

# **Big Sky Fire Management Strategy**

## **Big Sky, Montana**

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## Executive Summary

According to the Federal Wildland Fire Management Policy and Program Review adopted by the Federal land management agencies in December 1995, “nearly every state has experienced **wildland/urban interface\*** fire losses.” The Federal Fire Policy further states that the wildfire hazard “has become a major fire problem that will escalate as the nation moves into the 21<sup>st</sup> century....It is clear from recent episodes that losses will increase in the future.”

The findings in the Federal Fire Policy are true in Montana due to the unprecedented amounts of fuel that have accumulated due to past fire suppression policies. In addition, the population has shifted to the rural areas of Montana. More and more people are living in or near areas that are prone to **wildfires**. In the recent past, the number of people living in the heavily vegetated areas of the Big Sky area has increased. These new wildland/urban residents rarely give thought to the wildfire hazard. The result is that more homes, developments and people’s lives are at risk from wildland/urban interface fires. Because of these concerns and due to the fact that significant areas of the Big Sky Fire Planning Area do not have structural fire protection services, a group of interested landowners and agencies formed the Big Sky Fire Planning Committee in the spring of 1998. In the fall of 1998, they commissioned this report which analyzes the fire protection issues in the Big Sky Fire Planning Area.

Chapter I provides an overview of the Big Sky Fire Planning Area, outlines the purpose of the document, identifies the Big Sky Fire Planning Committee, and describes the planning area outlined on the map on the following page. In describing the current situation in Big Sky, the Federal Wildland Fire Management Policy and Program Review is reviewed along with its impacts on the long-term fire protection in the Big Sky Fire Planning Area. A desired future condition for fire protection is described.

Agency and landowner roles and responsibilities are described in some detail in Chapter II. The partners and their roles, responsibilities, capabilities, and statutory duties are delineated. Other partner agency functions, such as the planning and zoning organizations are discussed in relation to their role in the overall fire protection system for the Big Sky Fire Planning Area. A key part of this chapter is the discussion of the roles and responsibilities of the private homeowner and developer.

The vegetation, fire history and fire behavior of the Big Sky Planning Area’s fuels and their relationships are addressed. Next several example fires are modeled using normal and extreme fire weather for the Big Sky area, the resulting predictions for the fires are mapped at the end of Chapter III.

Chapter IV deals with the wildland/urban interface and is intended to be used primarily by homeowners, developers, and fire officials. The current situation of the wildland/urban interface is described and the values at risk in the Big Sky Fire Planning Area are enumerated. Strategies are addressed in this chapter that should be employed by the homeowner to make their home safer from an encroaching wildland fire.

In Chapter V, several pre-planning issues are explored to better prepare the fire agencies to respond to a wildland/urban interface fire in the Big Sky Fire Planning Area. Chapter VI outlines several approaches to educating the public about the fire protection issues in the Big Sky area. A series of recommended implementation, monitoring and evaluation components are suggested in Chapter VII. The appendices contain additional useful information to which the reader should refer for further information.



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# Chapter I. Overview

## Background

In the past twenty years the Big Sky Area, including the Big Sky community, Jack Creek drainage, Beaver Creek, and surrounding private forest lands, have experienced enormous residential and commercial growth. With this change has come significant increased threat to personal safety and risk to property due to the growth of development, natural fuel accumulations, and the lack of structural fire protection in many areas. In the spring of 1998, a group of interested landowners and agencies came together and formed the Big Sky Fire Planning Steering Committee to develop a fire management strategy for the Big Sky Area. This plan is the result of the Big Sky Fire Planning Steering Committee's efforts.

## Statement of Purpose

The purpose of this document is to design a fire management planning process and plan which will:

- enhance levels of fire protection provided to the Big Sky Fire Planning Area;
- focus fire agency response activities on the safety of the public and fire fighters during wildland fires and wildland/urban interface fires;
- identify and rate the risk of a significant wildland/urban interface fire in the Big Sky Fire Planning Area; and
- identify strategies for fuel treatments which will mitigate or reduce the risk to the homes and businesses during a wildland/urban interface fire.

## Objectives

The objectives of the project are to develop a fire management plan which will:

1. Improve fire fighter and public safety through:
  - a. Education.
  - b. Training.
  - c. Fire Prevention.
  - d. Fuel modification.
  - e. Wildland/urban interface standards.
  - f. Coordinated fire suppression operations.
2. Enhance fire protection through:
  - a. Improved fire prevention and public education.
  - b. Improved coordination and cooperation of fire suppression agencies.
  - c. Development of long term strategies for fire services and community consistent with agency policies.
3. Reduce risks to stakeholders, (residents, visitors, businesses, and government agencies) through identification and implementation of fuel mitigation measures such as mechanical fuel treatments and prescribed fires on private and federal lands.
4. To reduce the potential for and the consequences of catastrophic wildland fire events.

## Committee Members

Cooperating partners on the Big Sky Fire Planning Steering Committee include representatives from:

- United States Forest Service
  - Gallatin National Forest (GNF)
  - Beaverhead-Deerlodge National Forest (B-DNF)
- Montana Department of Natural Resources & Conservation (DNRC)
- Gallatin Canyon Consolidated Rural Fire District (GCCRFD)
- Gallatin County
  - Disaster & Emergency Services
  - County Fire Warden

- Madison County Disaster & Emergency Services
- Gallatin Peaks Land & Development, LLC
- Moonlight Basin Ranch, Inc.

