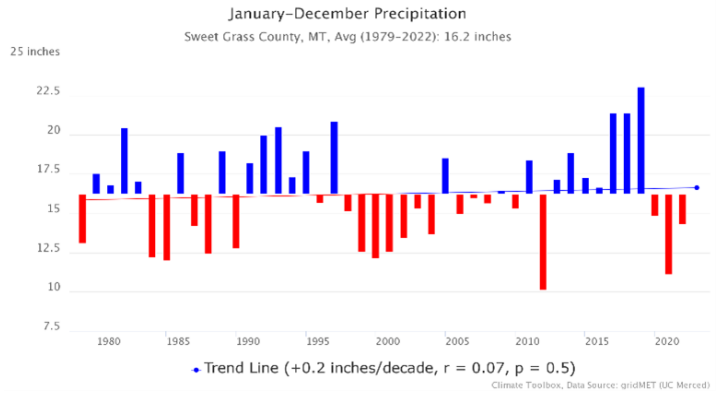
Annual mean temperatures are trending up.

Over the past thirty (30) years, annual average mean temperatures have increased in Sweet Grass County. Warming temperatures exacerbate drought, reduced snowpack and spring runoff, extreme heat conditions, air quality, and health hazards. Warming temperatures can also weaken trees to disease and infestation.



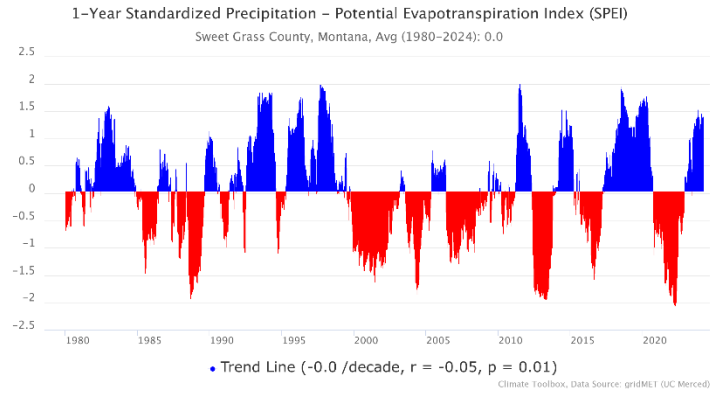
Fall (September – November) minimum temperatures are trending up.

Reduced nighttime humidity recovery, particularly during the fall season, is an observed inclination towards increased minimum daytime temperatures as a proxy for fire danger.



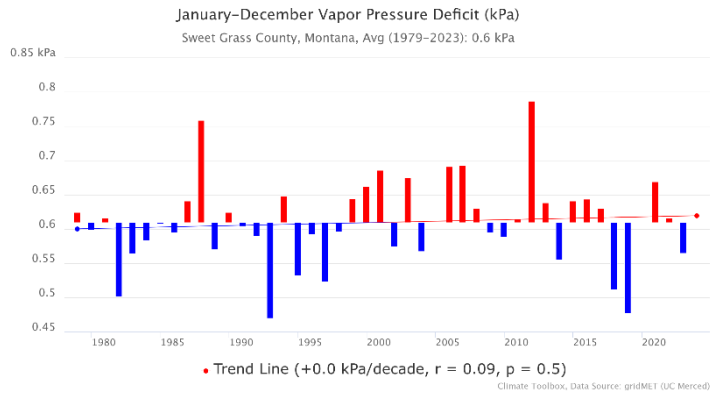
Precipitation is trending up.

Evidence indicates that increased precipitation during the summer months leads to increased fuel loads, which drive more intense fire behavior. This is especially true in later months as vegetation cures with the natural growing season and begins to go dormant for the winter.



Standardized Precipitation-Evaporation Index (SPEI) is trending down (dry).

The SPEI considers temperature, precipitation, and evapotranspiration (the moisture the earth loses to the atmosphere from both evaporation and transpiration from plants). It can be used to determine the onset, duration, and magnitude of drought conditions concerning normal conditions in a variety of natural and managed systems, such as crops, ecosystems, rivers, water resources, etc.



Vapor Pressure Deficit (VPD) is trending up.

Research indicates that climate change is increasing the vapor pressure deficit (VPD). VPD is used to measure dryness, or aridity, near the Earth's surface. It is directly related to the rate at which water is transferred from the land surface to the atmosphere.

(**https://www.climatesignals.org**)

"Vapor pressure deficit has increased over the past 40 years across most of the American West, largely because warmer air can hold more water. This is a primary mechanism by which global warming is elevating wildfire hazards." (Garthwaite, 2022)

4.4.3 Climate Projections

Natural climate variability and human caused emissions (i.e., Greenhouse Gas [GHG]) shape future climate change projections. Studies published in the last decade, including Abatzoglou and Williams' article, "*Impact of Anthropogenic Climate Change on Wildfire Across Western US Forests*", conclude, in high confidence, that future climate projections will have implications for an increase in fire occurrence and severity.

Sweet Grass County has a projected temperature increase of 5°F to 10°F by Year 2100, with increases seen across all seasons, including daily maximum and minimum temperatures. This projection is shown in Figure 17 and Figure 18, using the RCP8.5 emissions trajectory (i.e., very high baseline emission scenario, representing the 90th percentile) and RCP4.5 emissions trajectory (i.e., moderate baseline emission scenario, representing the 50th percentile).

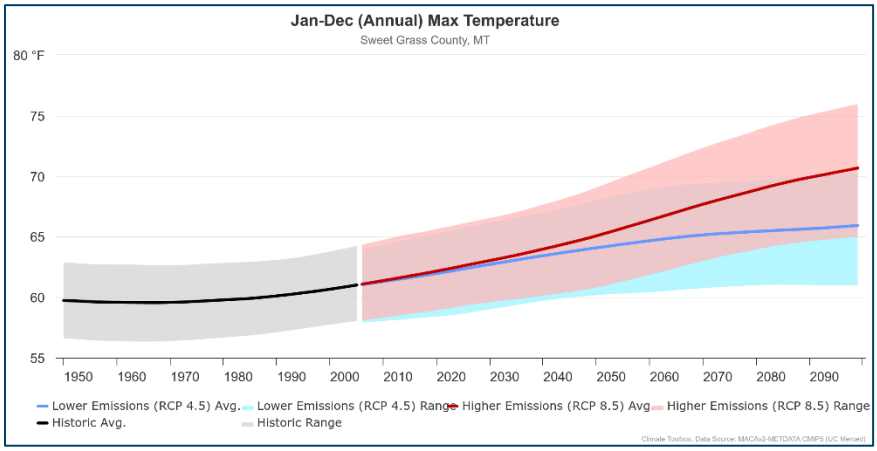


Figure 17: Annual maximum temperature

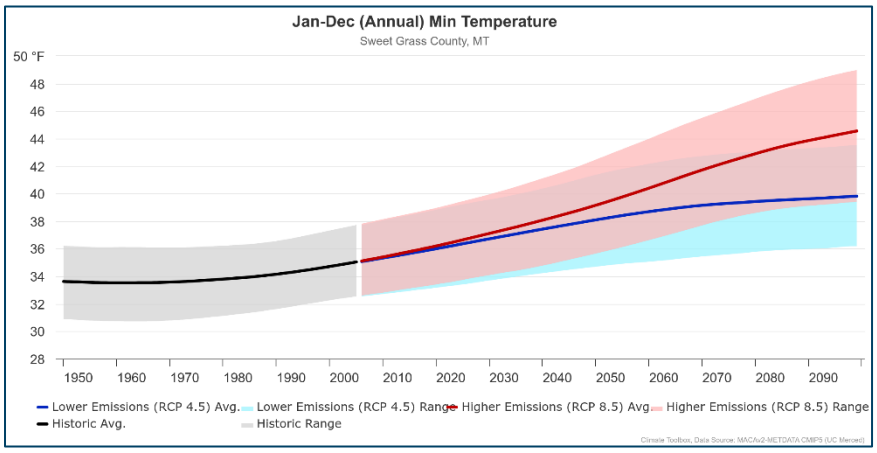


Figure 18: Annual minimum temperature

4.5 TOPOGRAPHY

Topography plays a significant role in wildland fire behavior. It influences local winds (foehn), diurnal winds, wind patterns and intensities, and channeling winds through canyons and drainages. Topographical features that affect fire behavior include slope, aspect, terrain features, and elevation, with the steepness of the slope being the most influential. (For every 10 degree increase in slope, a fire will double in rate of spread. Western Fire Chiefs Association).

Two (2) mountain ranges, the Absaroka-Beartooth along the southern part of the county and the Crazies to the northwest, dominate the higher elevations of Sweet Grass County. Elevations in the Absaroka-Beartooth range from 10,992 feet near Monument Mountain to 5,156 feet at Natural Bridge. Elevations in the Crazies range from 11,214 feet near Crazy Peak, dropping to 5,800 feet along the eastern side of the mountain range. The open prairie lands range from 5,800 feet near Melville to 3,800 feet along the Yellowstone River at Reed Point. As elevation drops from the mountains toward the valley floor, a series of high gravel-capped tablelands are encountered. Below these tablelands are benchlands adjacent to moist streams and river bottoms. The majority of land development occurs in these areas, including farming/agricultural, communities, commercial, and residential sites.

The Boulder River drainage generally flows from south to north. It begins at the hydrologic divide near Monument Mountain at nearly 10,992 feet in elevation and descends to 5,156 feet at the Natural Bridge. As the river flows north, it drops over a mile in elevation, and by the time it travels, it travels twenty-four (24) miles to the Natural Bridge area. From the Natural Bridge, the Boulder River continues in a generally north flow past the City of Big Timber and empties into the Yellowstone River just north and east of Big Timber.

The Whistle Creek Fire June 2020.

Wildfire Hazard + Risk Assessment

Assessing the impact of wildfire hazard and overall risk to the community will be used for determining projects and priorities for risk reduction within the county.

Whistle Creek Fire_Sweet Grass CO_MT_Credit_SGCSO

5.0 Wildfire Hazard + Risk Assessment

5.1 WILDFIRE HAZARD ASSESSMENT

All of the modeling used in this CWPP was produced by the United States Forest Service Wildfire Risk to Communities (US Forest Service, n.d.) to show probable wildfire behavior over a landscape and the associated impact on communities. These models help to determine where priority fuel treatments should occur by evaluating where fire would be most impactful to the landscape and where the community values at risk are located concerning the hazard.

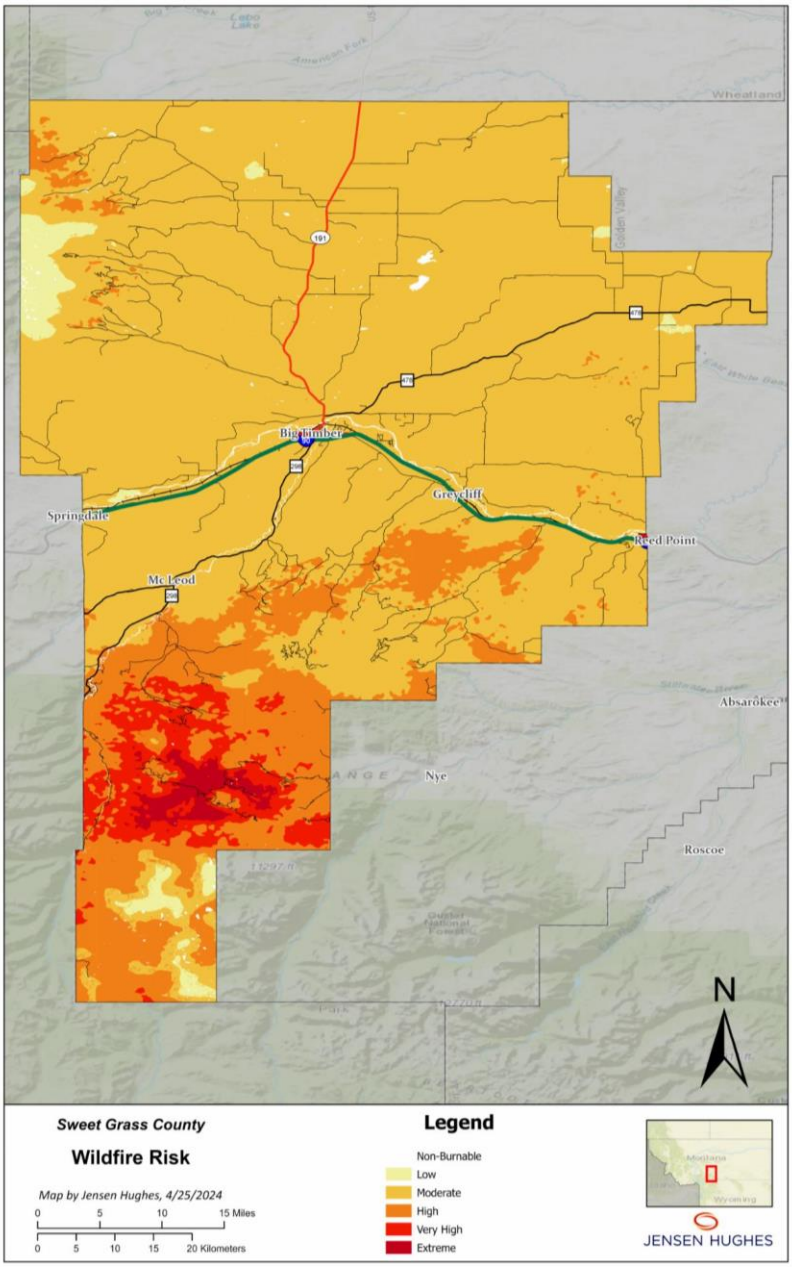


Figure 19: Wildfire Risk Potential

5.2 RISK ASSESSMENT

In this CWPP, the risk of a wildfire occurring within the Planning Area has been based on an evaluation of wildfire hazard, values at risk, and fire frequency across the landscape. Risk is defined as severity times probability of occurrence. For this plan, severity is represented by the impact of hazards on community values, with probability represented by the historical fire occurrence.

$$Risk = (Occurrence + Hazard) \times Community\ Values$$

This theory of risk was used to determine projects and priorities for risk reduction throughout the planning area. These projects and recommendations are intended to reduce risk by reducing the vulnerability of community values, the impact of wildfire hazard, or the probability of occurrence. Reduced risk can be simplified to risk divided by mitigating one or more individual elements. More information on mitigation efforts and recommendations can be found in Section 6 of this plan.

$$Reduced\ Risk = \frac{(Occurrence + Hazard) \times Community\ Values}{Mitigation}$$

Risk can be represented visually through the following risk matrix.

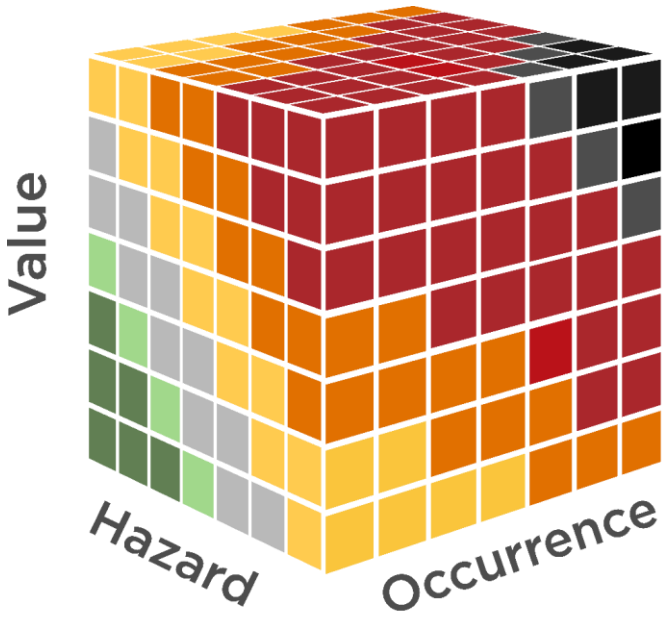


Figure 20: Risk matrix

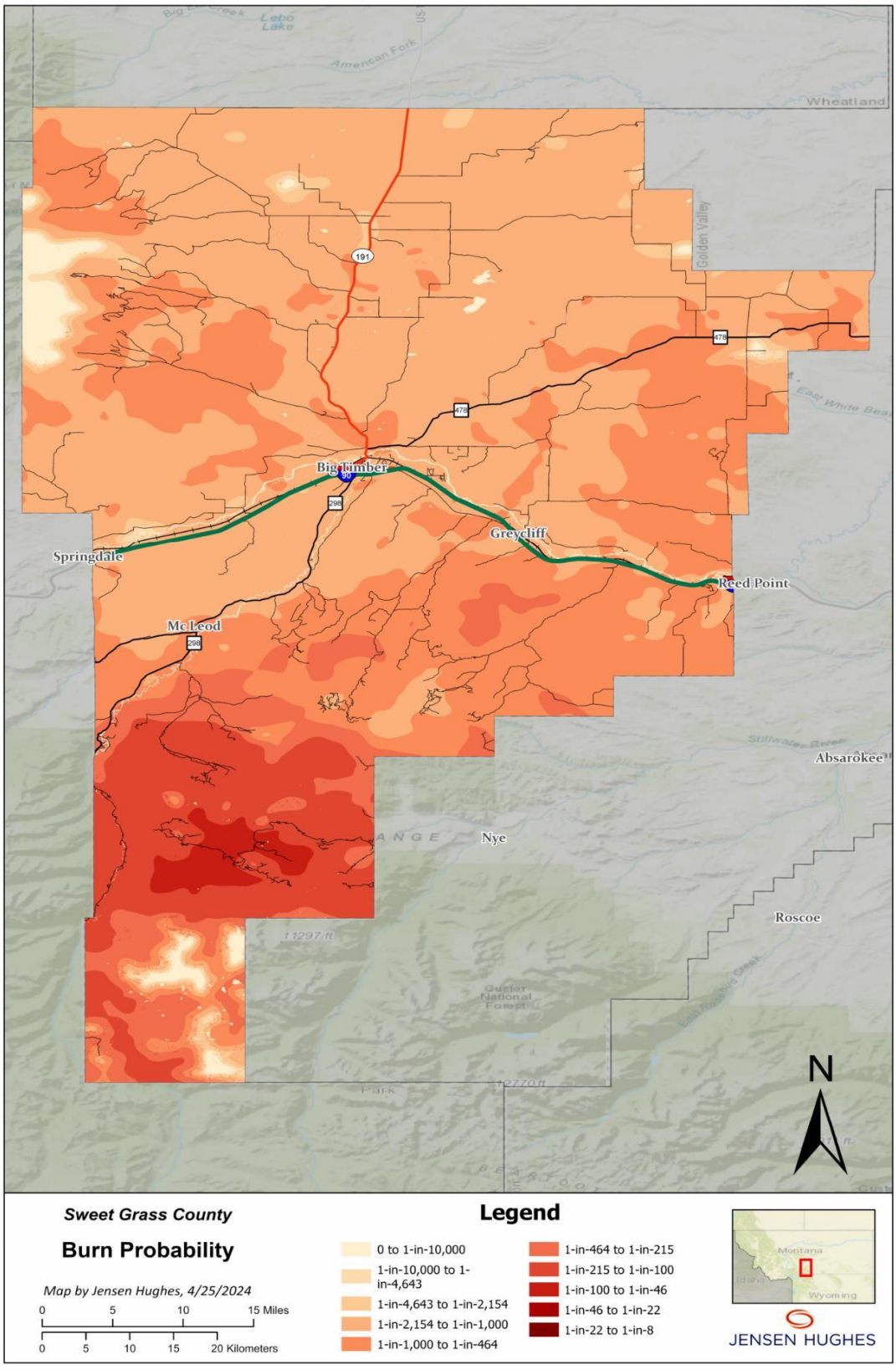


Figure 21: Wildfire probability

Based upon the provided risk assessments of Wildfire Hazard Potential, Wildfire Risk, and Flame Length, the highest probability of a wildfire that escapes an initial attack with the possibility of becoming a large growth event is in the southern region of the county, south of McLeod. This area includes heavy timber fuels, continuous ground and surface fuels, steep slopes, and limited access. If a fire were to become established in this area of the County, it would be difficult to manage. The potential for a hot, high intensity, fire with a mature pyro cumulus plume and long-range spotting is a realistic possibility.

The central and northern part of the county has much less timber and contains less steep terrain, much of it is irrigated or grazed, which reduces the risk in these other parts of the county. In addition, because of the population density in these lessened risk areas, early detection is more probable and access to fire response is more readily available. The probability of an unmanageable fire in these areas is much less.

Figure 22 recognizes the Flame Length that could be expected in the event of a wildfire, understanding that wildfire is a dynamic event that contains many variables that influence the fire behavior on a given day. The model demonstrates, under assessed variable conditions, the flame length that would be produced given the vegetation density, species composition, and canopy base height of the vegetation. The map creates opportunities for land managers and landowners to further identify areas of possible fuels treatment across landscapes in efforts to reduce the crown fire activity and fire intensity.

The flame lengths map is a vital tool for firefighters, given the safety parameters that must be adhered to during suppression efforts and the tactics in which fire can be suppressed most effectively. This model, coupled with the Incident Response Pocket Guide (IRPG) and Haul Chart and the experience from firefighters, can help inform tactical decisions and more quickly obtain appropriate resources for suppression and further support firefighter safety.

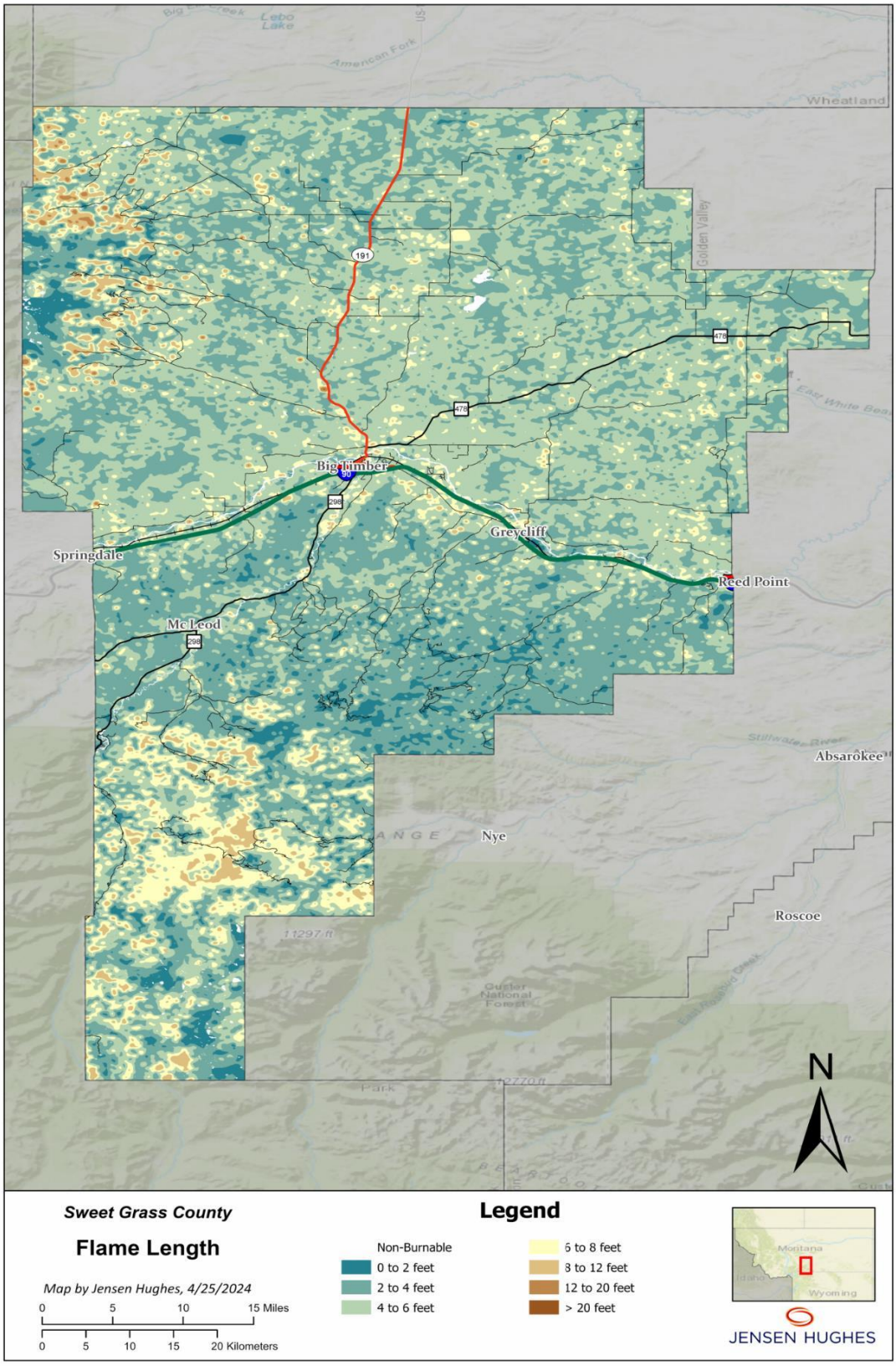
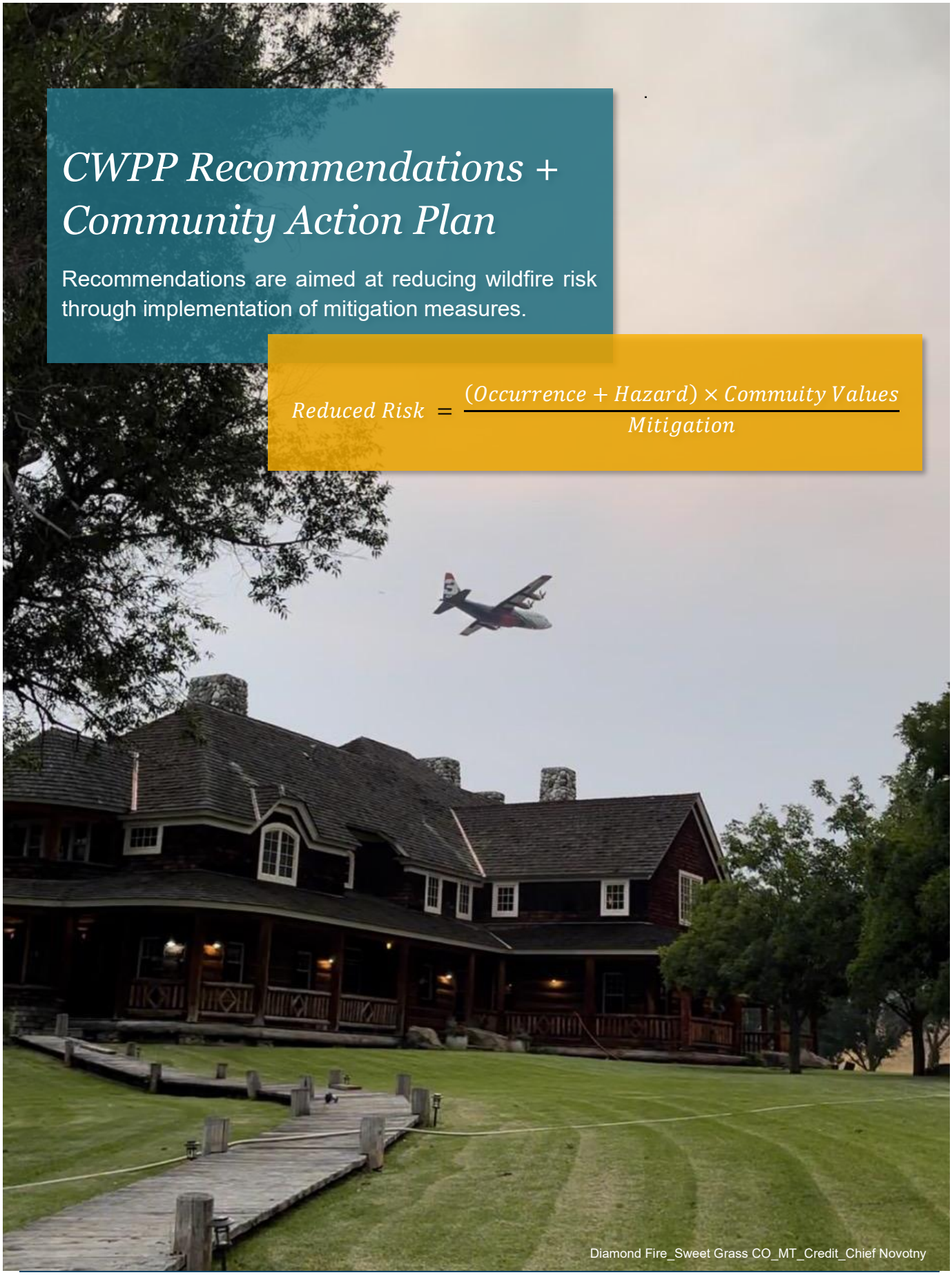


Figure 22: Flame length

CWPP Recommendations + Community Action Plan

Recommendations are aimed at reducing wildfire risk through implementation of mitigation measures.

$$Reduced\ Risk = \frac{(Occurrence + Hazard) \times Commuity\ Values}{Mitigation}$$



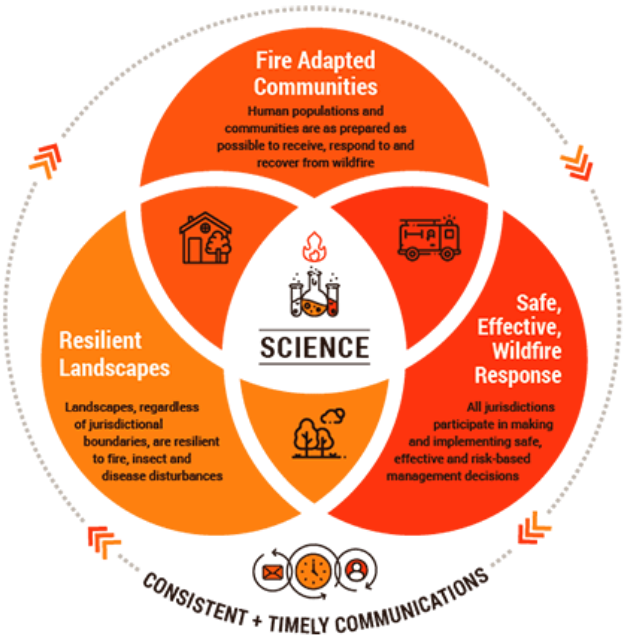
Diamond Fire_Sweet Grass CO_MT_Credit_Chief Novotny

6.0 CWPP Recommendations + Community Action Plan

6.1 COMMUNITY ACTION PLAN

A Community Action Plan is a necessary tool to help identify priorities for management of the hazards and risks of wildfires in the Planning Area over the next three (3) to five (5) years. These include community education and communication, emergency planning, improving structural resilience, fuel management, evacuation preparedness, and recovery. Part of the Community Action Plan is finding sustainable funding sources to accomplish meaningful work throughout the county.

The Sweet Grass County Community Action Plan, shown in Table 88, aligns with the National Cohesive Wildland Fire Management Strategy, which focuses on creating resilient landscapes, fire-adapted communities, and safe, wildfire response.



National Cohesive Wildfire Strategy_Credit_USDA

Figure 23: National Cohesive Wildland Fire Management Strategy

6.2 AREA NOTIFICATION SYSTEMS

Sweet Grass County Alerts (CodeRED)

Sweet Grass County Alerts is operated through the CodeRED platform. The county contracts this service to allow the immediate mass distribution of critical information and instructions in case of large-scale disasters, such as wildfires, major road closures, evacuations, or other catastrophic incidents.

Residents can register cell phone numbers (for voice and text messages), home or work phones, or email addresses to receive time-sensitive emergency messages on multiple devices, regardless of location.

More information and registration can be found here: **https://sweetgrasscountygov.com/government-departments/other-departments/disaster-emergency/emergency-alert-system/.**

Integrated Public Alert and Warning System (IPAWS)

IPAWS is the primary method for distributing emergency alerts for most emergencies as it does not require registration. When IPAWS is not the appropriate method, Sweet Grass County Alerts will be the primary public notification method.

National Weather Service (NWS)

The NWS transmits continuous weather information on 146.425 MHz and 146.525 MHz frequencies. NWS severe weather broadcasts are preceded by a 1050 Hz tone that activates weather monitor receivers equipped with decoders. The NWS can also access the National Warning System to announce severe weather information.

RECOMMENDATIONS

Inform

- Continue to inform the public of emergency notification systems.
- Encourage all residents to register for emergency notification systems.

Monitor

- Continue to monitor the effectiveness of each program.
- Perform tests and ensure the system is functioning and readily available for emergency managers.

6.3 SOCIAL MEDIA AND MEDIA PROGRAMS

6.3.1 Social Media

Local agencies use social media to keep stakeholders updated on events, advisories, and alerts. Table 4 summarizes some of the primary social network links for emergency preparedness in Sweet Grass County. It must be noted that during the community engagement meeting 56% of the respondents preferred in person contact, followed by 22% preferring a social media platform and 22% email. See Appendix G for survey results.

Table 4: Social Media and Media Programs

Source	*Weblink*
Sweet Grass County	https://www.facebook.com/people/Sweet-Grass-County-Big-Timber-MT/100064897981643/
Sweet Grass County Sheriff's Office	https://www.facebook.com/sweetgrasscountysheriff/
Big Timber Volunteer Fire Department	https://www.facebook.com/bigtimberFD

RECOMMENDATIONS

Expand

- Expand social media presence throughout the county for use in distribution of wildfire risk reduction messaging and evacuation notifications.

Reach

- As a shift towards social media use for information gathering becomes more common, having a robust social media presence will allow the county to reach a broader audience.

6.4 PROTECTING VALUES

This section describes actions to enhance the protection of values at risk in the Sweet Grass County Planning Area.

6.4.1 Life Safety

6.4.1.1 Firefighter Safety

Many factors affect the ability of firefighters to safely protect structures and other community assets. Part of the safety process is determining whether or not it is safe to engage in direct suppression operations. Firefighters perform an assessment or “triage” to determine whether a structure or asset is defendable. Before engaging in structure protection activities, firefighters look for viable, safe, and intact access/egress routes, whether a structure or improvement has hardened construction features (class A roof), etc., hazardous material presence, adequate water sources, and defensible space.

Firefighter safety and whether they commit to protecting a structure is many times determined by the be fuels reduction and wildfire mitigation actions taken by homeowners, landowners, and land managers. It is essential that vegetation management, hazard fuels reduction and mitigation efforts are implemented to not only protect a landscape or property but to also reduce the intensity and severity of the fire behavior, allowing firefighters to enter an area to engage the fire to protect the structural / values at risk.

6.4.1.2 Public Safety

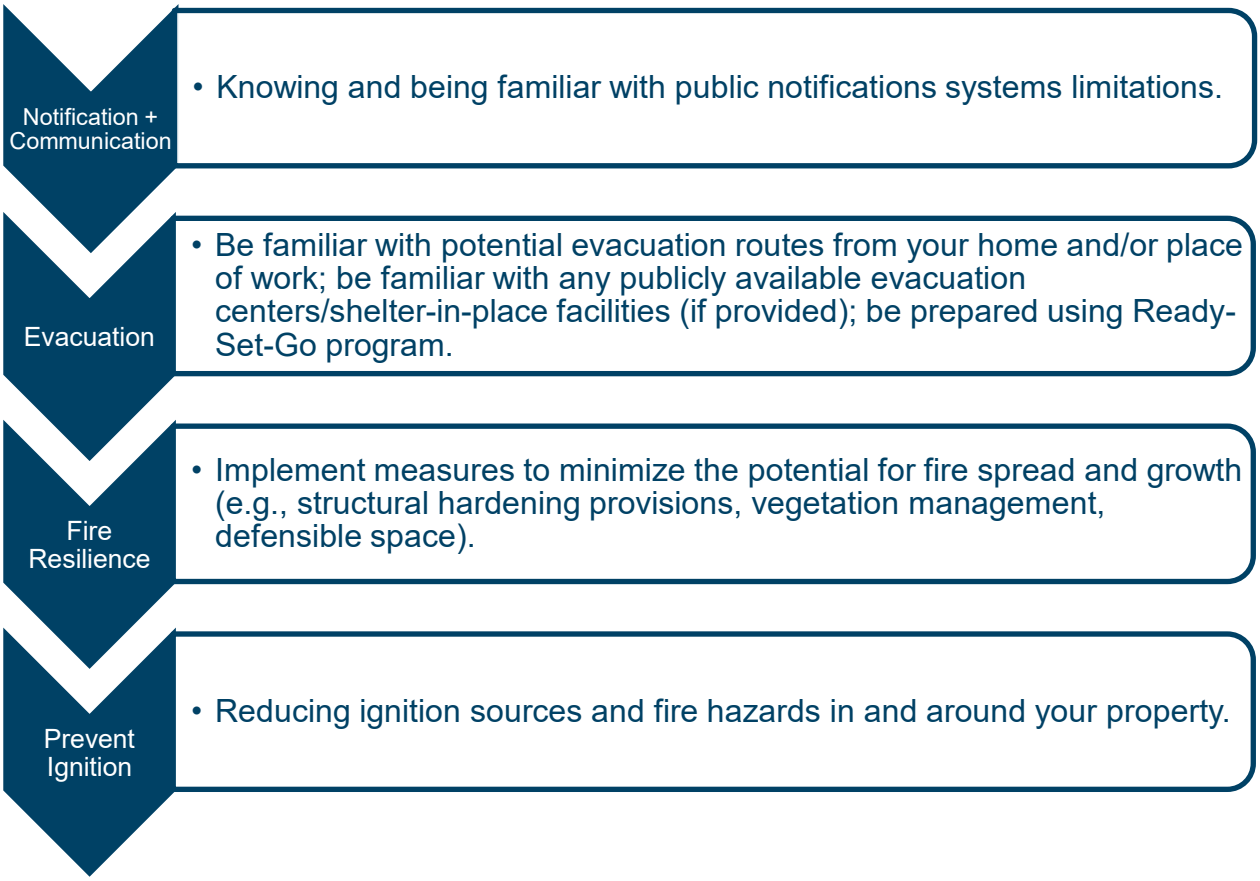
As with any natural hazard, minimizing the risk of wildfire threats to human life and public safety necessitates a comprehensive approach including fire prevention, mitigation, preparedness, response, and recovery.

Sweet Grass County has several life safety challenges:

+ Emergency evacuation and management.
+ Limited and possibly congested travel routes during evacuations.
+ Limited egress and access for citizens, firefighters, and law enforcement.
+ Limited and/or deficient defensible space in specific neighborhoods.
+ Numerous structures with construction features that make them receptive to fire and embers.

Recommendations for mitigation, structural hardening, and evacuation are focused on improving life safety. Individual community members should become aware and actively engaged in understanding the various wildfire hazards and risks that may impact where they live, work, and recreate and take the necessary steps to prepare themselves, their homes, and their family members for a wildfire.

The list below covers the fundamental concepts of fire life safety for residents:



6.4.1.3 At Risk Populations

The top priority for the county is human life safety. At risk populations may have limited capacities to prepare for, respond to, and/or recover from a major wildfire incident. (Palaiologos Palaiologou, 2016) Children, seniors, and physically disabled people may require additional assistance with notification, evacuation, sheltering in place, and accountability. Research and recent catastrophic wildfire events (Lahaina, HI, Paradise, CA, and Marshall, CO fires) have demonstrated that "At Risk Populations" are at higher risk in a disaster than the general population.

6.4.1.4 Evacuation

Sweet Grass County is a relatively isolated, rural area of Montana. Evacuation corridors and routes are limited to a few paved primary and secondary roads. With the exception of I-90 running east to west in the central part of the county, the majority of roads in the county are two-lane, which limits the capacity for egress and access. For evacuation planning for isolated structures and remote neighborhoods, roads should be assumed as two (2) lanes. Non-residents and tourists unfamiliar with the road system may complicate the egress effort.

During an emergency, "flow-contra flow" (opposing traffic movements) as first responders access the area while residents and tourists are leaving can compromise evacuations. Many roads have security gates and cattle guards, are very narrow, have steep grades, are not paved, have switchbacks, and/or sharp curves, all of which present challenges for fire personnel responding to an area while residents are leaving.

Numerous Forest Service, neighborhood, private, and secondary routes lead to primary routes. The short-term solution is to educate and situationally inform residents in these areas. The long-term solution is to reduce and/or eliminate hazardous vegetative fuels that further threaten access and egress routes along the roadsides and in areas where roads bottleneck to single-lane.

It is recommended that an evaluation of access and egress routes be conducted and identified for maintenance and viability regularly. Assess vegetation encroachment and potential fire behavior that may compromise a route.

Figure 24: Common road conditions in the county

6.4.1.5 Temporary Refuge Areas

A Temporary Refuge Area (TRA) may be an option when the evacuation route becomes compromised or unusable. The purpose of the TRA is to give evacuees and firefighters temporary relief from life-threatening heat and smoke, as well as the opportunity to reevaluate conditions and determine if escape routes are viable. TRAs include road intersections, irrigated fields, sports complexes, parking lots, or large open areas with little or no vegetative fuel. Even the inside of a structure can better protect a person from extreme heat and smoke and provide a temporary haven during the passage of a fire front. The primary goal is to evacuate the area ahead of the fire. However, it is possible that civilians may not be able to leave before the fire front encroaches upon their location, and a TRA is the only alternative. Locations of potential TRAs should be developed at the local level and would be shared through Sweet Grass County Alerts at the time of the event through the advisement of the Emergency Manager.

6.4.1.6 Potential Evacuation Complications

The following are a few complications that may be encountered with an evacuation. These items should be considered by the emergency operations planning staff responsible for evacuation planning:

- Residents, ranches, and business owners may not have established preparedness plans. Public outreach and education should be provided for community evacuation awareness.
- Residents and business owners may choose not to evacuate but rather to stay and defend their homes/ranch/businesses or decide to shelter in place until the fire danger passes. They should be aware of alternatives (TRAs and Safety Zones), and understand the potentially fatal consequences of not having a wildfire preparedness plan, for example: (Ready-Set-Go).

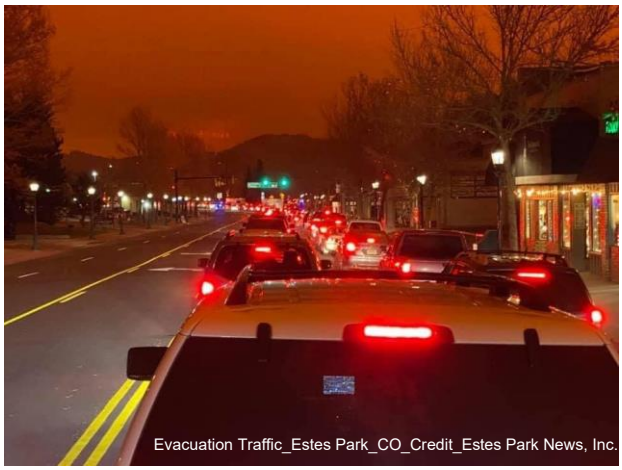
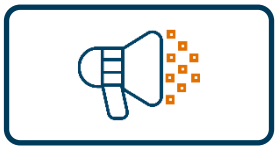


Figure 25: Traffic congestion during wildfire evacuation

- Individuals often delay their evacuation to defend their property or leave their homes too late to evacuate.
- People tend to take multiple vehicles or trailers when fleeing their homes. This can introduce additional demands on the limited road access or create additional hazards along the roadways in the county.
- Vulnerable populations and/or individuals with limited mobility may need additional support, assistance, and time during an evacuation.
- Evacuating pets, service animals, and large animals poses significant problems since panicked animals behave unpredictably and may refuse to respond to regular handling approaches.

RECOMMENDATION



Promote

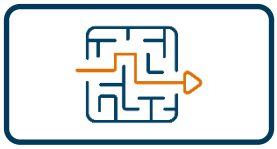
- Continue to promote evacuation awareness through Ready! Set! Go! Program and other local county messaging including evacuation notification systems.

Conduct

- Conduct roadside fuel treatment projects to reduce fire intensity along roadways, allowing for safe evacuation as well as safe access for fire service personnel.

Create

- Create a program to develop Temporary Refuge Areas (TRA) and educate the public on their use, where appropriate.
- Create a program to establish shelter in place procedures and an accompanying public messaging campaign in appropriately identified areas.



Evaluate

- Evaluate where improvements can be made to existing rights-of-way, through expansion or paving, to improve evacuation capability.

Monitor + Update

- Monitor and update the existing Sweet Grass County Evacuation and Sheltering Plan.

Develop

- Develop a plan to increase capability for livestock evacuations through shelter locations and transportation of livestock.

6.4.2 Resilient Landscapes

This section summarizes the fuel treatment strategy for the county's Planning Area. It is based on the need to provide enhanced wildfire protection for the community while also protecting visual, biological, and cultural resources. This strategy provides broad direction on where and how to manipulate vegetation to reduce wildfire hazards. While the local jurisdictions and county, state, and federal agencies play an important role in fuel mitigation, the greatest responsibility for improvements in the protection of the community rests with individual property owners. The development of adequate defensible space and structural hardening are common needs in the majority of the locations evaluated for this plan and are a priority.

Fuel treatments are conducted using a strategic plan and the application of treatment techniques. These strategies and techniques are selected based on the fuel types, topography, and the type of protection best suited for the area. The following sections outline the different strategies and techniques and the environments in which they are best suited. These are not the same as prescriptions. The prescriptions will use the strategies and techniques to provide specific treatment parameters for an area and based upon the vegetation of the identified area. Some combinations of different techniques may be applicable depending on the size and scope of a project.

6.4.3 Fuel Treatment Techniques

6.4.3.1 Fuel Breaks

Fuel breaks are natural or manmade changes in fuel characteristics that affect fire behavior so that fires burning into them can be more readily managed. In addition to slowing the spread of fires, fuel breaks provide firefighters with anchor points to begin or tie in control lines during fire suppression efforts. The reduced fire intensity through these areas allows firefighters a safer place to operate during a fire and increases the defensibility of adjacent areas. There are three (3) subcategories of fuel breaks: Shaded fuel breaks, non-shaded fuel breaks, and ingress/egress (evacuation corridors) fuel breaks. For many of the Federal partners such as the Custer Gallatin National Forest, Potential Operational Delineations or PODs are utilized in managing wildfires. This system recognizes roads, ridges, rivers, and other natural features to help delineate areas where wildfire and fuels management projects can be implemented or managed most effectively.

- **Shaded Fuels Breaks:** Fuel breaks are built in timbered areas where the trees on the break are thinned and pruned to reduce the fire potential yet retain enough crown canopy to make a less favorable microclimate for surface fires. This includes the removal of ladder fuels, downed and dead vegetation, and surface litter.
- **Non-Shaded Fuel Breaks:** Fuel breaks are built in timbered areas that are thinned to remove vegetation, including the canopy, to reduce fire potential. These are sometimes called "fire breaks".

Figure 26: Example of a non-shaded fuel break

- **Ingress/Egress Route Fuel Breaks:** Fuel breaks built adjacent to roadways to reduce fire intensity directly adjacent to the roadway, allowing for safe ingress/egress. These breaks are critical to the life safety of both civilians and firefighters.
- **Potential Operational Delineations (PODs)** are pre-determined boundaries created to identify the safest and most effective places to control wildfire and areas where fuels treatments can be most effective. These PODs also allow fires to be managed in small areas using natural and human made features. The USFS has developed PODs, which should be considered in fuels treatment planning and suppression efforts.

6.4.3.2 Defensible Space

Defensible space is the area around homes or structures that have been treated to reduce the structure's ignition potential. This includes removing vegetation and other combustible materials around the structure. Defensible space allows firefighters a safe space to tactically operate during a wildfire but does not guarantee the survivability structure.

Figure 27: Example of a shaded fuel break to create defensible space

Defensible space should be provided within the Home Ignition Zone (HIZ). More information about the HIZ can be found at the National Fire Protection Association website: **https://www.nfpa.org/Education-and-Research/Wildfire/Preparing-homes-for-wildfire**.

6.4.3.3 Private Ownership Lands Recommendations

Over 50% of the land within the Planning Area is managed or owned by private individuals. Mitigating and fuels management for wildfire is the responsibility of the individual property owners, however, collaborative efforts and cross-boundary projects can be implemented and encouraged.

+ Follow defensible space and structural hardening direction.
+ Remove fire susceptible fuels, grasses, and shrubs from the defensible space zones.
+ Remove all combustibles within five (5) feet of a structure. The first five (5) feet from a structure is the most susceptible to wildfire. This area should be free of combustible material of any kind.
    - A recent study focused on the flammability of landscape mulches found that all of the mulches evaluated were combustible under the test conditions of dry, hot, and windy weather and when the mulches have been exposed outdoors for more than 2½ months (*Smith 2011, Combustibility of Landscape Mulches, University of Nevada Extension, Reno*). Key recommendations from the study are:
        - Maintain a noncombustible, ignition–resistant area immediately adjacent to the house (5-foot zone) and other structures. During a wildfire, embers may accumulate in this area, providing an ample source of ignition for combustible materials.
        - Composted wood chips provide the least fire hazard of the eight mulch treatments tested and would be a better choice for use in a residential landscape in the 5-foot zone. Rock is the most preferred.
+ Implement fuels management/mitigation treatments on large parcels. Property owners should consider using Vegetation/Fuel Treatment Prescriptive Guidelines presented in this plan (Appendix E). These proven best practices and recommendations can help improve defensible space and reduce wildfire intensity.