## **Stakeholders**

Others who have an express interest in the fire protection in the Big Sky area include, but are not limited to:

- Gallatin County
  - Board of County Commissioners
  - Planning & Zoning Commission
- Madison County
  - Board of County Commissioners
  - Planning Board
- Fire Agencies
- Big Sky County Water & Sewer District
- Resort Tax District
- Homeowners' Associations
- Big Sky Resort
- The Yellowstone Club
- Developers
- Realtors
- Homeowners

## **Planning Area**

The Big Sky Fire Planning Area is located around Big Sky, Montana, approximately 35 miles southwest of Bozeman and 40 miles north of West Yellowstone, on Highway 191 (see Map 1-1).

The Big Sky Fire Planning Area is a corridor which is located in the Madison Range between two major areas of the Lee Metcalf Wilderness Area: the Spanish Peaks Unit to the north and the Taylor-Hilgard Unit to the south. To the west, the planning area extends west to the Madison Valley through the Jack Creek drainage. To the north, it follows the Gallatin River in a narrow corridor along the boundaries of the Rural Fire District to the Moose Creek Flat Campground. To the south, the planning area boundary is at an approximate line from Yellow Mule to the Red Cliff Campground. On the east the boundary of the

planning area is the Gallatin River.

Elevations range from a low of 6,000 feet on the western boundary at the mouth of Jack Creek to 7,800 feet on the divide between Jack Creek and the Middle Fork of the Gallatin River and back down to 6,000 feet at the mouth of the Middle Fork on the eastern boundary. The elevations of the mountain ranges to the north and south are 9,600 to 11,000 feet, with the timberline around 9,600 feet. Slopes are variable, ranging from almost level in areas to 60% along some of the steep mountain ridges.

## **Historical Review of the Development of Big Sky**

As late as 1970, when Chet Huntley announced Big Sky to great fanfare, only a handful of ranchers and loggers were living in the Big Sky Area. During the spring of 1970, the construction of the Meadow Village began. By the fall of 1971, the golf course was under construction.

The first condominiums, Silver Bow I, were started in the spring of 1971. In 1972, after a land exchange with the United States Forest Service went through, work on the mountain facilities began. By September of 1973, it was reported that ten homes were now occupied and nine more were under construction. Huntley Lodge wasn't completed until December of 1974, when Buck's T-4, The Corral, and Almart in the canyon; The Meadow Hostel (now Golden Eagle) in the meadow, and The Mountain Hostel (now the Mountain Lodge) on the mountain were also in place to provide housing to customers.

Boyne USA purchased the Big Sky Resort in 1976. In 1978, additional ski runs and lifts were constructed and in 1990 the Yellowstone Conference Center and Shoshone Condominiums were completed.

In July 1992, 25,000 acres of the Jack Creek drainage were purchased and have been developed into the Moonlight Basin Ranch. Twelve thousand acres of the 25,000 acres have been put into a

conservation easement.

Recently, real estate development in many areas of the Big Sky has been significant. Not only has Boyne built the Snowcrest Lodge, but construction is underway on the Summit Hotel. Other developments which have begun development or areas that are continuing to develop include: The Yellowstone Club, Gallatin Peaks Lands & Development, Spanish Peaks, Beaver Creek and Beehive Basin.

This extensive residential development in the planning area over the last 20 years has created an extensive **wildland/urban interface** fire problem.

## **Current Situation**

### Wildland/Urban Interface Implications at Big Sky

What is the wildland/urban interface?

The wildland/urban interface is defined as the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels. Other terms that are synonymous are wildland/residential interface and wildland/urban intermix.

Using this definition of the wildland/urban interface, nearly the entire Big Sky Fire Planning area should be considered an interface area. The extent of the interface continues to expand at a very rapid pace with the continued development of the Big Sky Area.

If you consider that the Big Sky area did not start to develop until 1970, the growth to date has been dramatic. The growth in the last five years, since the lifting of the sewer moratorium has been at a very rapid pace.

### Federal Wildland Fire Policy

The 1994 wildfire season created a renewed awareness and concern among the Federal land management agencies and their constituents about the impacts of wildfires. As a result of those concerns, and in response to specific recommendations in the report for the South Canyon Fire, where fourteen fire fighters lost their lives, the Federal Wildland Fire Management Policy and Program Review (Federal Wildland Fire Policy) was commissioned to ensure that uniform Federal policies and cohesive interagency and intergovernmental fire management programs existed throughout the Federal land management agencies.

The Federal agencies involved are the five principal fire/land management agencies, including the Forest Service (FS) under the Department of Agriculture; the Bureau of Land Management (BLM); National Park Service (NPS); Fish and Wildlife Service (FWS); and Bureau of Indian Affairs (BIA) under the Department of the Interior.

Key points made in the report on the Federal Wildland Fire Policy, which were a change in the previous policy or practices of the federal land management agencies and have an affect on the Big Sky Fire Management Plan, are:

- Protection of human life is the first priority in wildland fire management. Property and natural/cultural resources jointly become the second priority.
- Where wildland fire cannot be safely reintroduced because of hazardous fuel build-ups, some form of pretreatment must be considered, particularly in wildland/urban interface areas.
- All aspects of wildland fire management will be conducted with the involvement of all partners; programs, activities, and processes will be compatible.
- The role of Federal agencies in the wildland/urban interface includes wildland firefighting, hazard fuels reduction, cooperative prevention and education,

and technical assistance.

- Structural fire protection in the wildland/urban interface is the responsibility of Tribal, State, and local governments.
- The Western Governors' Association will serve as a facilitator to involve State, local agencies, and private stakeholders in a cooperative approach to fire prevention and protection in the wildland/urban interface.