6.4.4 Fuel Treatment Methods

6.4.4.1 Burning

Broadcast burning is a very efficient and effective method for reducing slash, and surface fuels, and helps improve forest health across a landscape. Burning supports natural forest ecology and allows for fire-dependent plants, shrubs, and trees to flourish. Burning of any kind under the State of Montana does require a permit, notification of the burn, and other requirements depending on the month of the burn. For additional information regarding Open Burning, please refer to Montana DNRC, **Montana Department of Environmental Quality**, and all **Western Montana Zone Requirements**.

Broadcast Burn

This method of treatment is typically cheaper than mechanical or human labor used for fuels removal where fire is implemented across a larger defined area to meet the objectives of a site or forest stand. Weather conditions limit opportunities to conduct burns and require careful planning and execution.

Understory Burning

A prescribed fire ignited under the forest canopy that targets the consumption of surface fuels (litter, needles, grasses, and shrubs). This tactic of burning is a low intensity fire designed not to burn the tree canopy and is often used as an adjunct to thinning and /or pile burning to further reduce the surface fuels. It many times kills invasive plants and unwanted seedlings, enhancing the overall health and resiliency of the stand.

Pile Burning

Pile burning involves stacking slash and litter into piles. These piles are then ignited and monitored until the material has been consumed. Pile burning is an efficient and inexpensive way to remove biomass but still requires labor to remove and stack the slash. Pile burning reflects the same challenges as broadcast burning but is lower in complexity and can be achieved during winter months when there is snow on the ground or weather conditions are conducive for smoke ventilation.

6.4.4.2 Mechanical

Mastication

Mastication involves the use of specialized machinery to grind trees, shrubs, and litter into wood chips that are broadcast onto the forest floor. This method is more time-efficient than hand thinning but can be costly due to the need for specialized machinery and operators. Special care must also be taken to ensure chip depth does not exceed four (4) inches. Chips deeper than four (4) inches can suffocate new growth and create lasting smoldering effects when wildfire burns through masticated areas. Mastication compacts fuels, reducing fire intensity and rates of spread, and allows for the decomposition of undesired woody biomass.

Figure 28: Mastication machinery

Mowing

Regular mowing reduces the intensity of fire in light flashy carrier fuels like native grasses. Keeping grass short, especially adjacent to roadways and structures is critical for slowing fire growth and reducing wildfire intensities. Mowing is labor intensive and does require maintenance for the treatment to be effective. Mowing can be completed with equipment or through grazing with livestock.

Hand Thinning and Stacking

This technique involves the manual removal and piling of ladder fuels, standing dead, small diameter trees, and slash. This practice usually allows for the larger tree trunks to be harvested and utilized. The bioproduct, slash, or undesired trees are then piled for processing. The piles are either removed, chipped, or burned. This process is very labor intensive but is still an effective method of reducing fuel loading.

Figure 29: Thinned timber stand

Grazing

Grazing is used to accomplish the same objectives as mowing using cattle, goats, yacks, or other livestock animals. Grazing is an environmentally friendly option and does have minimal impacts to a landscape if livestock is not limited to an area for long periods of time. Grazing with livestock is an effective way to manage the grasses in high-risk areas and in areas with steep terrain where machinery is inoperable.

6.4.5 Fuel Treatment Costs

Fuel treatment costs vary depending on the scope of the project, topography, fuels, type of treatment, fuel costs, availability of contractors, and environmental concerns. In writing prescriptions for fuels treatment projects, research should be conducted on the most cost-effective and appropriate treatment solutions to accomplish the objectives of the project. There are projects that homeowners can do on their property for limited cost, while some projects may require the use of a contractor and/or specialized equipment.

6.4.5.1 Biomass Removal

Biomass removal is an issue for Sweet Grass County. It is critical to establish biomass removal plans and programs (burning, chipping, hauling away) to help incentivize landowners to perform mitigation actions and remove fuel from areas with wildfire risk. Without biomass removal, mitigation efforts do not reduce risk it simply transfers the risk. In some cases, biomass is stored in slash piles which creates a concentrated fuel load of dried and cured fuels with the potential for high fire intensity and increased ember production or lasting smoldering impacts during a wildfire. Every effort should be made to work between agencies and with landowners to develop reasonable methods for the removal of biomass.

Examples of biomass removal include chipping programs, pile burning, selling for manufacturing or repurposing, and air curtain burners. Buck and rail fencing, snow fencing, and other creative means of use can be implemented as a means to reduce biomass produced during mitigation. Biomass removal is a critical function of mitigation efforts and must be a part of the planning process for any project..

6.4.6 Prioritizing Fuel Treatment Activities

Prioritization of projects should be determined by several inputs and variables. Data from the wildfire hazard assessment, projected flame length, community input, boots on the ground analysis, existing fuels treatments, collaboration potential, and fire history have been evaluated to determine the projects that will give the county the most feasible opportunity to meet management and fiscal objectives. This refers to the recommended projects that will provide the greatest increase in resiliency and the largest decrease in life and property loss.

Projects that have the potential to reduce risk through multiple risk components should be given a higher priority. Fuels reduction projects have the potential to reduce risk to community values, impact from the hazard, and probability of occurrence should be considered to have the greatest cost to value ratio for community wide risk reduction efforts.

Table 5: Potential Mitigation Measures

Community Values Mitigation	*Hazard Mitigation*	*Occurrence Mitigation*
+ Structural Hardening + Reduced Structure Density + Firewise/HIZ + Evacuation Capability + Community Notification Systems	+ Fuels Reduction + Early Detection and Suppression + Irrigation	+ Lightning Protection Systems + Public Education + Fire Restrictions

Fuel treatment units should be designed to enhance the protection of identified values at risk. This is by no means an exhaustive list, but it provides a starting point for a more targeted fuel management program that can expand over time. By developing a public/private network of fuel treatments, the county can further reduce the unwanted consequences of wildfire. See Appendix E for Prescriptive Guidelines and Best Management Practices for Fuel Treatments.

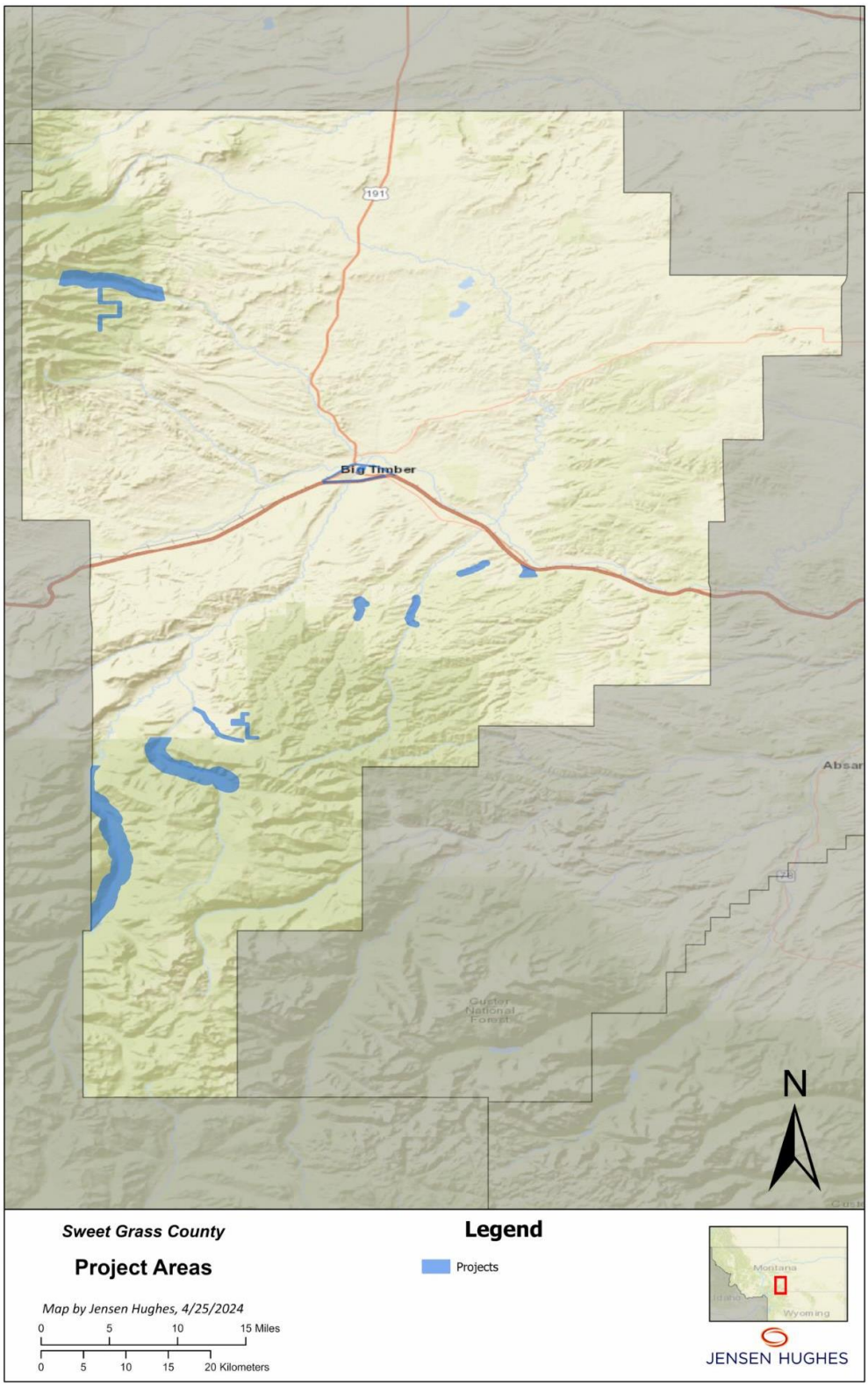


Figure 30: Sweet Grass County proposed fuel treatments

6.4.6.1 Landscape Scale Treatments

The following projects are identified as having county-wide impact and should be a priority for the county. These are identified projects, not prescriptions, that were derived from public comments, land manager experience, fire response, historical fires, and wildfire modeling. Each project area should develop a unique prescription will be tailored for each respective project area by the responsible party or contractor.

Main Boulder Road Corridor

The main boulder road corridor is a winding gravel road at the bottom of a valley surrounded by dense vegetation. It serves as the main access/egress for three remote church camps, residents, and high-use recreation areas.

- Church Camps: Significant fuel reductions should be completed around each of the church camps located in the valley. Each camp is susceptible to wildfire and poses unique challenges due to the large populations present and limited transportation access for evacuation. Aggressive thinning should be done to create survivable space around each camp. HIZ Guidelines and structure hardening practices are recommended to create defensible space around the structures and to increase the effectiveness of risk reduction treatments.
- Roadside Treatments: The narrow, curvy roadway creates dangerous conditions for evacuation during a wildfire. The dense vegetation along the road increases the hazard for evacuees and responders. Aggressive thinning should be conducted directly adjacent to the roadway to reduce the intensity of fire. As the treatment extends beyond the roadway, the treatment can become less aggressive and blend into the current landscape. Dense and overgrown trees should be removed, and ladder fuels eliminated to increase the effectiveness of this treatment.

East Boulder Road Corridor

The East Boulder Road corridor is the main point of access and egress for the East Boulder Mine, dispersed housing, and recreation sites. Aggressive thinning should be conducted alongside the roadways to reduce fire intensity and increase evacuation capability. As the treatment extends beyond the roadway, the treatment can become less aggressive and blend into the current landscape. Dense and overgrown trees should be removed, and ladder fuels eliminated to increase the effectiveness of this treatment along the road corridor.

Big Timber Canyon Corridor

Big Timber Canyon provides access to the east side of the Crazy Mountain range, which is heavily used for recreation and hunting. Similar to the Boulder Corridors, the current conditions compromise the evacuation capability out of the canyon. Aggressive thinning should be conducted alongside the roadways to reduce fire intensity and increase evacuation capability. As the treatment extends beyond the roadway, the treatment can become less aggressive and blend into the current landscape.

East Boulder Mine

The East Boulder Mine is an integral economic piece of the community and should be protected as such. The mine property and buildings are fairly resilient to wildfire, however, there is concern about evacuation and smoke from a wildfire filling the shaft while workers are inside. Shaded fuel breaks should be implemented surrounding the mine property to reduce the intensity of approaching fires and limit smoke production and infiltration into the shaft.

Dornix Park

Dornix Park has the most significant fuel load in Big Timber. Shaded fuel breaks should be implemented across the park landscape to reduce the potential for ignition and intensity of fire if one should occur. Due to the proximity to high population densities and the increased human interaction with the landscape, the park should be treated and maintained to reduce the risk to the adjacent community.

Greycliff Fuel Break

A shaded fuel break should be implemented in the timber stand above Greycliff. Ladder fuels should be eliminated, and dense, overgrown, dead, and diseased trees should be removed to reduce fire intensity and ember generation potential.

Homestead Corridor

The southern portion of the Homestead Road corridor consists of heavy timber stands, topography, and alignment that could contribute to a severe fire event threatening structures and cutting off egress for residents further south. This treatment area should focus on creating defensible space adjacent to structures and fuel breaks along roadways to ensure safe and effective evacuation. Treatments adjacent to structures should align with the HIZ Guidelines and structure hardening recommendations. Treatment along roadways should be aggressive adjacent to the right of way.

Lower Deer Creek

The Lower Deer Creek Corridor contains the same physical characteristics as the Homestead Corridor, which contributes to more extreme fire behavior. This treatment area should focus on creating defensible space adjacent to structures and fuel breaks along roadways to ensure safe and effective evacuation. Treatments adjacent to structures should align with the HIZ Guidelines and structure hardening recommendations. Treatment along roadways should be aggressive adjacent to the right of way.

Upper Deer Creek

The Upper Deer Creek area focuses on a dense pocket of timber located in a narrow draw, which could contribute to rapid fire growth and spread. Due to the physical characteristics of the area, aggressive forest thinning fuel treatment work should be implemented to limit fire spread and intensity. Dense, overgrown, dead, and diseased trees should be targeted for removal.

Elk Creek Corridor

The Elk Creek Corridor is located in a high fire risk area. There are several houses located along the roadway and dense vegetation adjacent to the structures and road. The surrounding fuels are light flashy fuels that can carry fire at rapid speeds and high intensity. Forest thinning projects should be completed along the roadway and around structures focusing on removing dense, overgrown trees while also eliminating ladder fuels and creating canopy spacing. This will reduce the intensity and rate of spread along the roadway, creating a more defendable environment.

Federal/Private Boundary 1 (Crazies)

Federal agencies and private landowners/managers have a vested interest in Crazies area. The threat of a fire starting on a particular piece of property and spreading to adjacent ownership requires collaboration for suppression and recovery. This project area has two (2) objectives. The first is to limit the potential for fires in this region to impact multiple landowners and managers by creating a shaded fuel break along the ownership boundary. Programs like the Good Neighbor Authority (GNA) provide latitude for coordination between agencies and landowners to conduct fuels management projects collaboratively. The second objective is to create a strategic boundary designed to keep a fire manageable. The alignment of drainages and fuel on the eastern aspect of the range is conducive to fire spread downslope and into the foothills. Creating a break in fuel perpendicular to this alignment will hinder fire spread and provide responders with an opportunity to hold the fire at this fuel break.

Federal/Private Boundary 2 (Boulder)

Much like the previous priority area (Crazies), this boundary project aims to prevent the potential for trespass fires. The main objective of this area treatment is to prevent the spread of fire from private to federal lands. Based on the alignment of terrain and fuels in this location, a fire ignition has the potential to burn for miles with uninterrupted dense fuels. The limited access to the area creates challenges with suppression, making this a critical project to prevent a fire from burning beyond the suppression capabilities of the responding agencies.

Big Timber Fuel Break

Big Timber is surrounded primarily by light flashy fuels and intermixed with ornamental landscaping and trees. Recent fires have shown that this combination of fuels poses a significant threat when paired with weather conditions that contribute to rapid fire spread and structure-to-structure ignition. The fuels surrounding Big Timber are the easiest to modify to create resilient landscapes. A buffer of 150 feet on both sides of the highway and railroad easement should be mowed or burned to limit the fuel loading in areas of high ignition potential and to serve as a fuel break if a fire were to spread toward these areas.

6.4.6.2 Additional Projects in Priority Areas

The following section contains recommendations on additional measures within the priority areas to increase resiliency for the community. These recommendations are not focused on vegetation management, but rather on a holistic approach to resilience.

Church Camps

Immediate action should be taken to protect the church camps located on the Main Boulder Road. In addition to conducting fuel management on the property and coordinating with federal agencies to conduct fuel treatments on the surrounding lands, there are measures the camps can take to protect themselves and their campers from wildfire. Structural hardening measures per Table 6 should be implemented to the extent possible. Evacuation procedures should be developed or expanded upon for each camp. These procedures should include ensuring that there is adequate transportation and drivers available for all campers and staff onsite should an evacuation be necessary, notifying campers and parents of an evacuation, and designated meeting points. Additionally, shelter-in-place procedures should be developed for when evacuation can not be completed safely based on the conditions.

Roadway Improvements

Many of the roadways in the county are gravel surface, windy, and narrow, all of which present challenges during a wildfire evacuation. An analysis should be conducted to determine if there are areas where the roadways can be improved to increase evacuation capacity. The current roadways create dangerous conditions that could trap evacuees and limit first responder access. The county and its partners should evaluate where any roadways could be widened, how bridges could be improved, and the feasibility of improving the road surfaces. All of these would contribute to safer access and egress routes. Temporary Refuge areas (TRAs) should be identified and developed, per Section 6.4.1.5 where evacuees could shelter as a last resort if the road was impassable and the fire front was approaching.

East Boulder Mine

The East Boulder Mine is less vulnerable to impact from a direct fire front than other areas within the county; however, it is still susceptible to impacts from a wildfire. The mine should develop or expand upon evacuation procedures for employees. This plan should include how employees will be transported from the site and where they will be taken. The majority of employees are shuttled to the mine due to limited parking onsite. This means employees are not able to self-evacuate in a wildfire and are dependent on outside resources. Due to this, shelter-in-place plans should be established to protect employees in the event that shuttles are unable to conduct evacuation effectively. The plan should identify where employees will be sheltered and how they will be notified. Additionally, the mine should evaluate ways to prohibit smoke migration into the shaft during a wildfire in order to maintain a tenable environment for employees.

Home Ignition Zone (HIZ)

Within the priority areas and across the County, residents should follow the Home Ignition Zone (HIZ) guidelines for creating resilience on private property. These guidelines include recommendations for managing vegetation adjacent to structures and home hardening measures to prevent the ignition of structures. These recommendations should be used to supplement the fuel management recommendations.

6.4.7 Structure Vulnerability

From 2004 to 2019, the National Interagency Fire Center (NIFC) estimates that on average approximately 2,593 structures per year are lost due to wildfires across the United States with more than half of these losses as primary residences (**www.nifc.gov**).

Research has shown repeatedly that the main reason for structure loss during a wildfire is due to the ignitability of the structure itself, which is not always associated with large, high intensity fires. Low intensity fires can destroy structures that are highly ignitable while structures with low ignitibility can survive high intensity fires (**www.fema.gov**, *Jack Cohen, USFS, How Homes Ignite, pgs. 117-121*).

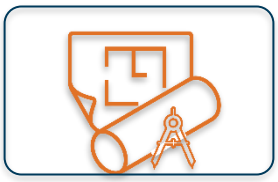
Wildfires can ignite structures in numerous pathways. These pathways depend on a variety of characteristics found in the WUI; examples include:

Adjacent Wildland Open Space

- Fuels
- Terrain
- Weather
- Fires influence on itself

Community

- Housing density
- Zoning
- Separate distance
- Physical barriers



Structure

- Exterior structure construction material
- Structural design
- Site location (e.g., mid-slope, hilltop)
- Structure maintenance
- Heat sources (e.g., landscaping, falmmable exposures) within 100 to 200 feet

The risk of a structure's ignition is a direct result of the thermal exposure by wildfire, and the vulnerability or ignitability of the structure (i.e., building materials and construction). Structures ignite in three (3) ways:

Convection

Convection is the transfer of heat by the movement of rising hot air or gasses.

Convective heat tends to rise – visually observed as flames and smoke columns.

Convection lifts firebrands into the sky. Flames can overwhelm a structure by direct flame impingement, which could be a result of inadequate spacing of structures, lack of defensible space, and/or extreme fire behavior.

Radiation

Heat energy is released in all directions from a burning object (the same way the sun heats the earth).

If exposed combustible structural elements reach their ignition temperature, a structure can ignite. Nearby burning structures can radiate heat and ignite other structures in close proximity, moving the fire from structure to structure.

The potential for ignition is greatly reduced as space between structure and fuel (e.g., wildland and urban) is increased.

Ember Cast

Embers are flammable material that detach from the main fire front, get carried by strong convection drafts and/or winds to receptive fuel down wind.

Wildfires can produce hundreds to thousands of embers that can be carried miles by winds potentially starting secondary fires and igniting remote structures.

Receptive vegetation and fuel beds can include ornamental landscaping, dead vegetation, litter, debris build up in rain gutters, mulch beds, etc. Enclaves, islands, and riparian corridors of wildland vegetation, and ornamental vegetation are also interspersed with structures and subdivisions throughout the community. These create significant opportunities for wildfires to ignite, establish, and destroy structures. Wildfires will continue to threaten values at risk within Sweet Grass County despite all efforts to prevent it from occurring. However, stakeholders can and should take proactive measures to mitigate this threat.

Table 6 below shows vulnerable components of a structure that can contribute to ignition during a wildfire. Table 7: Structure Mitigation Actions: provides mitigation recommendations for these vulnerabilities.

Table 6: Vulnerable Components of a Structure

Roofing	Roof construction and maintenance has been a key factor in structure loss in many fires. It is not just the type of roofing material, but also the design, construction details, the condition of the material, and whether the roof is clear of burnable material (e.g., pine needles and other debris). Gutters collect debris and vegetation and should be considered in evaluation of the roof system.
Garages	Garages with gaps at the top, bottom and edges of doors allow firebrands to enter. Oftentimes garages contain combustible materials that can enhance ignition potential. Garages usually have vents at various locations, especially if they contain gas furnaces or hot water heaters. These vents can be easy entry points for embers.
Siding	Combustible siding can provide a pathway for flames to reach vulnerable portions of a structure, such as the eaves or windows. Siding needs a source of ignition, which in many cases includes vegetation, wooden decks, and fences, or stacked firewood or other combustible material in close proximity to a structure. This can provide a heat source that can ignite siding.
Vents	Soffit vents in the eaves are an easy entry point for wind-driven burning embers during a wildfire. Attic fires are not easily detected from the outside, and structures have been lost when fire personnel have left the scene unaware that a fire has ignited within the attic.
Windows	Unprotected and inadequate windows can be another major entry point for fire. Windows broken by airborne materials or cracked by thermal expansion during a wildfire ignite materials in the structure through radiation, convection, and/or firebrands.
Joints and Angles	Joints, inside corners, and roof valleys all become areas where flammable debris (e.g., pine needles, bird's nests) have collected over time. Burning embers can land on this debris, igniting it. These areas can also be a collection point for multiple embers which creates a larger ignition threat to the underlying material.
Crawlspace Vents	If not adequately screened, these areas, not just under a structure but also under decks and other attachments, are difficult to protect. Much like vents in the attic, firebrands enter these areas and combustible material underneath a structure can ignite.
Wood Fences	Firefighters have observed that wood fences act as a fuel source that can carry fire to a structure. Fences when attached to homes present a threat to the structure.
Wood Decks	Decks act as a source of fuel that is attached or directly adjacent to structures. When ignited by wildfire the radiant and convective heat output can ignite structures. In addition, most decks are adjacent to large windows or glass sliders and the heat from a deck fire can cause the glass to fail allowing the wildfire to enter a structure.
Landscape Vegetation/Debris	Flammable landscaping and/or combustible items such as firewood or debris piled in close proximity to the house. As a result, structures are more susceptible to ignition when exposed to significant radiant and convective heat from burning material.
Defensible Space	Defensible space is the space between a structure and the wildland or neighboring structure that, under normal conditions, creates a sufficient buffer that modifies the spread of a wildfire to a structure. Defensible space can protect a structure from direct flame impingement, radiant heat, and reduce the number of burning embers and is essential for structure survivability during wildfires.

6.4.8 Fire Adapted Communities

Collaboration and engagement by all stakeholders are critical for the success of emergency preparedness. The challenge for Sweet Grass County is how to engage the community to affect change at the individual and community level in a locally relevant and sustainable way. Communicating accurate and timely information before, during, and after a wildfire is a challenge that communities are addressing through a variety of programs before an event escalates. The following is a list of current preparedness actions and measures.