Recommendations in the report affecting the Big Sky Fire Management plan are:

- Inform the public so that it understands the hazards and risks from fire in the wildland/urban interface and the prevention methods available to mitigate these hazards.
- Public fire protection roles, responsibilities, and activities within the wildland/urban interface should be identified through a partnership between Federal, Tribal, State, local, and private entities.
- Responsibility should be focused on individual property owners and local, county, and State governments, in cooperation with Federal agencies, to reduce losses within the wildland/urban interface.
- Planning should be a collaborative effort, with all interested partners working together to develop and implement management objectives that cross jurisdictional boundaries.
- Federal agencies need to address wildland/urban interface protection needs occurring on and adjacent to Federal lands. This can be done through collaborative planning, analysis, and cooperative actions across agency boundaries.
- Fire Protection Agreements and partnerships should be developed, approved, and promoted in

order to clarify responsibilities and to provide for pre-fire hazard and risk mitigation activities, and suppression preparedness.

- Firefighters must be properly trained and equipped to ensure firefighter safety during wildland/urban interface operations.

### Governors' Policy Statement

As a result of its assigned role as a facilitator in the Federal Wildland Fire Policy, the Western Governors' Association established a policy statement concerning fire protection in wildland/urban interface, and re-affirmed that policy in June of 1998. The policy says, in part:

- The governors believe that fire policies should be based on input from a diverse group of stakeholders, professionals, and decision makers.
- Local communities in the wildland/urban interface should be encouraged to develop public awareness programs and land use development policies that ensure specific recommendations for public fire protection policies, programs and community-based activities will be implemented.
- Local entities should work closely with landowners and/or developers who choose to build among wildland fuels, in order to identify and mitigate conditions that add to wildland/urban interface hazards such as: limited access for emergency equipment due to width and grade of roadways; inadequate water supplies; species and density of vegetation around structures; flammable construction materials; structure locations in topographic features that are hazardous; and lack of adequate escape routes. Building lots should be sized so that subdivisions comply with state and local land use and fire protection regulations.

### Fire Protection Roles

The roles of the fire protection agencies providing protection in the Big Sky Fire Planning Area have been clarified since the Federal Wildland Fire Policy was published; the agencies must continue to work together in order to cope with the continuing growth at Big Sky. These roles are divided into three kinds of protection areas:

- The first is the Gallatin Canyon Consolidated Rural Fire District (GCCRFD) and the Madison Valley Rural Fire District (MVRFD), which are tax supported units of local government. The Rural Fire Districts are responsible for structural and wildland fire protection and other emergency services within the boundaries of their rural fire districts where there is no overlap with the Forest Fire Protection District or Affidavit lands.
- The second is private lands within the rural fire districts which overlap with US Forest Service wildland protection. In these areas the US Forest Service (the protecting agency) is the **recognized wildland agency** which can provide the highest level of wildland protection, and the Rural Fire Districts (jurisdictional agency) would provide assistance to US Forest Service; the Rural Fire Districts would be considered a supporting agency and would coordinate wildland suppression efforts with the US Forest Service. The Rural Fire Districts are responsible for structural protection and other emergencies.
- The third is those lands outside the Rural Fire District Boundaries, but within the US Forest Service Boundaries (Gallatin National Forest and Beaverhead-Deerlodge National Forest). The US Forest Service has primary responsibility for **wildland fire** protection on its lands and private lands for which they have contracted with the State of Montana to provide wildland fire protection under terms of the “**Six Party Agreement**.” There is no **structure fire suppression** provided by a fire department. Details of protection are identified in the Gallatin

and Madison County Fire Plans and the Local Interagency Operating Plan per the Six Party Agreement. The lands in the Big Sky Fire Planning area that are protected under this agreement and operating plans are outlined in Map 2-1.

Examining the boundaries of the fire protection entities in the Big Sky area reveals that there are significant areas of the planning area that are not provided with structural fire suppression. These areas include portions of the Jack Creek Drainage, Beaver Creek, and the proposed Spanish Peaks Development. The Yellowstone Club has signed a fire protection agreement with GCCRFD for fire and emergency services.

Under the Federal Wildland Fire Policy and Montana statutes, these unprotected areas may have no structural fire suppression if they experience a wildland/urban interface fire. The federal wildland fire agencies have no authority or responsibility to fight the structure fire and the rural fire districts have no statutory obligation to respond outside their boundaries to provide structural fire protection.

### **The Desired Future**

What does all of this mean in terms of future of fire protection in Big Sky?

The US Forest Service has indicated that due to the agency’s lack of authorizing legislation, lack of training in structure fire fighting, the lack of capability to fight structure fires, and the Federal Wildland Fire Policy, they want to clarify the wildland fire protection responsibility in the Big Sky area. They will negotiate with the State of Montana, through the Montana Department Of Natural Resources & Conservation to change the responsibility for protection under the Six Party Agreement. The net result will be that the wildland fire protection in the Big Sky area will return to the protection of the Montana Department of Natural Resources & Conservation.

In the near future, the unprotected areas, i.e., the areas with no structural fire protection, must be provided with structural fire protection. Options available to the homeowners and landowners to obtain structural fire protection include:

- Annexing into an existing rural fire district.
- Forming a new rural fire district or fire service area.
- Contracting, for a fee, with one of the rural fire districts to provide structural fire service.

The members of the Big Sky Fire Planning Steering Committee desire to create a true partnership to resolve the fire protection challenges at Big Sky. Through the partnership, fire protection in the Big Sky Fire Planning Area will be enhanced.

Finally coordinated planning of the fire protection transition, from the US Forest Service to the State of Montana, must occur to ensure that the Montana Department of Natural Resources & Conservation has adequate time to prepare a legislative request for funds.