6.4.8.1 County and Regional Programs

Ready, Set, Go!

This program developed was through the cooperation of numerous agencies and includes information on defensible space, structural hardening, evacuation, preparing families before and during a wildfire, and developing checklists to help residents prepare before a wildfire that may impact their community. More information on the Ready, Set, Go! program can be found **here.**

NFPA Home Ignition Zone

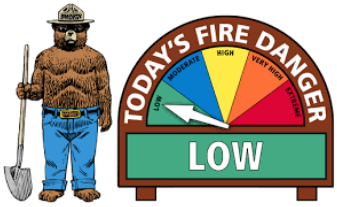
This program was developed to provide guidance to homeowners to increase the survivability of their homes. The program guides structural hardening as well as providing defensible space. More information on Home Ignition Zone can be found **here**.

NFPA Firewise

This program, developed by the National Fire Protection Association is similar to the Home Ignition Zone Guidelines. It provides guidance on creating defensible space and hardening your home against wildfire. It also provides guidance on preparing for evacuations and developing emergency action plans. More information about Firewise USA can be found **here**.

Red Flag Warnings

Red Flag Warnings identify weather conditions that are favorable or dangerous wildfire conditions. Red Flag Warnings are intended to make the public more aware of their behaviors and limit activities that could lead to fire ignitions. More information about Red Flag Warnings and registration for On Solve – CodeRed Notification System can be found **here.**



Fire Danger Ratings

Understanding current fire danger can help residents react appropriately when notified of an emerging fire situation. More information on Fire Danger Ratings is located **here.**

Fire Restriction Plan

Sweet Grass County coordinates with the Billings Interagency Dispatch Center to set restrictions. This link provides more information on fire restrictions and the factors for enacting restrictions: **https://gacc.nifc.gov/nrcc/dc/mtbdc/index.html.**

The county and its partners have done an excellent job in coordinating fire restrictions and providing consistent messaging to the public. This reduces confusion across jurisdictional boundaries and is critical for the enforcement of these restrictions.

RECOMMENDATIONS

Leverage

- Continue to leverage existing programs and efforts to reduce wildfire risk to the community while also expanding these programs.

Create

- Create a public messaging campaign targeted at wildfire preparedness that should be year-round.

Adopt

- Adopt NFPA Firewise USA, NFPA HIZ Guidance, and Ready, Set, Go! Programs across the county to provide consistent messaging.

Conduct

- Upon adoption of the CWPP, conduct “walk and talk” meetings with HOAs to demonstrate recommended mitigation practices and answer questions about fuels management and structural hardening.

Educate

- Educate the public on grants, disaster or impact tax credits, and other potential funding sources to remove hurdles for mitigation projects on their personal property.

Establish

- Establish a neighborhood ambassador program to help expand reach throughout the community.

Structural Resiliency Guidance

In the event of a wildfire, firefighting resources may be quickly overwhelmed. Resources will not match the number of structures or values at risk. It may not be safe for firefighters to engage in structure protection due to a variety of factors (e.g., defensible space, intensity of the fire, weather conditions, local topography, access issues, lack of water supplies, etc.). The survivability of a structure in a wildfire event may depend on the overall resilience of the property.

Most actions to reduce the ignition potential of a structure are associated with the structure itself and the surrounding environment from 5 - 100 feet out from the structure. The primary responsibility for protecting a structure lies with the property-owner and is the area within the Home Ignition Zone (HIZ). See Figure 31 for a representation of HIZ area.

The HIZ includes the structure itself and everything from the foundation out to 100 feet depending on fire behavior conditions (NFPA, 2021) and NFPA recommendations. Within this 100-foot area, there are three (3) zones.

+ **Zone 1:** 0-5 feet encompasses the structure and all its attachments (e.g., wooden decks, fences, and patios) for at least five (5) feet on all sides. The first five (5) feet is considered the “ember-resistant” zone. In this area, provide the following:
  - Avoid planting or allowing to grow any vegetation. This includes refraining from allowing wood mulch, woodpiles, combustible trellises, and stored items. This is an excellent location for walkways, or hardscaping with pavers, rock mulch, decomposed granite, or pea gravel. This should include a six-inch noncombustible zone between the ground and the start of the building’s exterior siding.
  - Ornamental and wildland vegetation should be carefully spaced, low growing, well-watered, and free of resins, oils, and waxes that burn easily.
  - Prune trees from the ground up to approximately a third up of the canopy height. The concept is to separate branches/canopy from ground and surface fuels.
  - Mow grasses regularly.
  - Create space between tree crowns and trim back any branches that overhang the house.
  - Remove dead vegetation from under the deck, and combustible piles, and refrain from storing firewood near structures.
  - Consider fire-resistant material for patio furniture, etc.
  - Water vegetation and mulch regularly.
  - Consider xeriscaping.

+ **Zone 2:** 5-30 feet from the home, and vegetation in this zone should be low growing, well irrigated, and less flammable. In this area, provide the following:
  - Leave 30 feet between clusters of two (2) to three (3) trees, or 20 feet between individual trees.
  - Encourage a mixture of deciduous and coniferous trees.
  - Create breaks in vegetation, such as driveways, gravel walkways, and lawns.
  - Prune trees 1/3rd of the canopy height from up from the ground.
+ **Zone 3:** 30-100 feet from the home. Thinning in this area should occur, although less thinning is required than in Zone 2. In this area, provide the following:
  - Thin vegetation and remove heavy accumulation of combustible growth, ground litter, and debris.
  - Reduce the density of tall trees so canopies are not touching.

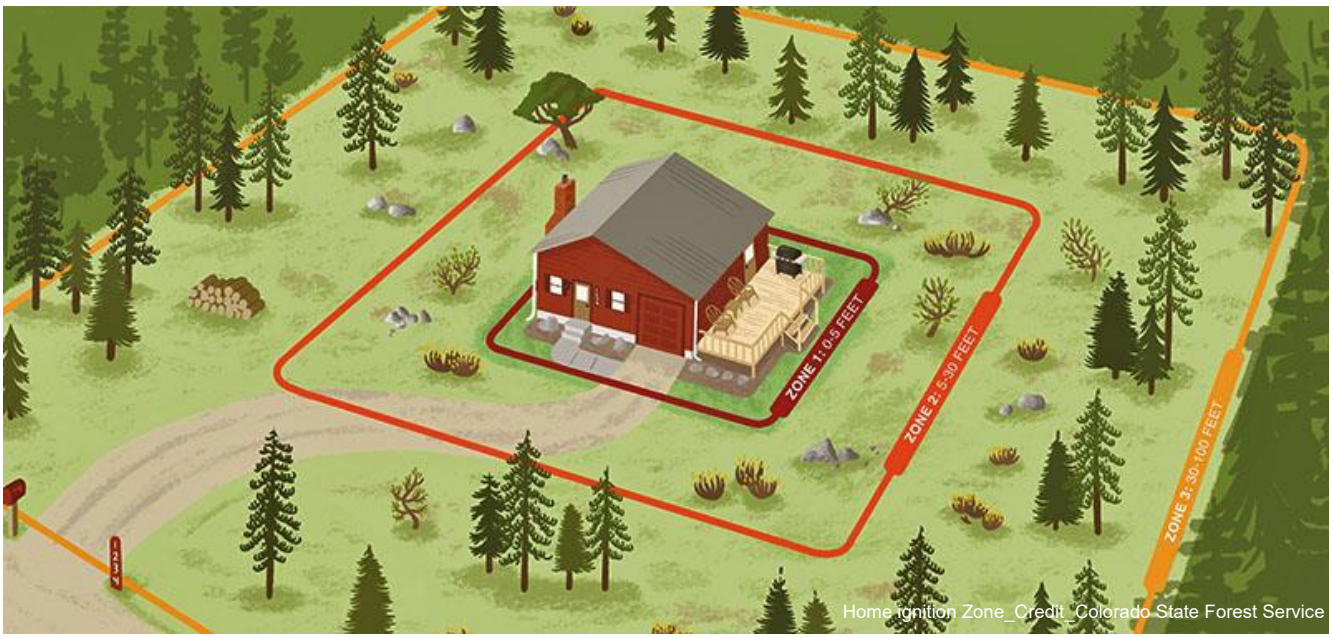


Figure 31: Defensible space zones

Table 7: Structure Mitigation Actions

Roofing	Replace wood-shake or shingle roofs with a Class-A material suitable for extreme fire exposure. Plug openings in roofing materials, such as the open ends of barrel tiles, to prevent ember entry and debris accumulation. Regardless of the type of roof, keep it free of bird's nests, fallen leaves, needles and branches.
Garages	Ensure garage doors seal with the concrete slab to prevent ember intrusion into the garage. Avoid storing combustible materials near openings where embers may accumulate. Provide any vents into the garage space with 1/8" steel mesh screening.
Siding	Noncombustible siding materials (e.g., stucco, brick, cement board, and steel) are better choices than traditional products such as wood. If using noncombustible siding materials is not feasible, keep siding in good condition and replace materials in poor condition.
Vents	All vent openings should be covered with 1/8-inch or smaller wire mesh. Another option is to install ember-resistant vents. Do not permanently cover vents, as they play a critical role in preventing wood rot. In the WUI, roof gutters shall be provided with the means to prevent accumulation of leaves, needles, and debris.
Windows	Single-pane windows and large windows are particularly vulnerable in older homes built prior to current fire codes. Recommend installing windows that are at least double-glazed and that utilize tempered glass for the exterior pane. The type of window frame (e.g., wood, aluminum, or vinyl) is not as critical; however, vinyl frames can melt in extreme heat and should have metal reinforcements.
Joints and Angles	Where joints and angles may contribute to structure ignition, provide metal flashing to prevent ignition of combustible materials. It is also imperative that these areas be kept free of combustible debris and vegetation.
Crawlspace Vents	All vent openings should be covered with 1/8-inch or smaller wire mesh. Another option is to install ember-resistant vents. Do not permanently cover vents, as they play a critical role in preventing wood rot.
Wood Fences	Where possible, replace wood fencing materials with noncombustible or limited combustible materials such as metal or vinyl fencing. Where replacing fence materials is not feasible, ensure fence is in good condition and sealed. Manage vegetaion adjacent to fencing to limit the spread of fire to the fence.
Wood Decks	Keep all deck materials in good condition. Consider using fire-resistant rated materials or heavy timber construction. Routinely remove combustible debris (e.g., pine needles, leaves, twigs, and weeds) from the gaps between deck boards and under the deck. Enclosing the sides of the deck may reduce this type of maintenance. Do not store combustible material under the deck.
Landscape Vegetation/Debris	Keep the porch, deck, and other areas of the home free of flammable materials (e.g., baskets, newspapers, pine needles, and debris). Keep firewood, bales of hay or straw, and other combustible/flammable materials at least 30-feet away from a structure.
Defensible Space	Defensible space is the space between a structure and the wildland or neighboring structure that, under normal conditions, creates a sufficient buffer that modifies the spread of a wildfire to a structure. Defensible space can protect a structure from direct flame impingement, radiant heat, and reduce the number of burning embers and is essential for structure survivability during wildfires.

RECOMMENDATION

Provide

- Provide guidance and resources for residents to protect their homes and businesses through structural hardening measures.

6.4.8.2 International Wildland Urban Interface Code Adoption

The county currently does not have regulations in place to require certain wildfire resilient construction features for new developments and construction. The International Wildland-Urban Interface Code (IWUIC) is a model code that requires defensible space and hardened structure elements based on the classification of ignition resistant construction. The county should be explored for options to adopt the IWUIC with appropriate amendments that accommodate Sweet Grass County and reduce the susceptibility to ignition of new construction.

RECOMMENDATION

Adopt

- Adopt and ammend as appropriate the International Wildland Urban Interface Code for new construction and homes located within the defined WUI and/or wildfire prone areas.

6.4.9 Safe, Effective, Risk-Based Wildfire Response

6.4.9.1 Suppression Capabilities

For specific Fire Agency information see Section 3.5.

Sweet Grass County, because of its unique population, interface, size, topography, fuels, access, and egress, presents a challenging scenario for wildfire response. The county depends on multi-jurisdictional services for fire suppression and emergency response. Each agency and entity is co-dependent upon the other, particularly if a wildfire escapes an initial attack or an immediate need to evacuate residents surpasses capacity. Because of the number of occluded interfaces and public exposure, it is a realistic possibility that all first arriving fire suppression resources will be engaged in evacuations instead of fire suppression. In the last 20 years, wildfire incidents have steadily increased both in size and severity, the majority being human caused. For this reason, the county should continue to foster greater partnerships and relationships with supporting agencies and further refine MOUs and IGAs to ensure the most effective public safety coverage can occur.

6.4.9.2 Personnel

Big Timber VFD is comprised of 38 volunteers. Due to the distances responders must travel and limited access to rural areas of the county, there may be a delay to suppress a fire during the initial attack. It is critical that agencies and responders receive early notification and arrive early during fire development to contain the fire

during the initial attack or the first operational period. There are areas within Sweet Grass County where the number of personnel available at any one time is not sufficient to contain and control a fire that could escape an initial attack. In recent years, a significant effort has been made to increase wildfire response capability and capacity. This effort should be continued to be reviewed. Given the modeling and assessment work completed for this document, additional tactical strategies can be improved, staging of various resources, and further training exercises can be developed to further enhance initial attack response and the capabilities of staff.

Figure 32: BTVFD apparatus

6.4.9.3 Apparatus

All agencies have apparatus designed for wildfire suppression. Big Timber VFD has a fleet of wildland fire apparatus that includes Type 6 Engines, Tenders, and a D7 Dozer. Because of the timber, steep terrain, and heavy fuel loads, a dozer is a critical asset in containing fires in the county. Additionally, Big Timber VFD has access to DNRC engines through a lease program. Most agencies have some capacity to supply themselves with a water source in the early stages of a fire, however, if the fire escapes, water delivery for fire suppression is a concern. In some areas, water tenders may take extended periods of time to arrive on the scene. Water Tenders and other heavy equipment resources should be strategically located or prepositioned during elevated fire danger.

Figure 33: Big Timber VFD D7 Dozer

6.4.9.4 Air Resources

Sweet Grass County DES and fire agencies are cognizant of the possibility of fire escapes during the initial attack. Because of the remote country, long response times or delays in the detection and notification of a fire, air resources are an invaluable asset. Air support for firefighting operations is available through any of several Interagency Dispatch Centers (Billings, Great Falls, Lewiston, etc.)) and/or through Air the State of Montana. However, any air resource is subject to availability. Weather and assignments to other fires may limit the availability of aircraft. Air resources include fixed and rotary wings. Aircraft can be used for observing and gathering intelligence, delivering retardants and suppression agents, logistics support, and transportation of resources.

6.4.9.5 Law Enforcement

Law enforcement, primarily the Sweet Grass County Sheriff, has been trained to assist with evacuations, traffic control, and scene security. Law enforcement capacity can be challenged during a fire. Deputies and officers may be pressed into emergency evacuation duties initially, and traffic management for access and egress corridors, roads, and highways may become congested. Law enforcement can also be used for security and perimeter control.

RECOMMENDATIONS

Promote

- Continue to promote collaboration across agencies.

Provide

- Continue to provide support through aid agreements.

6.4.10 Post-Fire Assessment/BAER

Post-fire damage assessments and emergency stabilization through the Burned Area Emergency Response (BAER) framework are critical aspects of wildfire response/recovery. Response to a wildfire event does not begin nor end with the fire suppression. Generally, the BAER is a post-fire stabilization team that assesses damage and initiates rehabilitation in and around the burn scar. This effort is a long-term process, taking many years for some fires. Post-fire recovery should begin while the fire is still active. Suppression tactics may be adjusted to enhance the recovery effort, examples might be water conservation, burn out operations, water bars and trenches built during firefighting operation, or the controlled use of slurry near watersheds.

A plan should be developed to guide how the county will handle post-fire damage assessments, area stabilization, and recovery. This plan should include the BAER program and a process to implement recovery planning into the incident command structure. Post fire recovery should be included in the planning section of the incident management structure. Monitoring fire behavior and burn severity in real time, identifying environmental damage, and initiating recovery efforts.

The recovery plan should also include personnel designated for conducting post-fire damage assessment as soon as it is safe to do so. Providing an efficient, coordinated response for post-fire stability is equally as critical as the suppression activities and could reduce the potential for long-term adverse effects on the landscape, particularly watersheds and community infrastructure.

Table 8: Community Action Plan

Objective	Action	Responsible Official	Target Date	Status
Public Education	Create a public messaging campaign targeted at wildfire preparedness.	Sweet Grass County DES	December 2024	
	Conduct "walk and talk" meetings with HOAs to demonstrate recommended mitigation practices and answer questions about fuel mitigation on private property.	BTVFD, DNRC	August 2024	
	Conduct HIZ assessments with Neighborhood Ambassadors to expand the reach of education efforts.	BTVFD, DNRC	Ongoing	
	Educate the public on grants, tax credits, and other potential funding sources to remove hurdles for mitigation projects on their personal property.	Sweet Grass County DES	May 2025	
Evacuation	Conduct roadside fuel treatment projects. Where possible mitigation on both sides of the roadway is recommended to reduce the potential of spotting across roadways.	Land managers and County	2029	
	Promote the use of the Ready! Set! Go! Program.	Sweet Grass County DES	Ongoing	
	Create a program to identify Temporary Refuge Areas (TRA) and educate the public on their use, including notification procedures for the use of these areas.	Sweet Grass County DES	May 2025	
	Evaluate where improvements can be made to existing rights-of-way to improve evacuation capability.	Sweet Grass County DES and Road and Bridge	July 2025	
	Implement improvements to existing right-of-way.	Sweet Grass County Road and Bridge	2029	

Objective	Action	Responsible Official	Target Date	Status
Evacuation (Continued)	Monitor and update the existing Sweet Grass County Emergency Operations Plan annually.	Sweet Grass County DES	Annual	
	Develop a plan to increase the capability for livestock evacuations through shelter locations and transportation of livestock.	Sweet Grass County DES	May 2025	
Fuel Treatment	Monitor the progress of recommended priority projects and update as necessary.	Sweet Grass County DES	Annual	
	Identify opportunities to leverage programs like the Good Neighbor Authority and other opportunities to collaborate across agencies for fuel treatment projects.	All agencies	Ongoing	
	Pursue funding opportunities for mitigation projects through multiple avenues including grants, taxes, mil levies, and any other potential sources.	Local Agencies and land managers.	Ongoing	
	Establish biomass removal programs across the county to assist homeowners in their efforts to reduce the risk to their personal property.	Sweet Grass County DES and BTVFD	August 2025	
Infrastructure Hardening	Develop a plan to harden critical infrastructure assets to include, electric distribution, communication systems, public utility infrastructure, hospitals, schools, temporary refuge locations, etc.	Sweet Grass County DES	December 2025	
	Implement hardening of critical infrastructure plan.	Sweet Grass County DES	2029	
Structural Hardening	Provide guidance and resources for homeowners to protect their homes through structural hardening measures.	Sweet Grass County DES and BTVFD	December 2024	
	Adopt the International WUI Code for new construction and homes and businesses.	Sweet Grass County Building Department	December 2025	

Objective	Action	Responsible Official	Target Date	Status
Structural Hardening (Continued)	Adopt an addressing ordinance to require minimum address markings in accordance with Chapter 13 of NFPA 1140 for Premises identification.	Sweet Grass County Building Department	July 2025	
Planning	Develop a Wildfire Resilience Plan for the East Boulder Mine.	East Boulder Mine	December 2025	
	Develop a list of dry hydrant and cistern locations throughout the county in an effort to create a comprehensive database of water supply locations.	Sweet Grass County DES, BTVFD	July 2025	
	Conduct inspection, testing, and maintenance of dry hydrants and cisterns throughout the county to ensure these water supplies are operational when needed.	BTVFD	Ongoing	
Resident Recommendations	Increase Home Ignition Zone resilience through implementation of vegetation management and structural hardening on individual properties.	Sweet Grass County Residents	Ongoing	
Funding	Establish reliable funding resources outside of grants for use in conducting mitigation projects, increasing fire protection district staffing and resources, increasing funding to the wildfire mitigation council, and expanding education programs within the county.	Sweet Grass County DES, BTVFD	Ongoing	

Monitoring

This CWPP provides a foundation to guide the community in wildfire protection activities based on input from stakeholders, current policy, a science-based wildfire assessment, and the development of mitigation strategies.

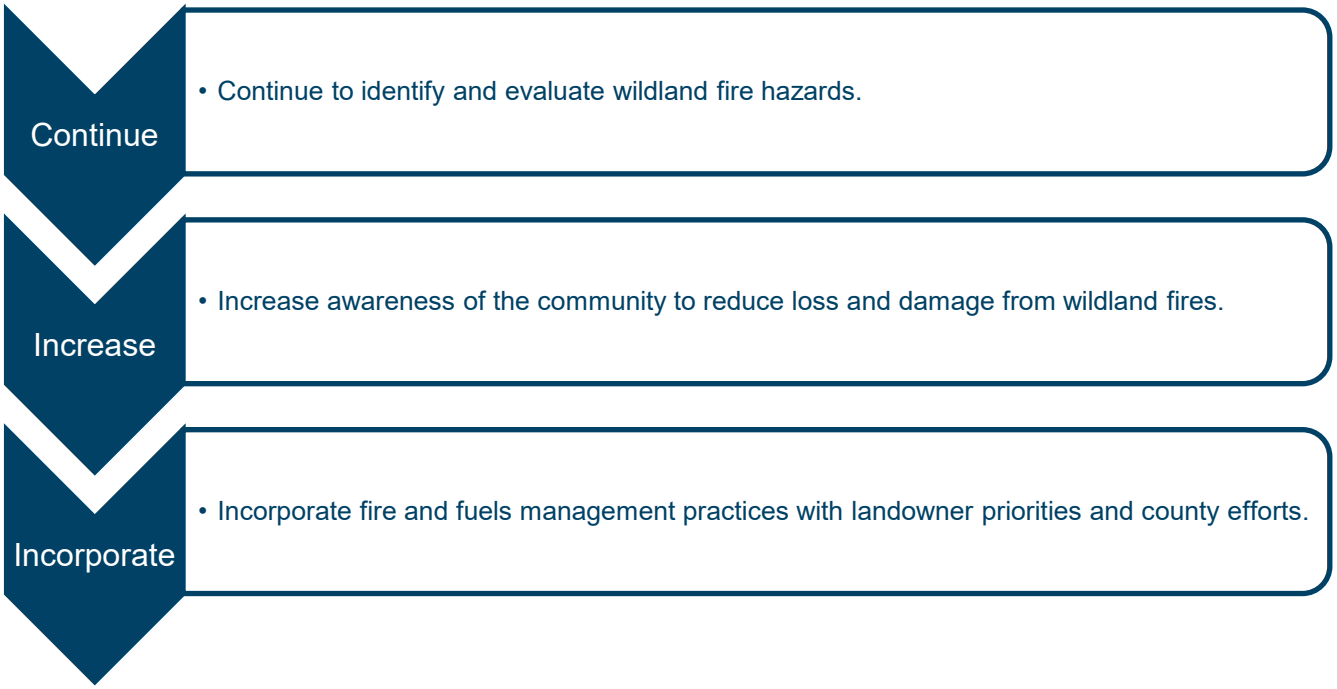
A CWPP's strength depends on collaboration, its relevance, and its ability to guide actions on the ground.

Big Timber_Sweet Grass CO_MT_Credit_JHProp_Cooper

7.0 Monitoring

This CWPP is intended to provide a foundation for continued multi-agency collaboration and cooperation for fire protection planning efforts in the county. Effective monitoring of wildfire planning efforts provides important opportunities to evaluate the overall success of the CWPP in reducing wildfire risk and improving planning processes. This plan does not end when it is adopted but evolves with a continuous cycle of collaborative planning, implementation, monitoring, and adapting strategies based on lessons learned.