## Chapter II. Agency/Landowner Roles & Responsibilities

### Fire Protection & Emergency Services

Fire protection is currently provided to the Big Sky Fire Planning area by:

- Gallatin Canyon Consolidated Rural Fire District
- Madison Valley Rural Fire District
- Gallatin National Forest
- Beaverhead-Deerlodge National Forest

Gallatin Canyon Consolidated Rural Fire District (GCCRFD) and the Madison Valley Rural Fire District (MVRFD) are political subdivisions having geographical boundaries established by a petition of the residents of the area. Their operations are supported by a tax on all real property in the fire district and they are primarily responsible for structural and wildland fire protection and other emergency services within the geographic boundaries of their rural fire districts.

In areas within the rural fire district boundaries, where they overlap with US Forest Service wildland protection, the rural fire district would assist and coordinate with the US Forest Service in wildland suppression efforts.

Gallatin and Madison Counties provide wildland fire protection for private and state lands through “county fire districts,” rural fire districts, such as GCCRFD and MVRFD, and the “**County Coop Program.**” Neither county provides structural fire protection in areas of the county where there is no structural fire protection entity, such as, a rural fire district.

The Gallatin National Forest (GNF) and Beaverhead-Deerlodge National Forest (B-DNF) have primary responsibility to provide wildland fire protection on their lands, on all Montana Department of Natural Resource & Conservation (DNRC) land and private “**classified forest land**” within the forest boundaries and that are within established “**Forest Fire Districts,**” or that are signed up under the “**Affidavit**

### System.”

Through an agreement with the DNRC, the GNF and the B-DNF are designated as the “recognized fire protection agencies” for the Big Sky area. The lands in the Big Sky Fire Planning area that are protected under this agreement and fire protection agency boundaries are outlined in Map 2-1.

Although the rural fire districts and wildland fire agencies may share geographical responsibilities, they differ in their respective missions. The “recognized fire protection agencies,” which include the National Forests, are primarily wildland fire fighters, and for the most part will not perform structural fire fighting. Rural fire districts, on the other hand, are geared towards fighting structure fires; some structural fire departments do not have expertise in wildland fire fighting.

Examining the boundaries of the fire protection entities in the Big Sky area reveals that there are significant areas of the planning area that are not provided with structural fire protection. The unprotected areas within the planning area boundaries are provided with wildland fire protection by the GNF and B-DNF, but structure fire suppression is the responsibility of the homeowner or landowner. These areas include portions of the Jack Creek Drainage, Beaver Creek, and the proposed Spanish Peaks Development. The Yellowstone Club is in the process of signing a fire protection agreement with GCCRFD for fire and emergency services.

### County Disaster & Emergency Services

The county Disaster & Emergency Services (DES) office is responsible for ensuring that the counties meet State and federal emergency management requirements. This primarily involves planning, resource tracking, readiness evaluation, response

coordination, and recovery operations.

Both Gallatin and Madison counties have an Emergency Operations Plan that spells out preparedness and response actions for declared emergencies and disasters in the county. There is a wildfire annex in each plan which addresses wildfires that are declared to be emergency situation or that result in a major disaster. Although every wildland fire is technically an emergency, the counties do not officially declare them an Emergency in most cases. An Emergency Declaration is probably warranted in fire situations where multiple homes are under immediate threat of destruction, and where the ability of local fire suppression forces to handle the fire is inadequate. Such a situation would occur with a large scale fire in the wildland/urban interface in the Big Sky area.

If an Emergency Declaration is issued, the responsible DES official serves as conduit to the incident for resources ordered through the State DES system. However, for wildland fires and wildland/urban interface fires all the resources are to be ordered through the regular fire ordering process for that particular county.

Other duties and responsibilities of the DES Coordinators include keeping local elected officials informed, establishing and managing the County Emergency Operations Center, sheltering evacuees, and dealing with recovery issues.

### **Cooperative Fire Management Agreement**

The Cooperative Fire Management Agreement which implements the wildland fire protection for the Big Sky area is commonly referred to as the “Six Party Agreement.” This agreement is signed by the Montana Department of Natural Resource & Conservation, United States Forest Service, National Park Service, Bureau of Land Management, Bureau of Indian Affairs, and the Fish & Wildlife Service.

The Cooperative Fire Management Agreement is implemented by local interagency operating plans. The lands in the Big Sky Fire Planning Area in Gallatin and Madison Counties are covered by two separate operating plans covering each of the counties and their respective fire protection agencies.

The operating plans outline how the signatory agencies will cooperate and assist each other in providing wildland fire protection to the geographic area covered by the plan, and includes:

- Initial Attack Assistance
- Burning Permits
- Dispatch Procedure
- Fire Prevention
- Training
- Incident Management

### **Agency Capabilities and Responsibilities**

#### Gallatin Canyon Consolidated RFD

The Gallatin Canyon Consolidated Rural Fire District has thirty two volunteer firefighters, one paid Fire Chief/Paramedic and one paid district clerk/secretary. The District encompasses an area of approximately forty five square miles. District services are provided through resources housed in two fire stations, located in the Meadow Village and Mountain Village.

The fire district’s apparatus consists of **engines**, **water tenders**, a mini-pumper, a wildland engine, ambulances, and a command vehicle. For a detailed resource list see Appendix 2 - Agency Contact List.

The District responds to approximately two hundred calls for emergency assistance each year, of which three incidents are wildland fires.

The GCCRFD has an **Insurance Services Office** (ISO) rating of Class 6 and 9, depending on the distance from a fire station and water supplies.

### Madison Valley RFD

The Madison Valley RFD is an all volunteer rural fire district operating out of two fire stations, one located in Ennis, another located in the South Madison near the intersection of Highway 287 and Highway 87.

The district's apparatus consists of engines, a rescue, water tenders and wildland engines. For a detailed resource list see Appendix 2 - Agency Contact List.

The MVRFD has an ISO rating of 7, 9, or 10 depending on the specific location of the property.