Basic recommendations that will lead to a successful program are:



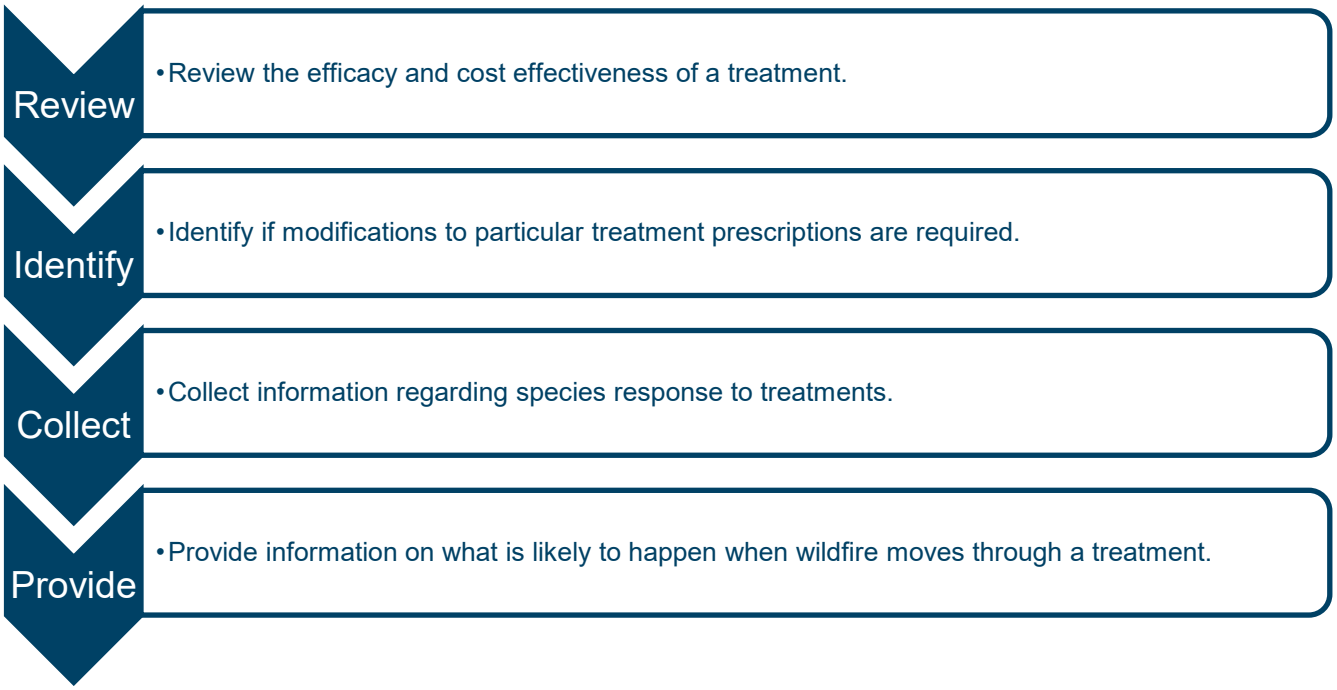
7.1 CWPP MONITORING

The CWPP should be constantly monitored and updated as needed to reflect changes in conditions. At a minimum, the county should revisit the plan annually for a review and to update any changes to the environment or the community. This includes monitoring project progress for both fuel treatments and other recommended projects. The CWPP should have a thorough review and update process conducted every 3-5 years. The process for updates should begin in year three (3) with completion by year five (5).

7.2 FUEL TREATMENT MONITORING AND MAINTENANCE

Monitoring of fuel treatments is the only way to validate that activities on the ground are progressing towards the goals of more resilient landscapes and the increased safety of people and property. Commitment to monitoring the Plan can lead to more effective fuel management programs by providing an understanding of how treatments affect wildland fire spread or protect local values at risk.

Monitoring information should be used to:



Developing targeted questions to guide monitoring can aid in formulating a monitoring plan. By focusing on addressing a few key questions, it ensures that the right information is collected to efficiently address specific objectives.

Jain and others (2012) provide questions that can be used to develop an effective monitoring plan: **https://iftdss.firenet.gov/landing_page/**.

There are essentially three (3) phases of fuel management monitoring: short-term, medium-term, and long-term. Short-term monitoring addresses the immediate results of a treatment, while long-term monitoring can provide information about the effectiveness of fuel treatments to enhance community wildfire resiliency.

References

The following references were used in the development of this CWPP.

Prairie_Sweet Grass CO_CO_Credit_JHProp_Cooper

8.0 References

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9.0 Tables

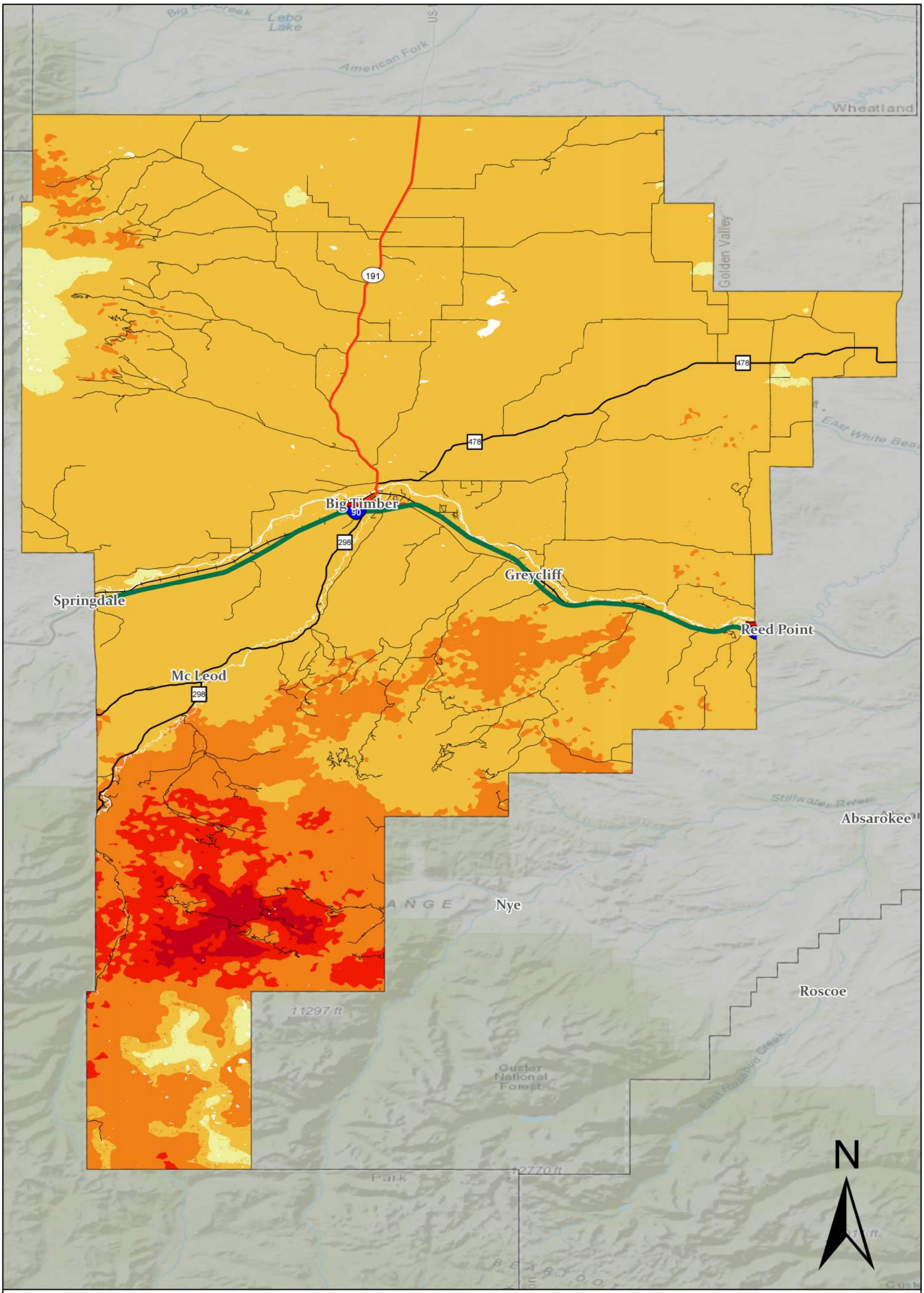
10.0 Figures

Appendices

Additional information relevant to the Sweet Grass County Community Wildfire Protection Plan is provided in the following pages.

Appendices Table of Contents

Appendix A – Maps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East White Bea
Big Timber
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Greycliff
Springdale
Reed Point
Mc Leod
298
Stillwater River
Absarokee
Nye
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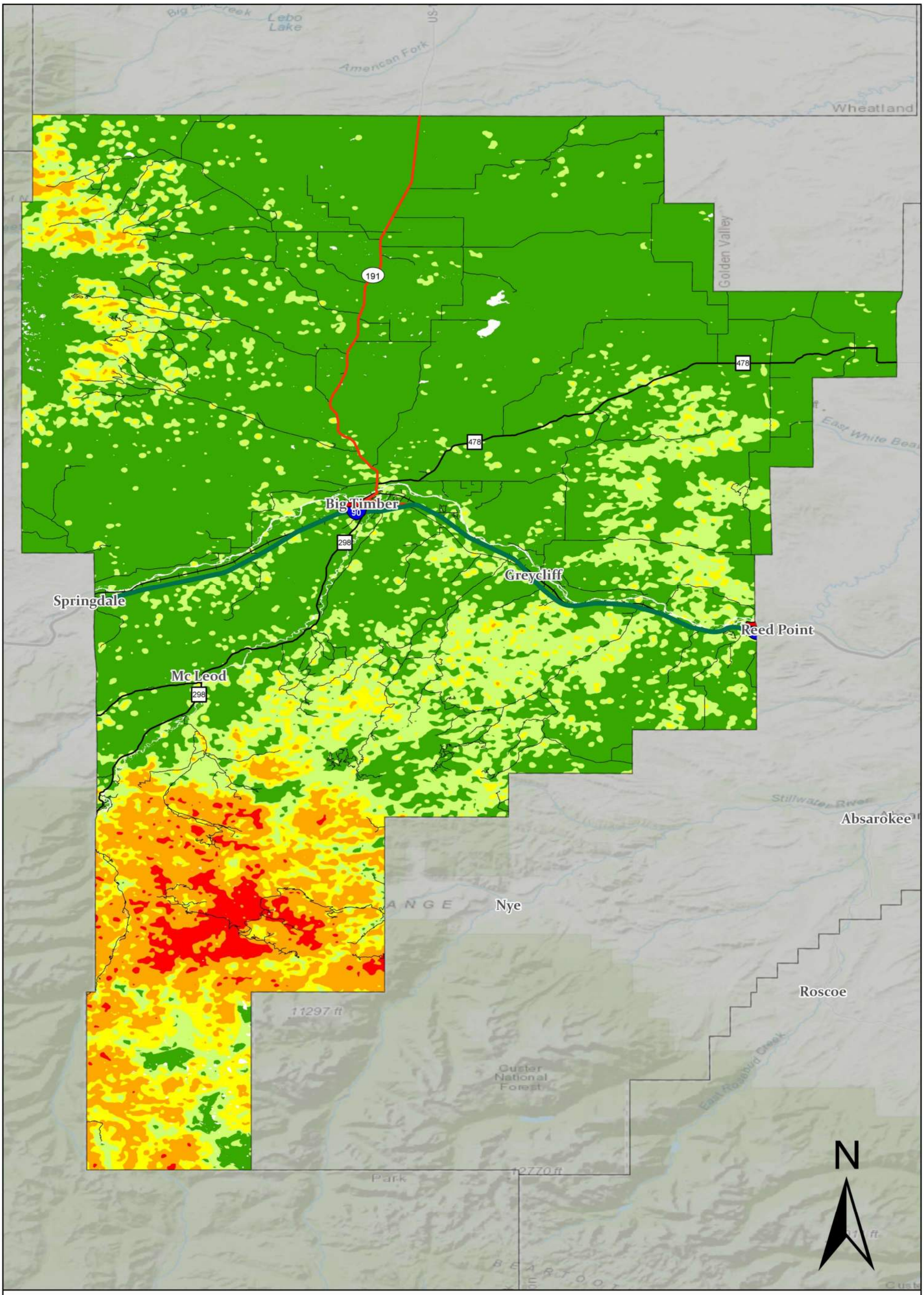
Roscoe
11297 ft
Custer National Forest
East Rosebud Creek
12770 ft
Park
N
Sweet Grass County
Wildfire Risk
Map by Jensen Hughes, 4/25/2024
0 5 10 15 Miles
0 5 10 15 20 Kilometers
Legend
Non-Burnable
Low
Moderate
High
Very High
Extreme
Montana
Idaho
Wyoming
JENSEN HUGHES



Sweet Grass County

Wildfire Hazard Potential

Map by Jensen Hughes, 4/25/2024

0 5 10 15 Miles

0 5 10 15 20 Kilometers

Legend

- Non-Burnable
- Very Low
- Low
- Moderate
- High
- Very High

JENSEN HUGHES

Blacktail
Wheatland
Sweet Grass
Lebo Lake
American Fork
Fish Creek
5625 ft
Golden Valley
Grass Creek
Big Timber Creek
11212 ft
10830 ft
191
478
5324 ft
East White Bea
Big Timber
90
298
Hobble
Greycliff
Springdale
Reed Point
Lane
Mc Leod
Mendenhall
Boulder River
Derby
Jungle
May
East Boulder River
9021 ft
Stillwater River
Absarokee
ABSAROKA RANGE
Nye
West Fork Stillwater River
Tumble Creek Cathedral Peak
Cathedral Peak
Roscoe
Hicks Park
Custer National Forest
East Rosebud Creek
Monument Monument
12770 ft
Park
Cascade
N

Sweet Grass County

Historic Fire Perimeters

Map by Jensen Hughes, 4/25/2024

0 5 10 15 Miles

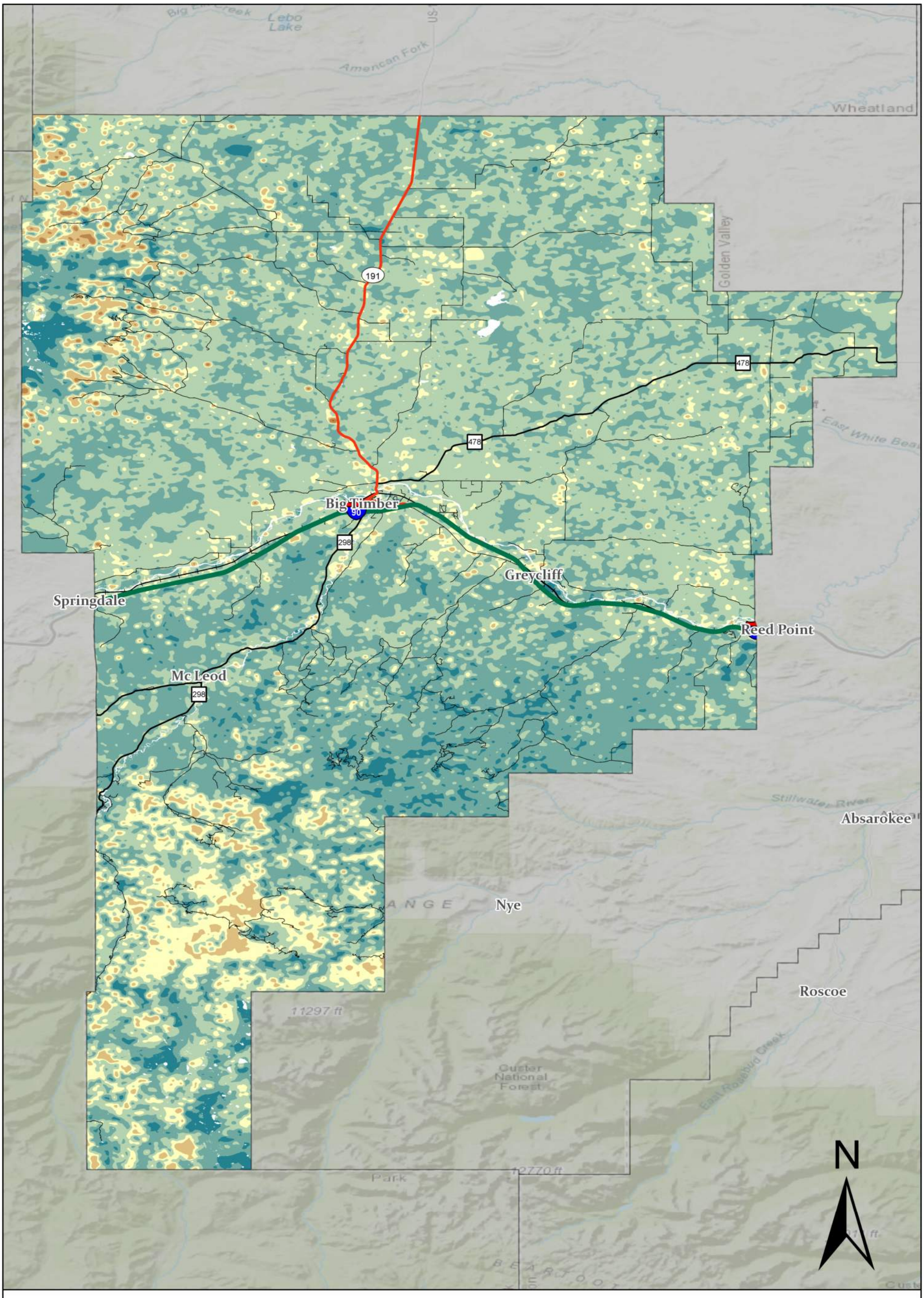
0 5 10 15 20 Kilometers

Legend

US_HIST_FIRE_PERIMTRS_2000_2018_DD83

Montana
Idaho
Wyoming

JENSEN HUGHES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Golden Valley
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East White Bear
Big Timber
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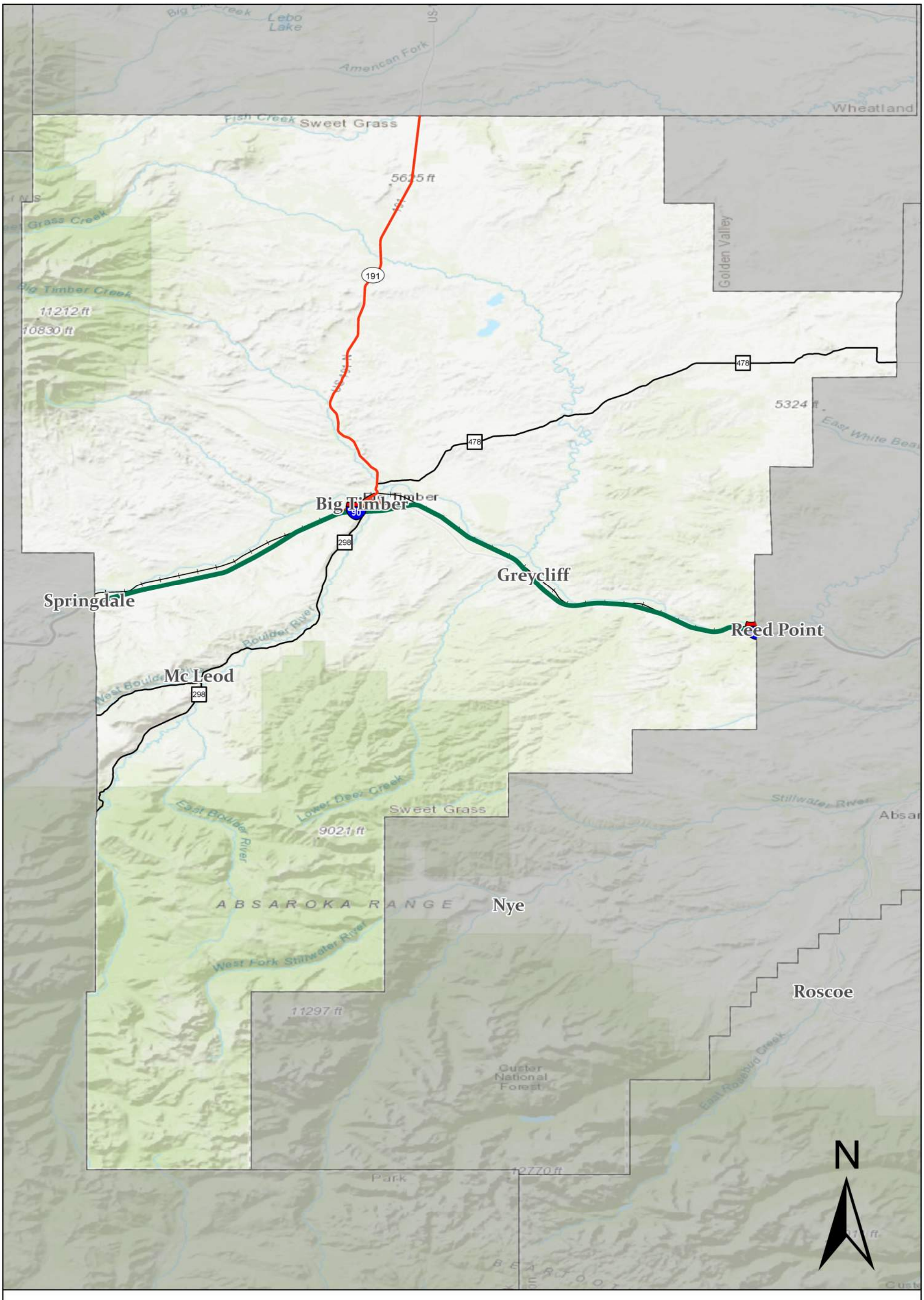
Greycliff
Springdale
Reed Point
Mc Leod
298
Stillwater River
Absarokee
Nye
11297 ft
Roscoe
Custer National Forest
East Rosebud Creek
12770 ft
Park
N
Sweet Grass County
Flame Length
Map by Jensen Hughes, 4/25/2024
0 5 10 15 Miles
0 5 10 15 20 Kilometers
Legend
Non-Burnable
0 to 2 feet
2 to 4 feet
4 to 6 feet
6 to 8 feet
8 to 12 feet
12 to 20 feet
> 20 feet
Montana
Idaho
Wyoming
JENSEN HUGHES