### Gallatin County Fire Warden

The Gallatin County Fire Warden provides fire protection through Gallatin County Fire, which is a wildland fire suppression agency only. They do not have the training, capability, or authority to provide structural fire protection. They have the wildland engines strategically located throughout Gallatin County. For a detailed resource list see Appendix 2 Agency Contact List.

### Madison County Fire Warden

The Madison County Fire Warden is the Madison County Sheriff. The Madison County Fire Warden is a wildland fire agency only. They do not have the equipment or training for structural fire fighting.

Their equipment consists of wildland fire engines strategically located throughout Madison County. For a detailed resource list see Appendix 2 - Agency Contact List.

### MT Department of Natural Resources & Conservation

DNRC has no direct fire protection responsibility in either Gallatin or Madison Counties. Under the "County Coop" program, DNRC provides fire protection assistance to a county. When the county experiences a wildland fire incident that exceeds the county's capability, it has the ability to request assistance from DNRC. DNRC's help can range from a technical advisor to full suppression support with an incident management team and fire suppression resources. DNRC can request fire suppression reimbursement funds through the Federal Emergency Management Agency (FEMA) for fires

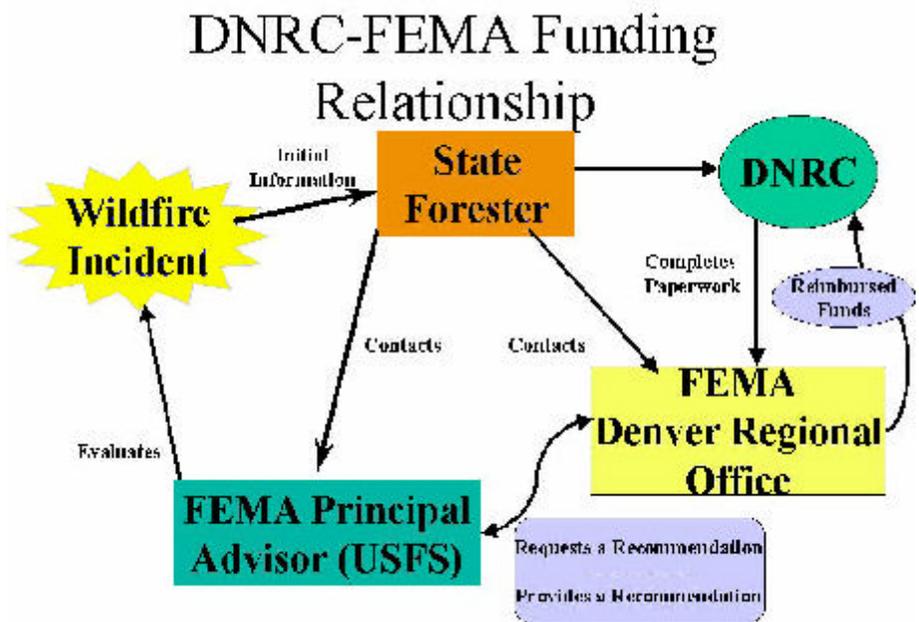


Figure 2-1. FEMA Funding Relationship.

that meet certain criteria. The process is illustrated in Figure 2-1.

### Gallatin National Forest

As a wildland fire agency, GNF staffs a varying number of wildland fire engines in the Big Sky area from mid-May to mid-October. At peak staffing during high fire danger days, GNF may have seven engines and one helitack crew staffed in the GNF area. The GNF has twenty-four smoke jumpers and an air tanker stationed at West Yellowstone. These

resources are available to provide assistance during a wildland fire in the Big Sky area.

The GNF staffs an engine in the Big Sky area. The engine crew is responsible for making fire prevention contacts throughout the area and fire suppression. For a detailed resource list see Appendix 2 - Agency Contact List.

### Beaverhead-Deerlodge National Forest

The B-DNF staffs three engines and a five-person **hand crew** in the Madison Valley area. A national resource helicopter is stationed in Dillon and is available for fires in the Big Sky Fire Planning Area. The B-DNF has access through the resource ordering system to the air tankers stationed in West Yellowstone and other cities in Montana. For a detailed resource list see Appendix 2 - Agency Contact List.

If either forest were to experience a significant fire that exceeded the capabilities of the forests and their cooperators, it has access to regional and national resources through the resource ordering system.

### **Planning & Zoning Organizations**

The Big Sky Fire Planning Area is covered by two planning organizations. The Madison County Planning Board has jurisdiction for the lands in Madison County; the Gallatin Canyon/Big Sky Planning and Zoning District encompasses lands within the planning and zoning district boundaries in Gallatin County.

Both organizations have adopted regulations to manage the development of lands in their respective counties. The Madison County Comprehensive Plan was approved in 1999. The subdivision regulations in Madison County will be up-dated to reflect the changes in the Comprehensive Plan.

The purposes of the Gallatin Canyon/Big Sky Zoning Planning and Zoning District include but are not limited

to:

- Promote the health, safety and general welfare of County residents.
- Secure safety from fire, panic, and other dangers.
- Facilitate the adequate provisions of transportation, water, ..... and other public improvements.
- Guard against congestion on the roads.
- Encourage cluster development in and around existing development.

In both counties, the subdivision regulations regarding fire protection only provide the most essential fire protection requirements. Neither county has adopted or developed subdivision regulations specifically for developments in the wildland/urban interface. For example, the Gallatin Canyon/Big Sky Planning and Zoning requirements for wildland fire protection are:

- All structures located in an interface area shall use on Class A or B fire-rated roofing materials.
- Spark arrester screens shall be installed on chimneys.
- Smoke detectors shall be installed in dwelling units.
- The vegetation reduction and clearance guidelines of the *Fire Protection Guidelines for Wildland Residential Interface Development* (See Appendix 3 - Resources) shall be met.