Sweet Grass County

Communities and Planning Area

Map by Jensen Hughes, 4/25/2024

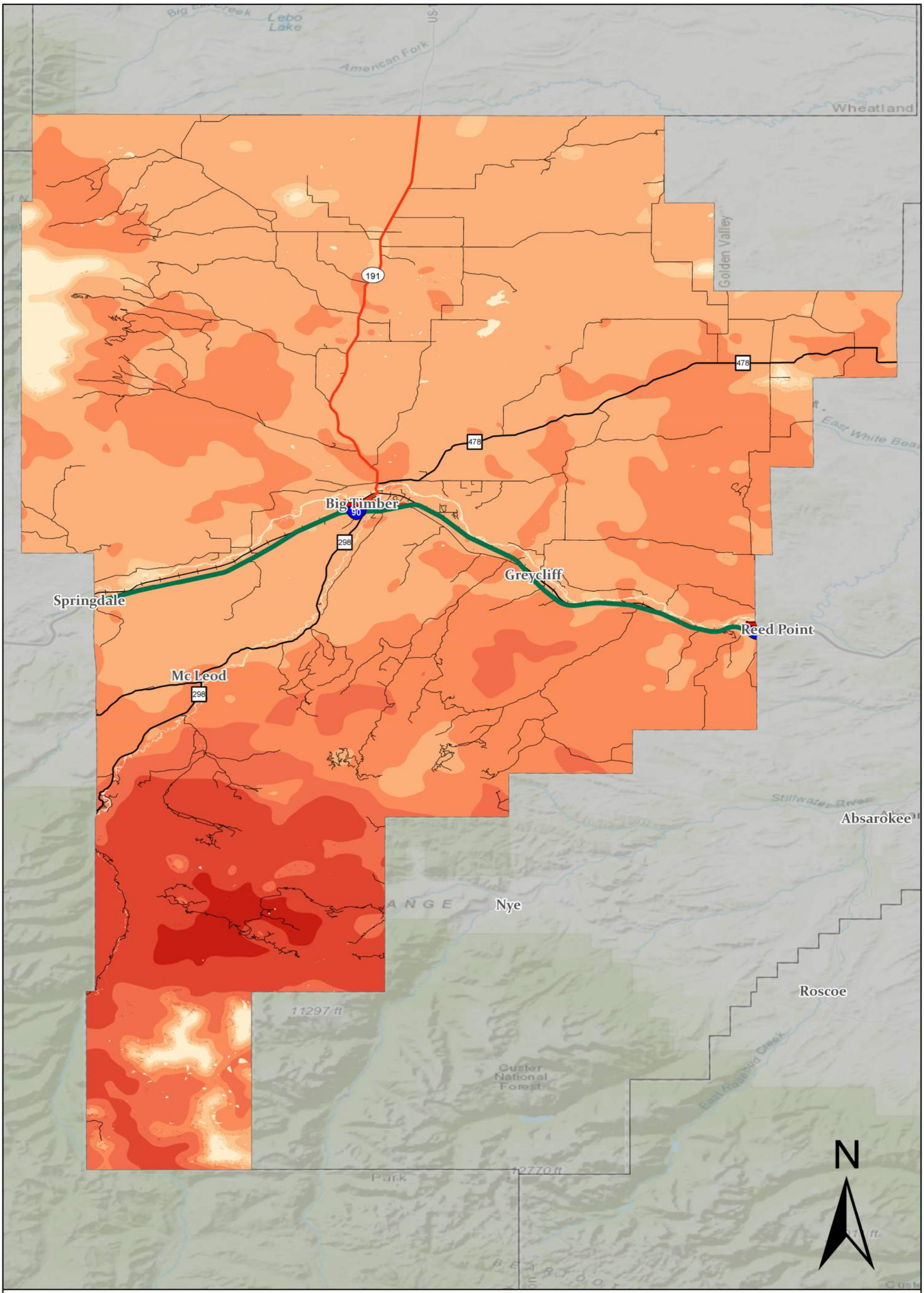
0 5 10 15 Miles

0 5 10 15 20 Kilometers

Legend

- NHS Interstate
- NHS Non-Interstate
- Primary
- Secondary
- Railroads

JENSEN HUGHES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Springdale
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Mc Leod
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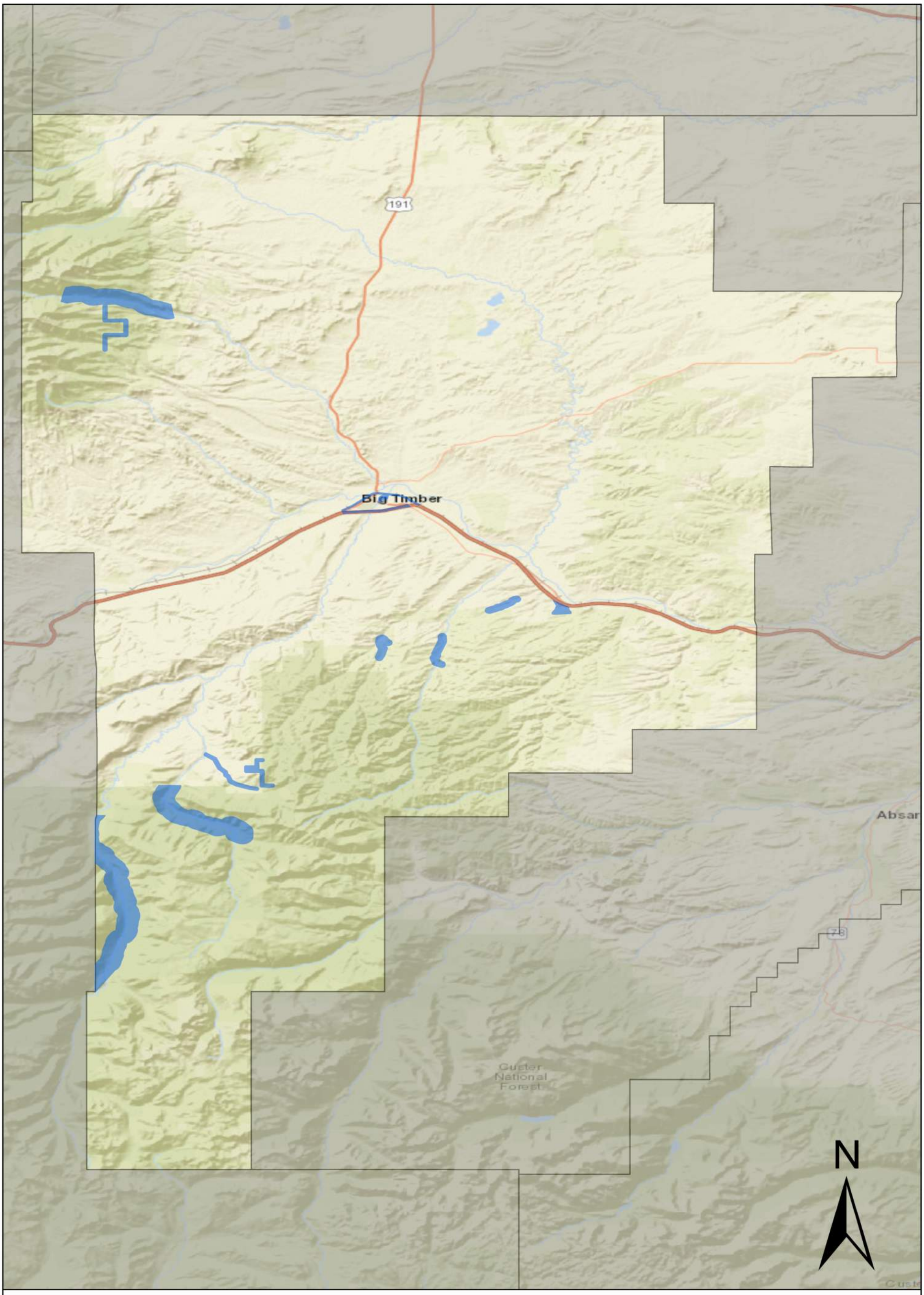
Stillwater River
Absarokee
Nye
Roscoe
11297 ft
Custer National Forest
East Rosebud Creek
12770 ft
Park
N
Sweet Grass County
Burn Probability
Map by Jensen Hughes, 4/25/2024
0 5 10 15 Miles
0 5 10 15 20 Kilometers
Legend
0 to 1-in-10,000
1-in-10,000 to 1-in-4,643
1-in-4,643 to 1-in-2,154
1-in-2,154 to 1-in-1,000
1-in-1,000 to 1-in-464
1-in-464 to 1-in-215
1-in-215 to 1-in-100
1-in-100 to 1-in-46
1-in-46 to 1-in-22
1-in-22 to 1-in-8
Montana
Idaho
Wyoming
JENSEN HUGHES



Sweet Grass County

Project Areas

Map by Jensen Hughes, 4/25/2024

0 5 10 15 Miles

0 5 10 15 20 Kilometers

Legend

Projects

JENSEN HUGHES

Sweet Grass County

Wildland Urban Interface

Map by Jensen Hughes, 7/17/2024

0 5 10 15 Miles

0 5 10 15 20 Kilometers

Legend

Wildland Urban Interface

Montana
Idaho
Wyoming

JENSEN HUGHES

Appendix B – Glossary of Key Terms

The following provides a description of terms and words found in or related to this plan (additional terms are available at **http://www.nwcg.gov/glossary**).

1-Hour Timelag Fuels (One-hour Fuels): Fuels consisting of dead herbaceous plants and roundwood less than about ¼ inch (6.4 mm) in diameter. Also included is the uppermost layer of needles or leaves on the forest floor.

10-Hour Timelag Fuels (Ten-hour Fuels): Dead fuels consisting of roundwood ¼ to 1 inch (0.6 to 2.5 cm) in diameter and, very roughly, the layer of litter extending from immediately below the surface to ¾ inch (1.9 cm) below the surface.

100-Hour Timelag Fuels (Hundred-hour Fuels): Dead fuels consisting of roundwood in the size range of 1 to 3 inches (2.5 to 7.6 cm) in diameter and very roughly the layer of litter extending from approximately ¾ of an inch (1.9 cm) to 4 inches (10 cm) below the surface.

1,000-Hour Timelag Fuels (Thousand-hour Fuels): Dead fuels consisting of roundwood 3 to 8 inches in diameter and the layer of the forest floor more than 4 inches below the surface.

Active Crown Fire: A fire in which a solid flame develops in the crowns of trees, but the surface and crown phases advance as a linked unit dependent on each other.

Aspect: Direction a slope faces.

Canopy Spacing: The distance from the edge of one tree canopy to another. Crown spacing varies from open (with 10 feet or more of space between tree canopies) to closed (where trees may be growing in very close proximity with little space between them).

Crown Fire: A fire that advances from top to top of trees or shrubs more or less independent of a surface fire. Crown fires are sometimes classed as running or dependent to distinguish the degree of independence from the surface fire.

Dead Fuels: Fuels with no living tissue in which moisture content is governed almost entirely by atmospheric moisture (relative humidity and precipitation), dry-bulb temperature, and solar radiation.

Direct Attack: A method of fire suppression where actions are taken directly along the fire's edge. In a direct attack, burning fuel is treated directly, by wetting, smothering, or chemically quenching the fire or by physically separating burning from unburned fuel.

Fire Apparatus Access Roads (Fire Lanes): The means for emergency apparatus to access a facility or structure for emergency purposes. Roadways must extend to within 150 feet of all portions of the exterior of the first floor of any structure and must meet specified criteria for width, pavement characteristics, roadway gradient, turning radius, etc.

Fire Behavior: The manner in which a fire reacts to the influences of fuel, weather, and topography.

Fire Frequency: Temporal fire occurrence described as a number of fires occurring within a defined area within a given time period.

Fire Intensity: A general term relating to the heat energy released by a fire.

Fire Lane Identification: Signs or curb markings that allow fire apparatus access roads to be readily recognized so that they will remain unobstructed and available for emergency use at all times.

Fire Potential: The likelihood of a wildland fire event is measured in terms of the anticipated occurrence of fire(s) and management's capability to respond. Fire potential is influenced by a sum of factors that include fuel conditions (fuel dryness and/or other inputs), ignition triggers, significant weather triggers, and resource capability.

Fire Regime: The characterization of fire's role in a particular ecosystem, usually characteristic of particular vegetation and climatic regime, and typically a combination of fire return interval and fire intensity (i.e., high frequency, low intensity/low frequency, high intensity).

Fire Return Interval: The length of time between fires on a particular area of land.

Fire Weather: Weather conditions that influence fire ignition, behavior, and suppression.

Flame Length: The distance from the base to the tip of the flaming front. Flame length is directly correlated with fire intensity.

Flaming Front: The zone of a moving fire where combustion is primarily flaming. Behind this flaming zone combustion is primarily glowing. Light fuels typically have a shallow flaming front, whereas heavy fuels have a deeper front.

Fuel: Any combustible material, which includes but is not limited to living or dead vegetation, human-built structures, and chemicals that will ignite and burn.

Fuel Bed: An array of fuels usually constructed with specific loading, depth, and particle size to meet experimental requirements. Also, commonly used to describe the fuel composition.

Fuel Loading: The amount of fuel present expressed quantitatively in terms of weight of fuel per unit area.

Fuel Model: Mathematical descriptions of fuel properties (e.g., fuel load and fuel depth) that are used as inputs to calculations of fire danger indices and fire behavior potential.

Fuel Moisture Content: The quantity of moisture in fuels expressed as a percentage of the weight when thoroughly dried at 212 degrees Fahrenheit.

Fuel Type: An identifiable association of fuel elements of a distinctive plant species, form, size, arrangement, or other characteristics that will cause a predictable rate of fire spread or difficulty of control under specified weather conditions.

Gates and Barriers: Devices that restrict pedestrian and vehicle ingress and egress to and from a facility.

Gate and Barrier Locks: Devices that are installed on gates and barriers to secure a property or facility.

Goals: A goal is a broad statement of what you wish to accomplish, an indication of program intentions.

Ground Fire: Fire that consumes the organic material beneath the surface litter ground, such as a peat fire.

Intensity: The level of heat radiated from the active flaming front of a fire, measured in British thermal units (BTUs) per foot.

Ladder Fuels: Fuels that provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease. Ladder fuels help initiate and ensure the continuation of crowning.

Live Fuels: Living plants, such as trees, grasses, and shrubs, in which the seasonal moisture content cycle is controlled largely by internal physiological mechanisms, rather than by external weather influences.

Mid-flame Windspeed: The speed of the wind measured at the midpoint of the flames, is considered to be most representative of the speed of the wind that is affecting fire behavior.

Objectives: They contribute to the fulfillment of specified goals and are measurable, defined, and specific.

Passive Crown Fire (Torching or Candling): A fire in the crowns of trees in which single trees or groups of trees torch, ignited by the passing front of the fire.

Safety Zone: A preplanned area of sufficient size and suitable location in the wildland expected to prevent injury to fire personnel without using fire shelters.

Red Flag Warning: Term used by fire weather forecasters to alert forecast users to an ongoing or imminent critical fire weather pattern.

Riparian: Situated or taking place along or near the bank of a watercourse.

Spotting: Refers to the behavior of a fire producing sparks or embers that are carried by the wind and start new fires beyond the zone of direct ignition by the main fire.

Strategy: The general plan or direction selected to accomplish incident objectives.

Surface Fire: Fire that burns loose debris on the surface, which includes dead branches, leaves, and low vegetation.

Surface Fuels: Fuels lying on or near the surface of the ground, consisting of leaf and needle litter, dead branch material, downed logs, bark, tree cones, and low stature living plants.

TRA: An area where firefighters or civilians unable to evacuate or get trapped during a fire, can take refuge for short term relief until conditions improve and egress routes are safe to use.

Topography (Terrain): The term also refers to parameters of the “lay of the land” that influence fire behavior and spread. Key elements are slope (in percent), aspect (the direction a slope faces), elevation, and specific terrain features such as canyons, saddles, “chimneys,” and chutes.

Understory: Term for the area of a forest that grows at the lowest height level below the forest canopy. Plants in the understory consist of a mixture of seedlings and saplings of canopy trees together with understory shrubs and herbs.

Values at Risk: People, property, ecological elements, and other human and other intrinsic values within the county. Values at Risk are identified by stakeholders as important to the way of life in the county and are particularly susceptible to damage from undesirable fire outcomes.

Wildland Fire Environment: The surrounding conditions, influences, and modifying forces of fuels, topography, and weather that determine wildfire behavior.

Wildfire Risk Area: Land that is covered with vegetation, which is so situated or is of such an inaccessible location that a fire originating upon it would present an abnormally difficult job of suppression or would result in great or unusual damage through fire, or such areas designated by the fire code official. For purposes of this document, Wildfire Risk Areas include Very High Fire Hazard Severity Zones, Wildland-Urban Interfaces (WUI), and similarly hazardous areas.

Appendix C - Firefighting Capacity + Fire Behavior Correlation

Evaluating the effectiveness of firefighting resources against wildfire is a complex matter. On the same wildland fire, there are locations where firefighters can be successful in defending structures or securing portions of the fire's perimeter, while at the same moment in time, firefighters elsewhere on the fire are being overmatched by the intensity and rate of spread of the fire. Elements such as the alignment of the fire spread (head or flacking fire versus backing fire) can significantly change the fireline intensity faced by firefighters. Other elements that can influence firefighter success include access, topography, the ability to secure a safe operational space, and the availability of aerial resources to support ground operations.

A common standard used to evaluate the potential of firefighting resources to succeed on the fire ground is fire suppression interpretations based on flame length found in the Wildland Fire Incident Management Field Guide (NWCG, 2014). Generally, these interpretations evaluate what type of firefighting resources would be required to successfully suppress the head of a wildland fire based on the observed fire length (Table 9). Since flame lengths can be directly related to potential firefighting success, these breakpoints are used for classifying modeled fire behavior throughout the CWPP.

Table 9: Suppression Capabilities Based on Flame Lengths

Flame Lengths (feet)	Fireline Intensity (BTU/foot/second)	Interpretation
0-4	0-100	Fires can be generally attacked at the head or flanks by persons using hand tools. Handlines should hold the fire.
4-8	100-500	Fires are too intense for direct attack at the head of the fire by persons with hand tools. Handlines cannot be relied upon to hold the fire. Equipment such as dozers, engines, and retardant aircraft can be effective.
8-11	500-1,000	Fires may present serious control problems – torching out, crowning, and spotting. Control efforts at the head of the fire will probably be ineffective.
11+	1,000+	Crowning, spotting, and major fire runs are common. Control efforts at the head of the fire are ineffective.

Caution: These are not guidelines for personnel safety; fires can be dangerous at any level of intensity. Wilson (1977) has shown that most fatalities occur on small fires or isolated sections of large fires.
Source: NWCG Fireline Handbook, Appendix B, Fire Behavior, April 2006

The classifications in Table 9: Suppression Capabilities Based on Flame Lengths provide insights into resource capabilities but can be misinterpreted if applied out of context. For example, eight (8) ft flame lengths can be successfully suppressed by engine crews using hose lays, if they can approach the fire from a direction where convective and radiant heat are focused away from the firefighter. The same eight (8) ft flame length will likely overwhelm firefighters positioned in a manner where they are receiving large portions of the heat flux from the fire. This can be the case where firefighters are performing structure defense or attempting a frontal assault on the advancing fire front. It has been found that convective energy transferred by wind gusts, fire whirls, or air turbulence can significantly increase the total heat transfer to the firefighter and increase the required safety zone size necessary to engage the fire (*B.W. Butler, Jack Cohen, USFS, Wildland Firefighter Safety Zones, 1998,2014*).

Appendix D – NWCG Standards for Mitigation in the Wildland Urban Interface

Refer to the National Wildfire Coordinating Group PMS 052 **https://www.nwcg.gov/**

A publication of the
National Wildfire Coordinating Group

NWCG Standards for Mitigation in the Wildland Urban Interface

PMS 052 MAY 2023

NWCG Standards for Mitigation in the Wildland Urban Interface

May 2023
PMS 052

The *NWCG Standards for Mitigation in the Wildland Urban Interface* establishes the standards for understanding and implementation of concepts, issues, and best practices to increase community fire adaptation. This publication is designed to:

- Support common understanding.
- Encourage use of consistent and proven local risk reduction efforts.
- Increase awareness and implementation of mitigation best practices, techniques, tactics, and strategies.
- Improve community and structure survivability as the result of pre-wildfire mitigation actions.

Table of Contents

History and Background

Wildfire knows no boundaries. Mitigation must involve cross-boundary partners; local, state, tribal, federal, and private land authorities working together to share and leverage resources and build partnerships focused on mitigation actions on the ground. Mitigation actions in wildfire prone communities are a critical piece of the National Cohesive Wildfire Management Strategy.

Historically developing a national wildfire response that provides consistent training and qualifications, funding, and leadership structure has been the focus. Increasing the focus to include reducing community wildfire risk will help develop sustainable national mitigation efforts and a consistent national strategy.

Local mitigation efforts can be challenging due to lack of resources, investments, training, workforce, and funding sources. The impact of wildland fire on communities grows each year. Increased development in the wildland urban interface (WUI) heightens the risk of wildfire. A comprehensive approach to mitigation is an effective way to address increasing risk.

The *NWCG Standards for Mitigation in the Wildland Urban Interface*, PMS 052 is grounded in the following concepts.

National Cohesive Wildland Fire Management Strategy

The National Cohesive Wildland Fire Management Strategy (Cohesive Strategy) is the result of the Federal Land Assistance and Enhancement (FLAME) Act of 2009. It was a collaborative cross-boundary effort to examine growing wildfire challenges across all lands regardless of ownership. The Cohesive Strategy is an all-hands, all-lands approach to wildfire management. The Cohesive Strategy focuses on three goals: (1) restore and maintain landscapes, (2) create fire adapted communities and (3) safe and effective wildfire response.

For more information, visit the Cohesive Strategy website at https://www.forestsandrangelands.gov/.

Community Fire Adaptation

As defined in the *NWCG Glossary of Wildland Fire Terminology*, PMS 205, a Fire Adapted Community (FAC) is "a community that recognizes its risk and takes action before, during, and after a fire in order for their community to be more resilient to wildfire. FAC members are informed and prepared, collaboratively planning, and taking action to better live with wildland fire." More fully, community fire adaptation enables communities to live safely with fire as part of the surrounding landscape.

A successful FAC approach has the potential to save lives, homes, and communities as well as billions of dollars in suppression, damage, and recovery costs annually. A successful approach also allows for the beneficial ecological processes of fire to take place.

Community fire adaptation does not refer to a specific program or endpoint but rather a dynamic state in which the community continually strives to reduce wildfire risk. Adapting to wildfire is a continuous process that requires maintenance and adaptation and regular risk reassessment.

Community fire adaptation involves all stakeholders who live, work, and play in the community. This includes residents, businesses, policymakers, land managers, and emergency responders and local, state, tribal, and federal governments.

There is a range of actions that communities can undertake to become more fire adapted. In general, the more elements that a community has addressed, the more fire adapted it is. As every community is unique, not all elements listed below will be emphasized to the same degree in each community.

Major elements of a FAC may include:

- An implemented Community Wildfire Protection Plan or an equivalent plan that specifically identifies wildfire risk, projects to reduce that risk and jurisdictional authority responsible for reducing risk.
- Ignition-resistant structures, building materials, and landscapes.
- Local fire departments engaged in best practices for effective on the ground mitigation and prepared for local wildfire response.
- Fuels treatments on public and private lands in and around communities to reduce hazardous fuels and create fuel breaks.
- Science and research to help inform decision making.
- Codes, covenants, and ordinances to foster development in the WUI that minimizes fire risk.
- Cooperation and collaboration between jurisdictional authorities.
- Evacuation planning.
- Wildfire prevention and preparedness education.

Mitigation 101

What is the Wildland Urban Interface?

The wildland urban interface, or the WUI, refers to the zone of transition between unoccupied land and human development. It is the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Communities adjacent to and surrounded by wildland are at varying degrees of risk from wildfires.

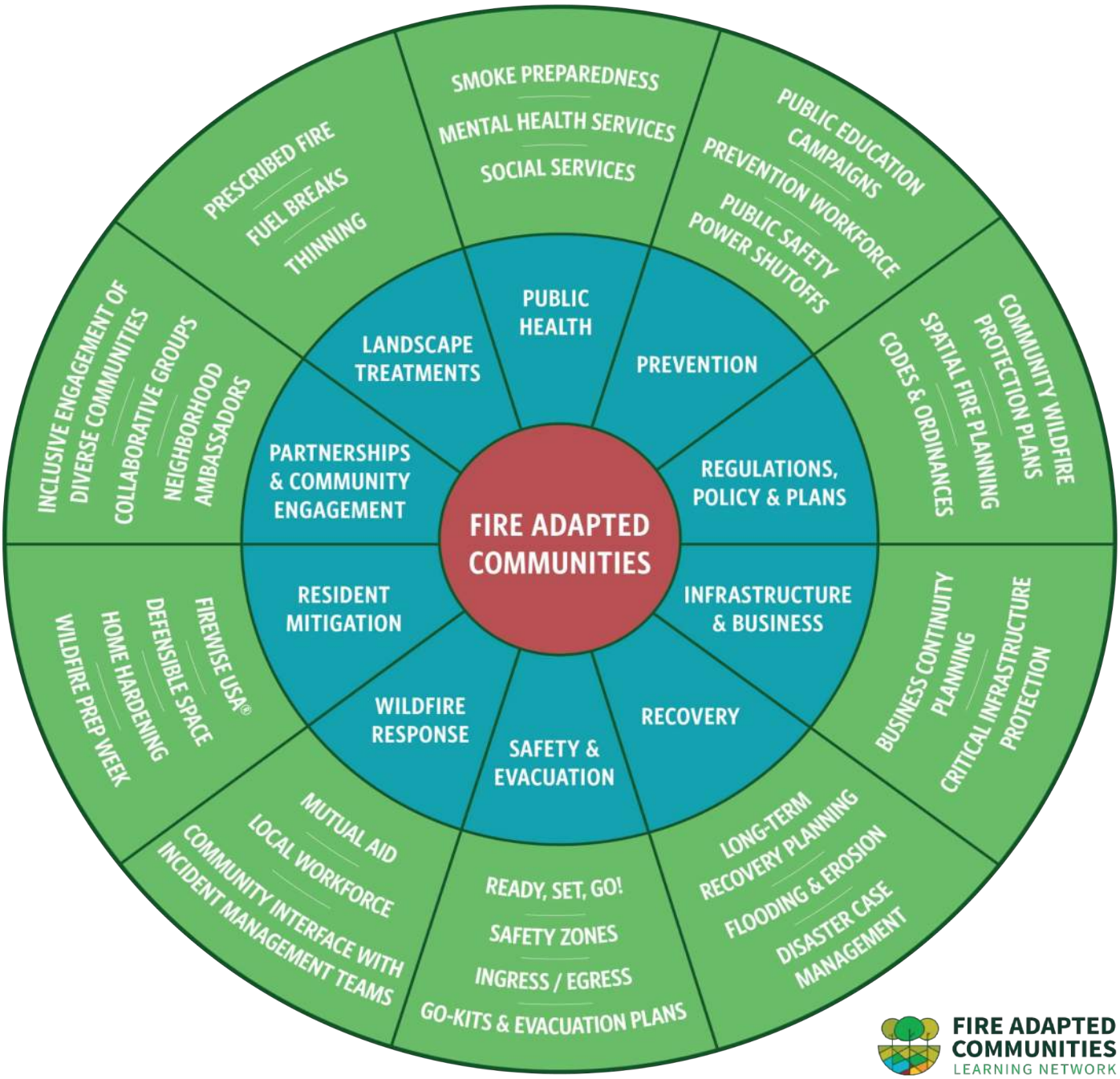


Figure 1: The Fire Adapted Communities graphic, created by the Fire Adapted Communities Learning Network, communicates the FAC framework. It depicts a set of components, which might make up community wildfire adaptation and provides examples of specific programs and actions that a community could undertake to advance their work. FAC is not a one-size-fits-all approach, and this graphic is not comprehensive. Community context matters and communities should undertake those actions which are most effective in, and appropriate for, their place.

What is Mitigation?

Mitigation, in this document, focuses on pre-incident actions that reduce community risk of wildfire. It is an effort to reduce the loss of firefighter and civilian life and to lessen the impact on the economy and environment.

Mitigation can be supported through:

- Consistent and sustainable funding of wildfire mitigation efforts on the ground.
- Participation in wildfire mitigation coalitions or collaboratives that get work done on the ground.
- Funding, requiring, and enforcing codes, ordinances, and policies that reduce wildfire risk to communities.
- Cross-boundary fuels reductions on a landscape scale.
- Outreach programs to engage the public in mitigation efforts.
- Incentives that elicit community engagement and action.
- Improved application of relevant research findings on structural ignition, fuels reduction, and key social dynamics.

The Importance of Mitigation

Undertaking wildfire mitigation in the WUI can reduce or eliminate the risk of damages caused by wildfire to the human environment like homes, neighborhoods, and communities. Mitigation can also reduce risk to the natural environment such as wildlife, watersheds, and ecosystems.

Mitigation actions offer multiple benefits, including:

- Contributing to firefighter and public safety.
- Creating communities that are more resilient.
- Allowing individuals and communities to minimize post disaster disruptions and recover more quickly.
- Lessening the financial impact on individuals, communities, business, and the natural environment.
- Enhancing other important values such as ecological benefits and aesthetics.

Mitigation Guiding Principles

Applying a set of guiding principles to mitigation work can contribute to its success. The following is an abbreviated list of these ideals.

- Learn about the audience and their barriers to mitigation.
- Understand the community's hazards, areas of risk, and available options to reduce exposure.
- Build trust-based relationships through in-person engagement during all phases of mitigation.
- Develop on the ground actions that are strategic, selective, and focused to reduce vulnerability and increase resiliency.
- Build partnerships to work collaboratively across boundaries and jurisdictions.

- Make mitigation support inclusive and equitable to everyone.
- Support vulnerable populations.
- Leverage resources with other partners and ask for help.
- Track program investments, progress, and partner contributions. Share success stories.
- One size does not fit all. Be flexible and adjust mitigation strategies according to community demographics, local values, and wildfire hazards.

Risk Assessments

Wildfire risk assessments are a systematic process using available knowledge to comprehend the nature, expression, and evaluation of risk. Assessments provide information on wildfire likelihood, intensity, and susceptibility of valued resources and assets. They are critical for a focused wildfire mitigation effort.

Risk assessments can be quantitative or qualitative and applied at multiple scales from a single property, to community, to landscape. A good risk assessment should geographically and specifically identify areas at risk from wildfire by ownership, location, and level of risk. Assessments should be collaboratively developed and shared with the community, landowners, and jurisdictional authorities. They are important for decision making and help to distinguish among various risk management options for accepting, avoiding, reducing, or transferring the risk.

Risk assessments are vastly different across the nation. The available options must be evaluated to determine the best fit for the local community. In many cases, multiple assessments can be adopted, modified, or developed to accommodate the local community and demographics based upon capacity and usage. Wildfire practitioners should be familiar with the risk assessments utilized in their community, how those assessments were constructed, and the methods used for community outreach and engagement.

WUI Mitigation Standards

Community Engagement and Partnerships

Effective community engagement is the result of interactive communication, a two-way process that values the input of all. It follows a whole community approach that is inclusive and equitable, and builds trust by engaging in face-to-face, give and take conversations.

Local capacity or the ability of the local community to provide funding, as well as resident and partner engagement to enable work on the ground is key to community mitigation. Capacity is the "infrastructure" that supports and shapes organizations into sustainable, efficient, and effective change agents. Capacity building enables organizations, leaders, and residents to develop competencies and skills in the delivery of a service.

When developing and delivering mitigation programs, strive to develop and recruit confident, competent, and skilled local resources who focus on wildfire risk reduction. This may include a local government authority, tribe, non-profit organization, contractor, and residents. Develop programs that share ownership and accountability directly with community members.

Inclusive Communications

Make Mitigation Support Accessible to All Populations

- Know the audience and determine the best way to communicate with them. Communities are composed of diverse residents, which include those who have different languages, socio-economic backgrounds, access, and functional needs, cultural backgrounds, and more. Successful mitigation is shared by all; work to be inclusive in your process from planning to implementation.
- Include translation and interpretation services in your mitigation planning, budget, and activities.
- Knowing the audience and communicating effectively in-person over time builds trusting relationships. Passive communication, like brochures, Public Service Announcements (PSAs), and handouts are not as effective in moving residents to take mitigation action.
- Make support accessible. At-risk community members need to know who to contact for help and they need to be confident that someone is available to help them.
- Use terminology that resonates the most with the community. Don't use jargon.
- Follow up with residents; a one-time visit is not enough. Mitigation is a continuum.

Ignition-Resistant Structures and Surrounding Landscape

Mitigation programs must include recommendations related to creating ignition-resistant structures and vegetation management to be effective. Research studies show that a lack of ignition-resistant structures and managed vegetation is the leading cause of structure loss during wildfires.

Many things can be done to reduce the wildfire risk of a property and several key terms have been defined in this standard. Practitioners should use the terminology that resonates the most with their community.

Structure Ignition Zone

The structure ignition zone is the area most critical to survivability of homes and structures. The structure ignition zone is the characteristics of a structure and its immediate surroundings within 100 feet. The structure ignition zone may be extended (e.g., to 150 or 200 feet) in areas of steep terrain or dense, highly flammable vegetation. The structure ignition zone is the key determinant for structure ignition potential during wildfire.

Management of the structure ignition zone includes ignition-resistant plants, managed vegetation, and ignition-resistant features of the structure.

There are several terms historically used to describe this area, including home ignition zone and defensible space. To be inclusive of the wide range of structures that are built in the wildland urban interface environment, the WUI Mitigation Standard uses the term structure ignition zone.

Ignition-Resistant Structures

Creating ignition-resistant structures is essential to wildfire risk mitigation. Structure enhancements and modifications can vary in terms of effectiveness and cost. When completed comprehensively, an ignition-resistant structure will reduce exposure greatly. Incremental adjustments will also have a complimentary impact.

The interconnectedness of structures and the landscape cannot be understated. Both where a structure is located on the landscape (i.e., adjacency to fuels and other structures, topography, and aspect) and the materials that the structure is constructed out of are critically important when considering the factors for ignition potential and structure survivability.

The design of a structure, the construction materials used, and how the structure is maintained are all critical to improving the chances of that structure's survival. The importance of examining the interrelated component of the effects of the surrounding landscape is a significant piece of structure maintenance.

Ignition-Resistant Structure Standards

Table 1: Standards and recommendations for modifications to elements and components that will create a more ignition-resistant structure. All elements and individual components described herein must be within the designated operational lifespan, well-maintained, and inspected on an annual basis. For instance, screens must be inspected to ensure they have not corroded and are otherwise compromised while decks and siding must be in good condition with no rot and or compromised areas.

Element	General Design, Location, and Construction Considerations
Introduction	Can increase or reduce exposure.
Components	**Standard**
Architectural designs that add numerous overhangs, corners, jut-outs, etc.	Vertical and horizontal joining on the roof (arch/aesthetics) may be better. Constructed of fire resistant or noncombustible materials and well-maintained.
Proximity of vegetation	Clear all combustible materials, such as dead vegetative material like leaves and pine needles, from Zone 1, including anything that overhangs the roof. Branches overhanging the roof should be cut back at least 10 feet.
Post and beam style foundations	Enclose open areas with noncombustible skirting.
	Adhere to landscape management guidance closely.

Element	Roof Assembly	
Introduction	Roofs are highly vulnerable to wildfire ignition. The roofing assembly of interacting roof components, which also needs to include the way they are installed, includes the final layer exposed to the elements (e.g., shingle, metal, clay, or cement tiles, etc.), the roof deck, vapor retarder, if needed, flashing, and insulation.	
Components		**Standard**
Roof Materials		Class A fire-rated roof assembly.
Roof Design		Complex roof assemblies where roof coverings meet vertical walls are susceptible to accumulation of materials. Pay close attention to keeping areas clear on complex roof assemblies. Install metal step flashing a minimum of 6 inches where combustible vertical walls meet the roof.
Roof Slope		Less slope means more debris accumulation. Pay special attention to roofs with less slope and clean these frequently.
Covering (shingles, tile, metal roofing)		Repair damaged shingles and seal any gaps.
Edging		Install metal flashing or "drip edge" to protect roof decking from direct exposure.
		Fill any gaps that exist where the roof covering and roof deck meet. For example, gaps can occur at the roof edge when clay tiles or metal roofing materials are used.
Skylights/Solar panels		Replace plastic skylights with tempered glass.
		Replace dome type with flat, tempered glass skylight.
Roof Vents		Use vents designed to resist ember entry. This includes assessing the turbine style air circulation vents from the interior of the structure.

Element	Gutters	
Introduction	Gutters can often act as debris traps and require significant maintenance.	
Components		**Standard**
Gutters.		Use noncombustible gutters, spouts, or connectors. It is important that they are kept clear of debris.
		Keep gutters clear of debris.

Element	Eaves and Vents	
Introduction	Vents are used in several areas on structures such as on or near the roof, attic and soffit vents, dryer, and/or heating vents and on vertical walls. Vents located on the exterior of the structure, especially attic vents, perform an important function by allowing excess moisture to leave the inside of the home preventing mold growth. These openings, however, can also allow embers generated during a wildfire to enter the building in a warm, dry place like the attic and cause the structure to ignite and burn.	
Components		**Standard**
Vents		Use vents designed to resist ember entry (e.g., ⅛ inch non-corrosive metal mesh).
Vertical wall vents (gable end, dormer face)		
Foundation Vents		
Dryer vents		Install vents that remain closed when the dryer is not running.
Overhangs/eave construction		Box in overhangs and soffits. Use vents designed to resist ember entry (e.g., ⅛ inch non-corrosive metal mesh).

Element	Siding	
Introduction	The type of siding and how it is installed are important to structure survival.	
Components		**Standard**
Siding materials		Use noncombustible siding, such as cement board or metal.
		Remove all human-made and vegetative combustibles from Zone 1.
Openings		Seal openings. This applies to logs/chinking or gaps around windows and doors.
Foundation to siding clearance		There should be at least 6 inches of distance from the bottom edge of the siding to ground. The exposed surface should be noncombustible (e.g., concrete foundation, or rock).
Introduction	Pay special attention to the interior corners of structures as debris often accumulates in these areas.	
Components		**Standard**
Corners of the structure and vegetation		Ensure vegetation is clear from Zone 1 and 2 near corners of the structure, as ignited vegetation could impact the structure siding.
Re-entrant corners		Keep clear of combustible materials and debris.

Element	Doors and Windows	
Introduction	It is important to consider what materials windows and doors are made of and how well they seal.	
Components		**Standard**
Windowpanes		Remove all human-made and vegetative combustibles from areas around or near doors and windows.
		Replace single-pane windows with dual or multi-pane.
Screening		Install metal screening in all windows and doors.
Pet doors		Seal pet doors when not in use.
Gaps		Ensure weather stripping is in good condition and replaced as needed.

Element	Decks and Attachments (including overhanging projections such as porches, balconies, and attached structures like pergolas)
Introduction	Reducing the deck's vulnerability requires an approach that focuses on the materials and design features used to build the deck and creating a noncombustible zone around and under the deck. Most wood-plastic composites, along with higher density tropical hardwood and fire-retardant treated decking products are less vulnerable to embers.

Components	**Standard**
Storage	Do not store combustible materials under decks. If this is not an option install noncombustible siding around the deck.
	Clear/remove all combustible materials (e.g., welcome mats, firewood, construction material) and vegetation.
Deck debris	Clear deck gaps and the intersection between deck and house. Regularly sweep or wash off decks to prevent flammable material from accumulating in the gaps.
Flashing	Install step flashing that extends a minimum of 6 inches from the deck to siding.
Attachments and overhanging projections, including supporting structural elements	Overhanging projections shall be constructed of heavy timber, noncombustible material, exterior fire-retardant treated wood, or ignition-resistant materials.

Element	Fencing
Introduction	Fences can provide security and privacy to people and their pets. Fences made of combustible materials are susceptible to ignition and carry fire to the structure.

Components	**Standard**
Section adjacent to the structure	Install a noncombustible section (3-5 feet) that attaches to siding.
Fence design	Minimize air flow and debris accumulation as well as the vegetation that grows near the fencing.

Element	Garages and Outbuildings	
Introduction		
Components		**Standard**
Garage door		Install a garage door if one does not exist. If one does exist, install a garage door weather seal.
Location of outbuildings		The same standards and maintenance for structures apply to any outbuilding within 30 feet of the main structure.
Seal		Weather seal around the perimeter so that there are no gaps.

Element	Propane Tanks	
Introduction		
Components		**Standard**
Location of propane tanks		Should be moved at least 30 feet from structures.
Vegetation and material surrounding the tank		All vegetation should be removed from around the tank. It is preferable to have rock mulch or concrete blocks underneath. Do not build a flammable screen around the tank.

Sources:

National Institute of Standards and Technology WUI research: https://www.nist.gov/el/fire-research-division-73300/wildland-urban-interface-fire-73305

USDA Forest Service Rocky Mountain Research Lab: https://www.fs.usda.gov/rmrs/publications/examining-influence-biophysical-conditions-wildland-urban-interface-homeowners-wildfire

National Fire Protection Association and Insurance Institute for Business & Home Safety Fact Sheets: https://www.nfpa.org/Public-Education/Fire-causes-and-risks/Wildfire/Firewise-USA/Firewise-USA-Resources/Research-Fact-Sheet-Series

National Fire Protection Association 1144 - Standard for Reducing Structure Ignition Hazards from Wildland Fire: https://www.nfpa.org/codes-and-standards/all-codes-and-standards/list-of-codes-and-standards/detail?code=1144

Landscape Surrounding the Structure

Check state and local resources, as several factors such as codes, standards, and regulations as well as topography, vegetation type, and condition as well as surrounding development can influence necessary actions. The WUI Mitigation Standard refers to the structure ignition zone, but an approach approved by a specific region or fuel type will suffice.

Research has shown that the characteristics of structures and their surroundings determine the risk of ignition. The structure ignition zone is the characteristics of a structure and its immediate surroundings within 100 feet. The structure ignition zone is further broken down into three subsets: Zone 1 (0-5 feet), Zone 2 (5-30 feet) and Zone 3 (30-100 feet).

Structure Ignition Zone: Landscape Surrounding the Structure

Table 2: Fuel management recommendations and standards for each zone focus on breaking up the continuity of fuels. Routine maintenance of vegetation and debris in these zones is crucial to slowing, or even stopping, fire spread as well as reducing wildfire intensity as it approaches structures.

Zone 1	0-5 feet from the structure
Introduction	The area 0-5 feet around a structure and its attachments is the noncombustible immediate zone. Research shows this is the most important zone to take immediate action on as it is the most vulnerable to embers. The zone should be extended to 7 feet in cases of complex building design and areas with re-entrant corners. The goal of this zone is to prevent embers from becoming flames and to stop creeping fire from reaching the structure by having only noncombustible materials near the structure. Having plants, shrubs, man-made objects, or vehicles in this area will decrease the effectiveness of this zone and increase the structure's risk of ignition. Ongoing maintenance to remove combustible debris is necessary.

Components	**Standard**
Noncombustible immediate zone	• The area 0-5 feet around structures should be designed and maintained to keep fire or embers from igniting materials and spreading fire to the structure. This includes spaces under steps, decks, and other attachments, such as fences, decks, or extensions. • Keep this area free of combustible material, such as mulch, plants, firewood stacks, patio furniture, vehicles, gasoline cans, piled construction materials, and other man-made objects. • Remove anything stored underneath decks or porches. • Remove anything stored underneath decks or porches. • Remove anything stored underneath decks or porches. • Replace combustible mulch with a hardscape material like rock, gravel, pavers, or concrete; bare ground is also acceptable. • While it's best to not have any vegetation here, having mowed grass, or a few scattered fire resistant plants can be acceptable if they are maintained. • Leaf litter, pine needles, and other windblown debris should be routinely removed from this zone.

Zone 2	5-30 feet from structure
Introduction	The zone 5-30 feet around structures (and their attachments) is the immediate landscaped area. The goal of this zone is to remove the fuels that support large flames so that only short, low-intensity, slow-moving flames could burn in this area. Short flames should run out of fuel when they meet the noncombustible immediate Zone 1. Other structures and vehicles that reside in this zone can burn for long periods of time, increasing a home's fire risk. Trees, shrubs, plants, and grasses in this zone will deposit vegetative debris that will need to be routinely removed.

Components	**Standard**
Immediate landscaped area	• This area should be kept clean by keeping grass mowed and vegetative debris raked away. • Vegetation should be watered/irrigated as needed during times of drought. • All dead vegetation should be removed. • Plantings should be limited to carefully spaced, low-growing, low-combustibility species, grasses, and lawns. • Lawns should be mowed regularly. • Trees and shrubs should be well-spaced and not highly combustible (such as evergreens). • If highly combustible trees or shrubs are in this zone, they should be limited in number and well-spaced from one another, have their lower limbs pruned up and away from the ground to prevent fire from moving into the crown and they should not be aligned with the corner line of structures. • Boats, RV's, and other vehicles should not be parked in this zone. • According to the Insurance Institute for Business & Home Safety, "There is not enough scientific understanding to prescribe exact distance recommendations for spacing of accessory structures." Even with this information, it's generally accepted that structures should not be within 30 feet of one another and if they are, each should have a managed structure ignition zone. • Propane tanks should not be in this zone. If they are, a 10-foot managed area should be maintained around them.

Zone 3	30-100 feet from structure
Introduction	Zone 3 includes the remaining 30-100 feet around structures (and their attachments) and is the extent of the structure ignition zone. This zone may need to be extended to 200 feet in areas with steep slopes or heavy fuels. The goal of this zone is to reduce the continuity of fuels in such a way that large flames (crown fire) cannot persist. Tall flames should be converted to short, low-intensity flames as they enter Zone 2.

Components	**Standard**
Immediate landscaped area	• Low flammability vegetation should be chosen for this area with adequate vertical and horizontal spacing between the vegetation to limit the potential of fire spread. • Trees should be spaced from one another to minimize the transfer of crown fire. Tree groupings should be well-spaced from one another as well. • Structures in this zone should also have a managed structure ignition zone. • Dead and downed fuels should be removed as much as possible.

Beyond Zone 3	Larger Landscape
Introduction	The landscape beyond Zone 3 should be considered for management when possible. Fuels in this area could be managed in such a way to lessen the volume of ember production, decrease fire intensity, and create opportunities for fire suppression equipment and personnel while being in line with other forest management goals. Fuel breaks can be created by lowering the density of forest vegetation, removing the higher flammability species. Fuel breaks should be strategically located with prevailing weather patterns in mind. Fuel breaks should be created to protect human development, timber stands, and other values at risk. Fuel breaks can be made even more effective if they are tied in with existing firebreaks, such as bodies of water, roads, trails, landings, rights of way, cultivated fields, golf course, etc. Accessibility to the breaks is key if they are to be able to be utilized by firefighters.

Sources:

Insurance Institute for Business & Home Safety's Wildfire Research: Near-Building Noncombustible Zone: https://ibhs.org/wp-content/uploads/wpmembers/files/Near-Building_Noncombustible_Zone_Report_IBHS.pdf

Behm AL, Long AJ, Monroe MC, Randall CK, Zipperer WC, Hermansen-Baez LA (2004*b*) Fire in the wildland–urban interface: preparing a firewise plant list for WUI residents. University of Florida, Institute of Food and Agricultural Services, Florida Cooperative Extension Service Circular 1453. (Gainesville, FL). https://edis.ifas.ufl.edu/publication/FR151.

Landscape-Level Treatment

Landscape-level treatment, also called vegetation management or fuel treatments, can restore forest health, and reduce wildfire risk to communities and infrastructure.

Landscape treatments may include thinning, mastication, grazing, vegetation management, prescribed fire, or other activities designed to modify the condition of the landscape. These activities occur on a significantly larger scale (e.g., watershed) than treatments occurring in the landscape surrounding a structure.

Effective landscape-level treatments require engaging with property owners and residents from the start to maximize the benefits of creating cross-boundary projects. This will also help to prioritize areas that impact identified community values such as structures, critical ecosystems, infrastructure, landscape health, cultural values, etc. Follow all historical, state, and federal ecological guidelines before completing healthy landscape work.

Safety

There are a range of safety considerations that mitigation professionals must consider. Equipment use, interacting with residents, home visits, and driving, among others, should all be considered. Check for specific protocols, policies, and procedures from local jurisdictions or organizations.

The National Wildfire Coordinating Group 6 Minutes for Safety Subcommittee provides comprehensive safety information available online, https://www.nwcg.gov/committee/6mfs/my-safety.

Regulations, Policy & Plans

Be familiar with the codes, ordinances, and plans adopted by local jurisdictions that may apply in an area.

Codes and Ordinances

Codes and ordinances can play an important role in community risk reduction. The most effective codes and ordinances are specifically designed and embraced by the local community to meet specific needs. They also have an enforcement mechanism. Without buy-in from residents or an understanding of the intent, code requirements are often viewed as additional costs or burdens.

The following codes often act as a model for local standards:

NFPA 1144: Standard for Reducing Structure Ignition Hazards from Wildland Fire. The 1144 Standard provides a methodology for assessing wildland fire ignition hazards around existing structures and provides requirements for new construction to reduce the potential of structure ignition from wildland fires.

*ICC 2018: International Wildland Urban Interface Code***.** This comprehensive WUI code establishes minimum regulations for land use and the built environment in designated WUI areas using prescriptive and performance-related provisions.

NFPA 1141: Standard for Fire Protection Infrastructure for Land Development in Wildland, Rural, and Suburban Areas.The 1141 Standard provides requirements for the development of fire protection and emergency services infrastructure to make sure that wildland, rural, and suburban areas undergoing land use changes or land development have the resources and strategies in place to protect people and property from fire dangers and allow firefighters to do their jobs safely and effectively.

Plans

Communities may have several different plans in place that guide wildfire mitigation efforts. Practitioners should be familiar with the various plans and determine what may best work for a community.

Community Wildfire Protection Plans

According to the *NWCG Glossary of Wildland Fire Terminology,* PMS 205, a Community Wildfire Protection Plan (CWPP) is defined as:

"A plan developed in the collaborative framework established by the Wildland Fire Leadership Council and agreed to by state, tribal, and local government, local fire department, other stakeholders, and federal land management agencies managing land in the vicinity of the planning area."

A CWPP identifies and prioritizes areas for hazardous fuel reduction treatments and recommends the types and methods of treatment on federal and non-federally administered land that will protect one or more at-risk communities and essential infrastructure. The plan includes recommendations and measures to reduce structural ignitability throughout the at-risk community. A CWPP may address issues such as wildfire response, hazard mitigation, community preparedness, or structure protection -or all the above."

The minimum requirements for a CWPP include:

1. **Collaboration.** A CWPP must be developed collaboratively. Local and state officials must meaningfully involve federal agencies that manage land in the vicinity of the community and other interested parties, particularly nongovernmental stakeholders.
2. **Prioritized Fuel Reduction.** A CWPP must identify and prioritize areas for hazardous fuel reduction treatments on both federal and non-federal land and recommend the types and methods of treatment that, if completed, would reduce the risk to the community.
3. **Treatment of Structural Ignitability.** A CWPP must recommend measures that homeowners and communities can take to reduce the ignitability of structures throughout the area addressed by the plan.

The three required signatories for a CWPP include:

1. The authority having jurisdiction (city or county),
2. Local fire department(s), and
3. State forestry agency.

For more information on CWPPs, visit the Wildland Fire Leadership Council website at https://www.forestsandrangelands.gov/resources/communities/index.shtml.

State/Tribal/Local Hazard Mitigation Plan

The Federal Emergency Management Agency's (FEMA) Federal Insurance and Mitigation Administration (FIMA) administers the National Hazard Mitigation Planning Program and provides guidance and technical assistance for developing hazard mitigation plans, https://www.fema.gov//hazard-mitigation-planning-resources.

FEMA requires state, tribal and local governments to develop and adopt hazard mitigation plans as a condition for receiving certain types of non-emergency disaster assistance, including funding for mitigation projects.

Many communities at risk for wildfire take an integrated planning approach and incorporate the jurisdiction's CWPP into their multi-hazard mitigation plan.

Other Plans

Other plans, at a variety of scales, may need to be considered for a community. These plans may provide more specific guidance for wildfire mitigation action in these community. Examples at a variety of scales include, but are not limited to, National Forest System Action Plans, Integrated Resource Management Plans, State Forest Action Plans, Hazard Mitigation Plans, local comprehensive or land-use plans and Firewise USA® Action Plans.