Neither county has fully adopted the *Fire Protection Guidelines for Wildland Residential Interface Development* as developed by MT Dept. of State Lands and the MT Fire Prevention & Investigation Bureau. In addition, neither county has adopted the *Urban-Wildland Interface Code* as developed by the International Fire Code Institute (See Appendix 3 - Resources).

Under the Gallatin Canyon/Big Sky Planning and Zoning district requirements, a land use permit is required for all development activities. No such mechanism exists for the Madison County area.

## Private

The ultimate responsibility for protecting a person's home or development lies with the homeowner or developer. Homeowners and developers make many choices which affect how and where they will live in a flammable environment.

Some of the private homeowners and developers have become more aware of the fire protection issues in the Big Sky area and are implementing strategies to mitigate the fire risks. Some examples are:

Gallatin Peaks Land & Development - reduced the fuel loading on the sites of developments by selectively logging. In addition, dead and dying trees were removed and slash from previous logging activity was piled and burned, prior to the beginning of development. They are also writing a management plan which will detail fire safety requirements for the project.

Moonlight Basin Ranch - has reduced fuel loading in the development by selective logging of the site, post and pole sales, firewood cutting, Christmas tree cutting, piling and burning, and the sale of house logs.

Boyne USA - has a requirement to complete a fire/fuel element for their recently approved master plan for expansion of the resort complex.

The Yellowstone Club - has requirements in the recently adopted master plan for the development which include vegetation management requirements, fuel breaks, location of helispots for fire suppression efforts, fire sprinklers in all newly constructed buildings, and defensible space requirements based on the fuel type.

## Trails Group

A trails group is just forming in the Big Sky area as this

report is being written. The fire protection agencies need to participate in this group to ensure that the work of this group coordinates with the needs of a fuel break system which incorporates the trail system as a component. Developers should be encouraged to work with neighboring projects to coordinate the trails systems throughout the community of Big Sky in addition to the trails in their project.

## The Desired Future at Big Sky

The desired future of fire protection at Big Sky includes:

- Coordinated, consistent approach to planning, building inspection, zoning and land use, and fire protection in the Big Sky Fire Planning Area.
- Interagency partnerships and public-private partnerships to enhance fire protection.
- Formalization of the Big Sky Fire Planning Committee.
- Ensuring that structural fire protection is provided to the unprotected lands with structures located on them, **OR** the property owners recognize and accept the responsibility for the protection of their own structures, and any wildland fire suppression costs resulting from a structure fire.
- Planning and constructing additional fire stations required by the increasing development, by the increased attention ISO is placing on the 5 mile distance from fire stations, and the annexations of land into the rural fire districts.

Strategies to achieve the desired future for fire protection in Big Sky are outlined below.

### Subdivision Review

The counties should:

- Ensure that developments have adequate access for fire apparatus and other emergency vehicles.
- Ensure that developments have two ingress-egress routes

- Check to ensure that covenants similar to those in Appendix 3 - Sample Covenants are included in the developments covenants.
- Ensure fuel management activities are completed prior to the recording of the final plat of a development.
- Ensure that defensible space is required for each home in a development.
- Ensure that an adequate water supply is provided for a development.

The fire agencies should:

- Develop cooperatively a standard set of criteria for review of subdivisions. Use it consistently.
- Conduct a coordinated review between the structure fire and wildland fire agencies.
- Develop a Fire Protection Master Plan for the Big Sky area adopted by both counties, which would:
  - R Assess the relative impacts of developments in the planning area.
  - R Develop coordinated fuel treatments.
  - R Coordinate fire breaks.
  - R Treat the entire area as one planning unit for fire protection.
  - R Outline the growth of the GCCRFD and it's need for additional fire stations, equipment and personnel.
  - R Establish the priorities for the fire protection system in the Big Sky area.
- Develop subdivision trade-offs as a partnership between the developer and the fire agencies. Trade-offs examples might include:
  - R Increased density in return for fuel reduction treatments.
  - R Less water storage in return for fire sprinklers in homes and businesses.
  - R Non-combustible construction for less fuel reduction.
- Show developers that dollars invested up front in the development process are cheaper than dollars required to retro-fit a development later.
- Meet and educate the planners. Get educated by the county planners, understand their terms, and the principals of planning and zoning.

### Interagency partnerships and opportunities

- Maintain part-time staffing of GCCRFD apparatus during fire season.
- State or Federal agencies provide fire apparatus, staffed by local government personnel.
- Add Emergency Medical Technicians-Wildland fire fighters during summer fire season.
- Cooperative fire prevention staffing.
- Coordinated fire prevention messages and programs.
- Coordinate training opportunities among themselves to promote cooperation and understanding of Standard Operating Procedures during emergency incidents.

### Big Sky Fire Planning Committee

The Big Sky Fire Planning committee should be formalized and chartered by the host organizations. Funding should be provided to enable the committee to complete projects in the Big Sky area. Some funding should be provided for staffing of cooperative projects and efforts, whether they are a coordinated media campaign or fire prevention effort.

Various task or work groups could be assigned:

- Operations - protocols, communications issues.
- Fire Prevention - develop fire prevention materials and programs for the Big Sky area.
- Training - coordinate training with all the agencies.
- Public Education.
- Administration - inform local government agency official of their financial roles and responsibilities, especially as they relate to the wildland/urban interface.
- Planning/developers liaison.

### Fire Stations

A fire station location study needs to be conducted by the fire agencies in the Big Sky area. Roughly estimating the distances required to travel to various

areas in the Big Sky Fire Planning area can identify a potential need for new fire stations in the following areas:

- The Yellowstone Club
- The Beaver Creek Area

### Unprotected Areas

The lands within the Big Sky Fire Planning Area without structure fire protection needs to be provided with fire protection for the structures. There are at least four alternatives to provide this protection:

- annexation into an existing rural fire district.
- form a fire service area.
- form a new rural fire district.

- contract for service with an existing rural fire district.

### Fire Protection

Fire district boundaries need to be constantly updated and verified for their accuracy.

Accurate maps will assist residents and homeowners to determine whether they are within the boundaries of one of the rural fire districts.

All agencies need to ensure that jurisdictional issues and financial responsibilities are clearly documented in operating plans.

## Chapter III. Vegetation and Fire History

### VEGETATION AND FUELS

The Big Sky corridor is situated within a mixed conifer forest that consists of many different vegetative **cover types** (see Map 3-1). These cover types vary greatly from dry grasslands, sagebrush and Douglas fir within the Jack Creek drainage, to the higher elevation where mixed conifer stands of lodgepole pine, Douglas-fir, whitebark pine, subalpine fir, and spruce are dominant. Timber harvesting within this corridor has removed much of the merchantable timber. This along with the slash cleanup has eliminated much of the wildland fuels and has, in effect, resembled many large wildland fires. This has changed the fuel complex from a timber type with heavier loadings of dead fuels to a grass and shrub type mixed within the remaining mixed conifer stands.

Vegetation as it relates to wildland fire can be classified into four primary **fuels groups**. These four groups are the basic fire behavior fuel model groups for estimating fire behavior. These groups are classified as: grass, brush, timber, and slash. Within the Big Sky corridor the dominate groups are grass and timber with areas that are a combination of each. The vegetative cover types include:

- Grass, grass-shrub, or grass-tree combinations



Photo 3-1. Fuel Model 1.

where the grass is the dominate cover and there is very little shrubs or timber present over less than one-third of the area. This cover type is represented at the lower elevations in the Madison Valley and Jack Creek. It also is representative of the many large areas that have had most of the merchantable timber overstory removed. These areas are now mainly covered with grasses or grasses with scattered seedling and sapling lodgepole pine regeneration. This cover type would be a fire behavior Fuel Model 1 (See Photo 3-1).

- Grass with open timber overstory. This cover type consists of open timber stands that cover about one-third (1/3) of the area. The timber overstory is mostly Douglas-fir with some lodgepole mixed in. These areas are mostly on the south and southwest slopes. They also consist of harvested areas where an overstory of timber remains. This cover type would be a fire behavior Fuel Model 2 (See Photo 3-2).



Photo 3-2. Fuel Model 2.

- Tree cover type. This includes all the closed canopy timber types which include lodgepole pine, Douglas-fir, subalpine fir, spruce, whitebark pine and aspen. This tree cover type needs to be separated into two fire behavior fuel types.

Immature timber stands and Douglas-fir stands with very little undergrowth or down dead material would be a fire behavior Fuel Model 8 (See Photo 3-3), and mature stands that have an abundance of undergrowth and dead woody



Photo 3-3. Fuel Model 8.

material on the forest floor would be a fire



Photo 3-4. Fuel Model 10.

behavior Fuel Model 10 (See Photo 3-4). For more information on fuel models contact your local fire agency or **see the reference list.**

### Fire Regimes

In 1995, land management specialists from the Gallatin and Beaverhead-Deerlodge National Forests began an extensive analysis of the social and biophysical resources of the entire Madison Mountain Range. The analysis covered the Bozeman and Hebgen Lake

Districts of the Gallatin National Forest (which includes the Big Sky corridor) and the Madison District of the Beaverhead-Deerlodge NF. This analysis is referred to as the *Ecosystem Management Assessment of the Madison Range* and was completed in 1997 (USDA 7/1997). In this analysis, the Madison Range is divided into **ecological land units** (ELU's) which were defined by elevation, fire groups and fuel models. The type and configuration of forest and grass land habitat types help define fire groups and fuel models. Fire groups are also based on the response vegetation has to fire and the role it plays in influencing fire behavior on the landscape throughout succession (Fischer and Clayton 1983). **Succession** is a term used to define the vegetation patterns or changes over time. The ELU's described here were also used for the Lee Metcalf Wilderness Fire Management Guidebook (USDA 9/1997).

The **fire groups** found within the Big Sky corridor include the following:

- Fire Group 0 is a miscellaneous collection of habitats that consist of scree and talus slopes, rocky forested areas, meadows and grassy bolls, aspen groves and alder glades. Most of these habitats will not readily burn under normal summertime weather conditions. The grasslands will carry fire during the driest part of the summer and fall when vegetation has cured. In the Big Sky area, older harvest areas now vegetated with grasses forbs and sapling-size trees will fall within this fire group.
- Fire Group 6 is a relatively moist Douglas-fir forest habitat type, with lodgepole pine as a major **seral** component. These habitats occur at elevations between 4,800 feet and 7,200 feet. Fire history studies indicate that thinning fires or stand-replacement type fires occurred in these habitats roughly every 42 years prior to the late 1800's. Low to moderate intensity fires converted dense pole-sized or larger forested areas to a fairly open condition. Severe fires that occurred in densely forest areas with heavy fuel

concentrations most likely resulted in stand-replacement.