The *NWCG Standards for Mitigation in the Wildland Urban Interface* is developed and maintained by the Wildland Urban Interface Mitigation Committee (WUIMC), an entity of the National Wildfire Coordinating Group (NWCG).

Previous editions: N/A

While they may still contain current or useful information, previous editions are obsolete. The user of this information is responsible for confirming that they have the most up-to-date version. NWCG is the sole source for the publication.

This publication is available electronically at https://www.nwcg.gov/publications/052.

Submit comments, questions, and recommendations to the appropriate agency program manager assigned to the WUIMC using the NWCG Publication Review Form, https://www.nwcg.gov/publications/publication-review-form. View the complete roster at https://www.nwcg.gov/committees/wildland-urban-interface-mitigation-committee/roster.

Appendix E - Fuel Treatment Prescriptive Guidelines + Techniques

This appendix provides fuel treatment prescriptions and guidelines to assist the county and property owners in implementing fuel treatments. This prescriptive guidance incorporates fire behavior assessment factors and best management practices (BMPs) for achievable wildfire hazard mitigation actions. Understanding and working within BMP standards will help minimize impacts to surrounding natural resources.

E.1 ROADSIDE FUEL TREATMENT PRESCRIPTIVE GUIDELINES

The following table describes the intensity levels for roadside and driveway fuel treatments:

Table 10: Roadside Fuel Treatment Prescriptive Guidelines

Location – Primary Zone (A) (10' minimum; up to 50') (distance varies with terrain & accessibility)	
Fuel Type	*Guidelines*
Grass/forbs	Reduce fuel depth to less than two (2) inches.
Surface dead/down material	Remove all large (> three (3) inches diameter) dead/down material.
Shrub	Remove all shrub vegetation within this zone. Retain the root system to provide for soil stabilization
Trees Overstory (without shrub understory)	Prune all trees to six (6) feet or ½ of the live crown height, whichever is less. Remove dead-standing trees and branches extending over roadways to a minimum height of 13 feet 6 inches.
Trees Overstory (with shrub understory)	Thinning specifications, same as Trees Overstory (without understory), but remove all understory shrubs below trees in this zone.

E.2 VEGETATION/FUEL TREATMENT PRESCRIPTIVE GUIDELINES

The following table describes prescriptive guidelines for vegetation management in the HIZ.

Table 11: Vegetation Management Prescriptive Guidelines

Location	*Primary Defense Zone (A) (0 – 30' from a structure)*	*Fuel Reduction Zone (B) (30' – 100' from a structure)*	*Fuel Reduction Zone (C) (100' and greater from a structure)*
Fuel Type	*Based on HIZ Recommendations*		*Based on Firefighter Safety*
Grass/Forbs	Reduce fuel depth to two (2) inches maximum.	Reduce grass height to four (4) inches or less. Longer grass in discontinuous open areas is acceptable.	Treatment may not be needed.
Surface Dead/Down Material	Remove all dead/down materials.	Reduce dead/down flammable material to < three (3) inches depth	Reduce heavier pockets of dead/down flammable material to < five (5) inches depth.
Shrub	Remove all but individual specimen chaparral plants. Individual ornamental/native shrubs should be spaced at a minimum of 2x shrub height.	Allow for intermittent small pockets or clumps of shrub vegetation. Pockets and clumps of shrubs remaining should be healthy, all dead material removed and limbed to 1/3 height of the shrub crown.	Less intensive shrub vegetation removal with up to 30 feet for spacing of pockets and clumps of shrubs. The remaining pockets and clumps of shrubs should be healthy, and all dead material removed.
Trees Overstory (without shrub understory)	Thin smaller trees leaving larger trees (>than six (6) inches DBH) at 10-20 ft crown spacing limb/prune lower branches six (6) feet above grade level, or lower 1/3 of tree height on smaller trees. Remove dead standing trees.	Thin smaller trees leaving larger trees (> than six (6) inches DBH) at approximately 10-foot crown spacing; limb/prune lower branches six (6) feet up, or lower 1/3 of tree height on smaller trees; remove all broken limbs and dead material.	Limb and prune lower branches of larger trees up to six (6) feet and remove all broken limbs and dead material.

Location	*Primary Defense Zone (A) (0 – 30' from a structure)*	*Fuel Reduction Zone (B) (30' – 100' from a structure)*	*Fuel Reduction Zone (C) (100' and greater from a structure)*
Fuel Type	*Based on HIZ Recommendations*		*Based on Firefighter Safety*
Trees Overstory (shrub understory)	Thinning specifications: the same as Overstory without shrub understory Zone A. Understory: remove shrub; limb/prune healthy ornamental shrubs to 1/3 of shrub height, maintain spacing between shrubs.	Thinning specifications are the same as Trees Overstory without shrub understory (Zone B). Understory: occasional less dense shrubs or small tree clumps in openings are acceptable.	Thinning specifications are the same as Trees Overstory without shrub understory in Zone C. Understory specifications are the same as shrubs in Zone C except the pockets and clumps are limited to tree openings (non-canopy).

E.3 IMPLEMENTATION GUIDELINES FOR FUEL TREATMENTS

The following describes possible restrictions to implement fuel treatments:

Noxious Weeds

- To limit the spread and establishment of invasive plant species (e.g., noxious weeds) in project areas, all off-road equipment used during project implementation will be washed free of invasive exotic weeds and seeds before entering project areas. If any equipment works in an area where weeds occur, it will be washed to remove weed propagules before entering other work locations.
- All equipment staging areas will be located away from known areas with noxious weed occurrences and outside of riparian habitat areas.

Cultural Resources

- Any known cultural resources within the proposed treatment area will be protected. If any sensitive cultural resources are found, work will stop, and a qualified Archaeologist will be notified.

Soil and Watershed

- Every effort should be made to minimize damage to the soil surface to reduce the potential for erosion and sediment transport due to project implementation activities.
- No mechanical equipment is used on slopes greater than 30 percent with the following exception: Mastication can occur on slopes greater than 30 percent where the equipment is operating on slopes less than 30 percent and accessing steeper slopes with a boom arm.

- Chipped or masticated material may be “blown” back onto the slope where feasible to enhance soil coverage.

E.4 RECOMMENDED BEST MANAGEMENT PRACTICES (BMPS)

- Shrubs will vary in size randomly scattered across the project area. Chipped material should not exceed four (4) inches in depth.
- Boundaries between treatment levels will maintain free-form shapes and feathered edges that replicate natural patterns; avoid straight lines by scalloping and feathering along edges of vegetation. The feathering of edges includes undulating edges horizontally and diverse heights of the brush retained on site.
- Precautions will be taken to prevent scarring of trees or retained shrubs by equipment.
- Signs should be posted warning the public of potential hazards during fuel treatment activities.
- Environmentally Sensitive Habitat Areas (ESHA) will be marked on the project area maps.
- Known landslides and unstable areas should be avoided as vegetation treatment activities may result in increased potential for mass wasting and erosion.
- Heavy equipment should not work on slopes greater than 30%. Movement of any heavy equipment across slopes should be minimized. Heavy equipment will not be used in areas any ESHA.
- When operating equipment off of roadways the use of rubber-tracked equipment, with a low ground pressure coefficient, is preferred.
- When treating herbaceous/grass fuels; mowing or weed whipping is preferred over discing to limit soil disturbance.
- Required riparian zone setbacks will be identified, mapped, and flagged before project implementation work.
- Any project-generated vegetation debris shall be removed from the stream course.
- Water bars and other erosion control structures will be located where necessary to limit erosion and associated run-off causing sediment movement into stream courses.
- No servicing or refueling of equipment will occur on site. Operators must remove residues, waste oil, engine coolants, and other harmful materials from all worksites. Spill containment will be established before any on-site servicing or refueling, even in approved on-site service locations.

Appendix F - Community Engagement Attendance

Participant ID	*Participant Name*	*Participant Email*	*Joined at*
373692633	Anonymous	Anonymous	06/09/2023 18:20:18
373692635	Anonymous	Anonymous	06/09/2023 18:20:20
373692638	Anonymous	Anonymous	06/09/2023 18:20:22
373692639	Anonymous	Anonymous	06/09/2023 18:20:22
373692641	Anonymous	Anonymous	06/09/2023 18:20:23
373692642	Anonymous	Anonymous	06/09/2023 18:20:24
373692643	Therese Metherell	Anonymous	06/09/2023 18:20:24
373692644	Anonymous	Anonymous	06/09/2023 18:20:25
373692646	Anonymous	Anonymous	06/09/2023 18:20:29
373692648	Anonymous	Anonymous	06/09/2023 18:20:32
373692650	Anonymous	Anonymous	06/09/2023 18:20:35
373692653	Anonymous	Anonymous	06/09/2023 18:20:45
373692656	Anonymous	Anonymous	06/09/2023 18:20:48
373693453	Anonymous	Anonymous	06/09/2023 18:35:44
373713169	Anonymous	Anonymous	06/09/2023 22:51:14
373717953	Anonymous	Anonymous	06/09/2023 23:55:29
379306108	Anonymous	Anonymous	06/29/2023 06:16:11
384014723	Anonymous	Anonymous	07/19/2023 18:08:48
384014724	Anonymous	Anonymous	07/19/2023 18:08:48
384014729	Anonymous	Anonymous	07/19/2023 18:08:49
384014756	Anonymous	Anonymous	07/19/2023 18:08:56
384014765	Anonymous	Anonymous	07/19/2023 18:08:58
384014766	Anonymous	Anonymous	07/19/2023 18:08:58
384014797	Anonymous	Anonymous	07/19/2023 18:09:08
384014841	Anonymous	Anonymous	07/19/2023 18:09:23
384014937	Anonymous	Anonymous	07/19/2023 18:09:51
384014942	Anonymous	Anonymous	07/19/2023 18:09:51
384015247	Anonymous	Anonymous	07/19/2023 18:11:50
384015310	Anonymous	Anonymous	07/19/2023 18:12:24

Participant ID	*Participant Name*	*Participant Email*	*Joined at*
384019317	Anonymous	Anonymous	07/19/2023 18:34:58
384554767	Anonymous	Anonymous	07/21/2023 09:45:30
384584347	Anonymous	Anonymous	07/21/2023 13:44:34
386506166	Anonymous	Anonymous	07/31/2023 15:19:55

Appendix G – Community Engagement Polling

CWPP Presentation - Big Timber

19 July 2023

Poll results

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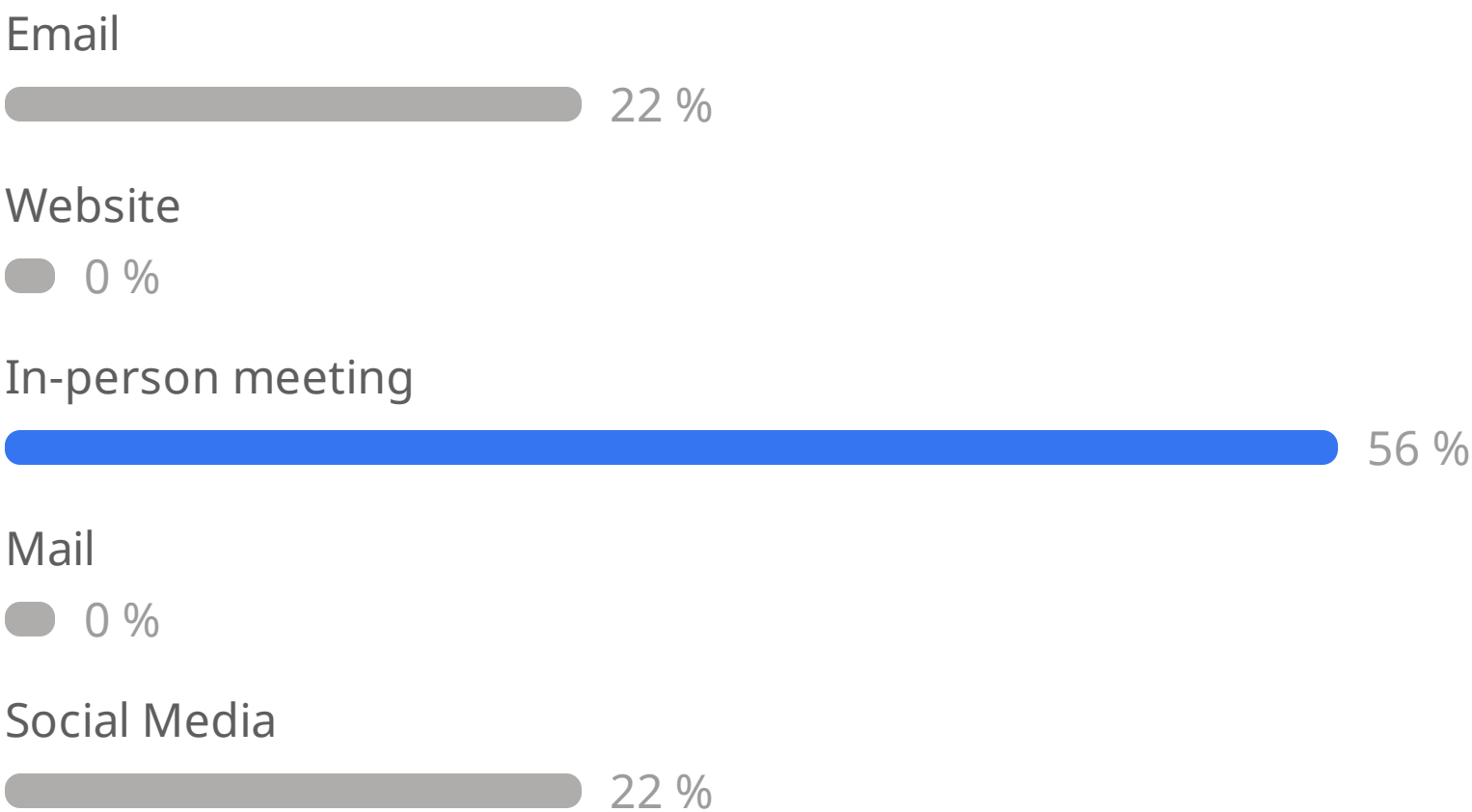
Table of contents

Multiple-choice poll

What is the best way to receive educational information?

0 0 9

(1/2)



What is the best way to receive educational information?

0 0 9

(2/2)

Radio

0 %

Multiple-choice poll

Are you familiar with NFPA Firewise?

0 1 0

Which areas in Parks and Open Spaces would you recommend fuel treatment?

006

- Airport
- Rail road right of way
- Tin Can Hill repeater site
- Buffer zones between houses, alleys, etc
- Dornix Park
- Mowing off open fields/yards

Which areas along emergency evacuation corridors would you recommend fuel treatment?

008

- East, west and main Boulder roads. Narrow spots along the Boulder (private areas)
- Main Boulder drainage And on either side of Camp on the Boulder
- Stagecoach Estates
- Camp on Boulder
- Elk Creek Road
- Main Boulder south of natural bridge
- Boulder
- Big Timber Canyon

Which areas on State and Federal forested lands would you recommend fuel treatment?

0 0 7

- Thinning and reburning areas around church camps
- Beetle kill areas
- BT Canyon 3 Boulder drainages
- Main Boulder
- USFS Main Boulder USFS boundary to all private land
- Main Boulder Elk Creek East Boulder Big timber canyon
- FWP fishing access

What are some obstacles to hardening your home?

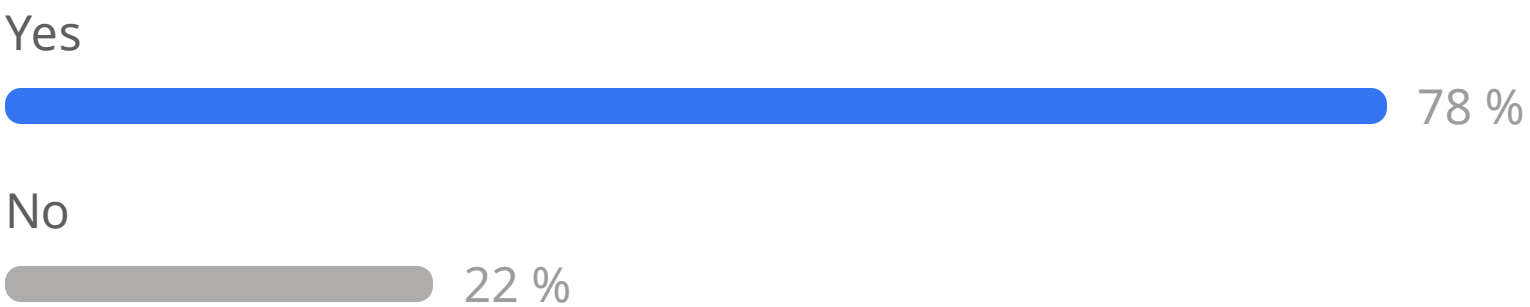
007

- Cost, available materials and labor to do the work.
- Physically unable
- Time
- Looks bad
- Regulations
- Cost Difficulty
- $$$

Multiple-choice poll

Are you familiar with Ready, Set, Go?

0 0 9



Multiple-choice poll

Do you have a personal evacuation plan?

0 1 0

Multiple-choice poll

How confident would you feel evacuating under current wildfire conditions in your community?

0 1 0

Not Confident

0 %

Somewhat Confident

0 %

Confident

60 %

Very Confident

40 %

What would help to improve your confidence level in an evacuation?

0 0 4

- Consistent communication with responders
- List Extended family prepared and ready
- Knowing my neighbors are just as confident.
- Having a plan in writing for myself.

Rank the following risk reduction items in order of your personal priority.

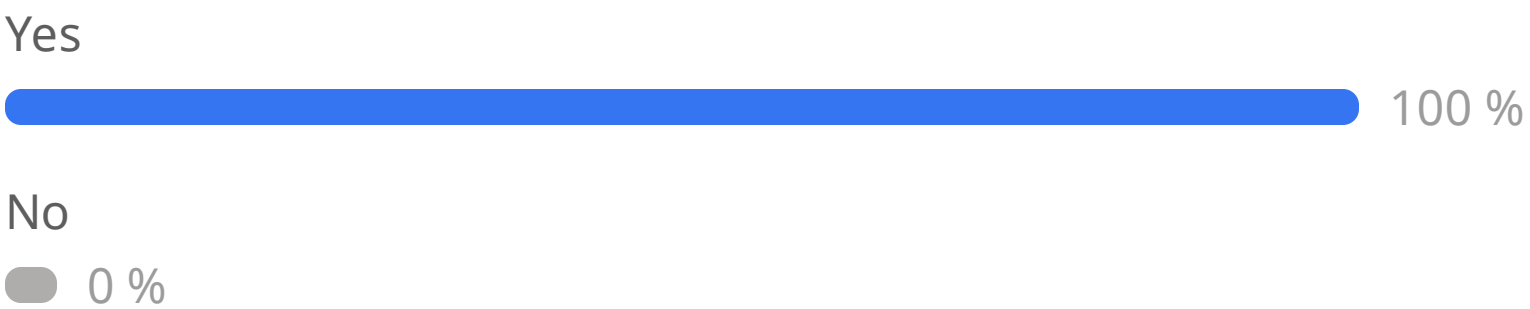
0 1 0

1. Personal Property Vegetation Management — 3.40
2. State/Federal Land Vegetation Management — 3.00
2. Evacuation Corridor Vegetation Management — 3.00
2. Evacuation Planning and Preparedness — 3.00
5. Structural Hardening — 2.30

Multiple-choice poll

Do you want more wildfire community mitigation, education, and outreach?

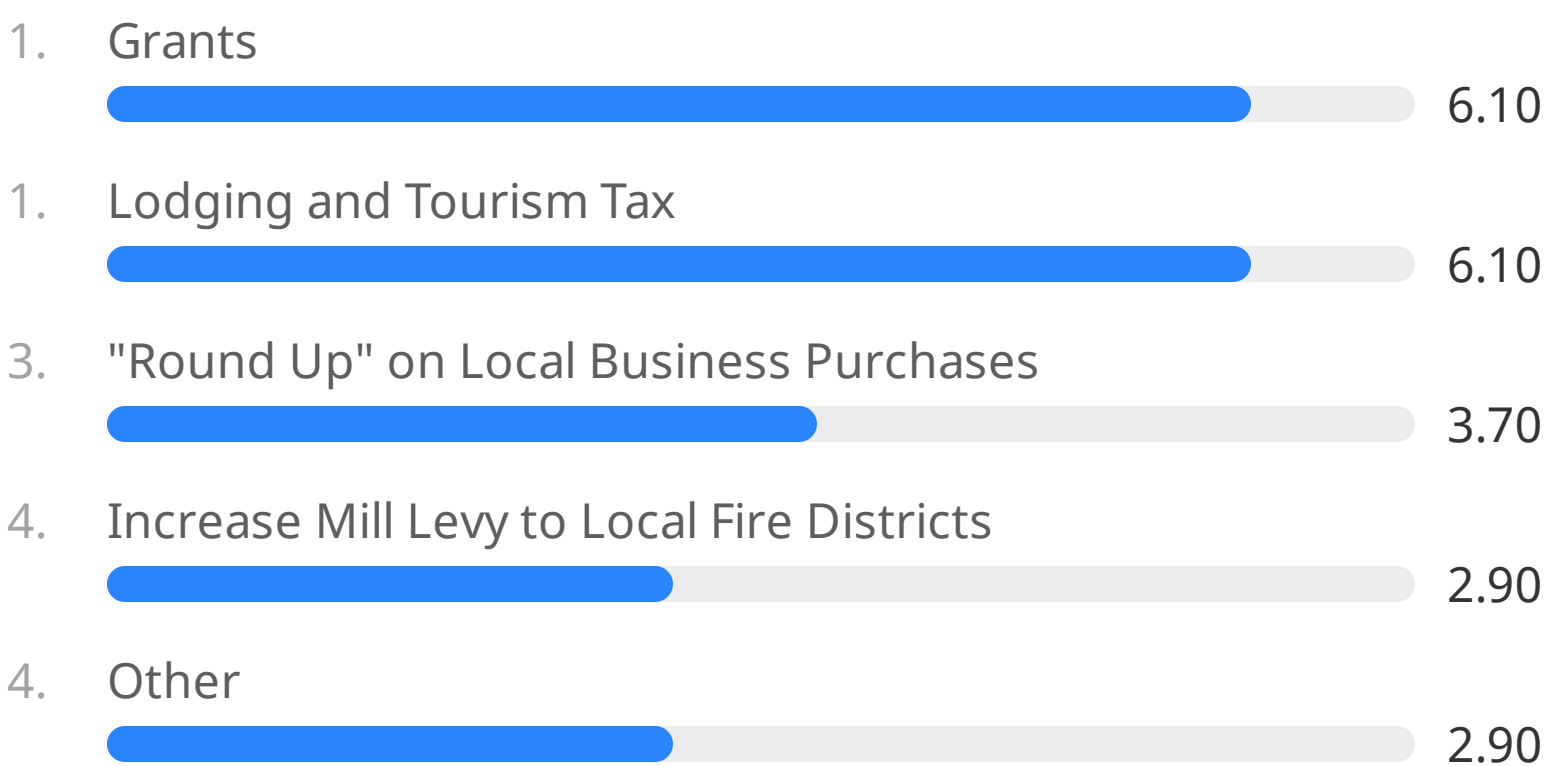
0 1 0



How would you be willing to fund TAWPC to further county-wide wildfire mitigation, education, and outreach?

0 1 0

(1/2)

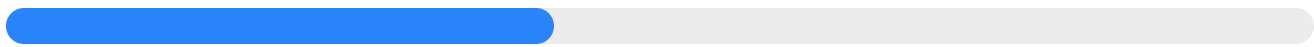


How would you be willing to fund TAWPC to further county-wide wildfire mitigation, education, and outreach?

0 1 0

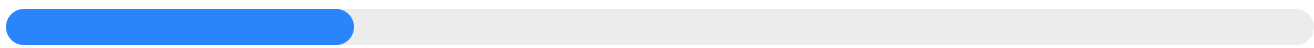
(2/2)

6. County Sales/SPET Tax



2.80

7. County Mill Levy



1.70

If you selected "Other" for the previous question, please elaborate.

0 0 2

- Contacting absentee owners for donations
- Toll booth for going up the Boulder.

In addition to life safety, personal property, and evacuation resiliency what are the things that you would like to protect? For example, places or things that make your community special or unique.

005

- Avalanche shack up near blue lake
  Indian caves
- Natural recreation access Historical
  structures River health
  Campgrounds Infrastructure
- East Boulder Mine
- EB mine
- East Boulder Mine

Multiple-choice poll

Where do you live within the County?

0 1 0