- Fire Group 7 consists of cool habitat types dominated by lodgepole pine with subalpine fir, spruce, Douglas-fir and/or whitebark pine intermingled throughout the stand. These habitats occur at elevations between 7,000 feet and 8,500 feet. A large majority of the Big Sky area fits into this fire group. Lodgepole pine is a fire-dependent tree species, requiring extreme temperatures to open cones and release seed for regeneration. In areas of seral lodgepole pine (below 7,500 feet elevation), fire acts to perpetuate or renew lodgepole pine forests. Prior to early suppression actions, stand-replacing fires occurred in these habitats on a cycle of every 90 to 115 years (Barrett *et al* 1997). In rare instances, extensive fires encompassing large amounts of acreage occurred every 300 to 400 years (Romme and Despain 1989).
- Fire Group 8 consists of lower subalpine fire habitat types that are dominated by lodgepole pine. Douglas-fir is present with lodgepole pine at the lower elevations. These habitats occur at fairly broad elevation ranges between 5,500 feet and 8,200 feet. The dominance of Douglas-fir and lodgepole pine in this fire group may be in part due to periodic fires that set back the invasion of spruce and subalpine fir. Fire history and frequency data is lacking for this group. Arno (1980) estimates that fire occurred within these habitats periodically every 50 to 130 years. Severe intensity fires would favor the re-establishment of lodgepole while low intensity fires will favor Douglas-fir.
- Fire Group 9 is a collection of moist and wet lower subalpine habitat types in the spruce and subalpine fir climax series. Elevations of this fire group range from about 5,800 feet to 8,200 feet. This group typically borders streams and adjoins wet meadows. Other locations are flat sites with poor drainage, moist bottom lands, benches,

northern exposures, and seepage areas. Abundant undergrowth occurs with accumulations of downed, dead, woody material on the forest floor. This can result in severe surface fires during unusually dry conditions; in drought years, fires can easily spread to the tree crowns. Under normal conditions the lush undergrowth would act as an effective barrier to rapid fire spread. Fire frequency in this group has been difficult to establish and mature stands suggest the absence of frequent moderate to severe fires.

- Fire Group 10 consist of high elevation forests near and at timberline. Subalpine fir is the indicated climax species with whitebark pine well represented. The cold, moist, rocky and unproductive environment of this group not only makes fires infrequent, but severely limits their extent. Fires are infrequent within this group and stand destroying fires are most likely to occur during extended drought conditions when severe wind-driven crown fires develop in the forests below and burn into the upper subalpine and timberline forests.

### Fire History

Fire history studies in the 1995 Madison Range Ecosystem Analysis and the Lee Metcalf Wilderness Fire Management Guidebook show that many of the area's fire patterns have changed due to the effects of fire suppression or exclusion. In the Fire Group 7 there has not been a high intensity fire for at least 70 years, setting up a situation where the probability for large catastrophic fires becomes greater. Wildland fires in recent history have been few and of low intensities. Fires within the Madison Range Ecosystem will be low to moderate intensity surface fires 90 percent of the time, high intensity, stand replacement fires may occur about 10 percent of the time during drought cycles.

The Big Sky area is similar to that found within the Spanish Peaks and Taylor-Hilgard Fire Management

Zones. The Big Sky Fire Planning Area lies on the Madison Divide between these two zones. The vegetation, topography, and weather conditions that effect fire behavior are similar. Fire history studies show that fire has played an important role in the Spanish Peaks with several severe intensity fires in 1845, 1855, 1881, 1910, and 1919. Since then the area has been free of large fire events and most fires have remained small, at 10 acres or less. The largest occurred in 1881; it started on the Madison Divide in mid-August and burned down into the Gallatin Canyon. This fire covered an area from the West Fork of the Gallatin River to Spanish Creek, traveling 40 miles and burning about 45,000 acres. There have been no fire history studies specifically on the Taylor-Hilgard zone. However, three fires in 1988 started on the lower elevation lands and burned 50, 300, and 2,860 acres. These fires started on the lower west flank in grass/sagebrush fuels and would run up slope into the wilderness.

Normal fire behavior under average conditions will result in wildland fires of low to moderate intensities that can be successfully suppressed. Some fires will exhibit torching, short crown fire runs, and spotting during the afternoon burning period. Large high-intensity fires within the **Northern Region** occur and exhibit some common characteristics. They usually occur during drought conditions when fuels are cured and very dry and there is a continuous source of forest fuels. All wildland vegetation is available as fuel for fire, but forest stands that are mature with heavy accumulations of dead material are the most susceptible. The prevailing wind usually pushes these fires in a north and/or easterly direction. These winds usually precede and follow frontal passages. They can be quite strong and are from the south, southwest, and west. This was very evident with the Yellowstone fires and other fires in the Northwest in 1988.

Fire exclusion has had an effect on vegetation and biomass buildup. Forest management practices (timber harvests) and commercial and private development on private lands has greatly reduced this

buildup and replaced fire in reducing the vegetation biomass. This has not eliminated the possibility of fire within the Big Sky corridor but has reduced the possibility of catastrophic high intensity fires in some areas.

### **The Wildland Fire Environment**

**Role of fire in the environment:** The lands in the Northern Rockies are known as a fire dependent ecosystem, i.e., fire plays a role in maintaining a healthy forest. The fire groups, identified in the Big Sky Fire Planning Area, have a historical burning frequency ranging from every 40 years to every 500 years. Since the 1800's fire has been playing a less active role in maintaining forest health due to increased grazing, land development, loss of aboriginal ignitions, and organized fire control.

**The wildland fire environment:** Topography, fuel, and weather are the components that determine the behavior of a fire. Each of these three components are discussed below.

**Topography:** Topographic features are static but exert considerable influence on how a fire will behave. The steeper the slope the faster a fire will spread: on a 30% slope a fire will spread roughly four times faster than on level terrain.

Aspect, or the direction the slope is facing, will determine the type of fuels available and how dry they are. South and southwest facing slopes are warmer and will have finer and drier fuels. These aspects always sustain a higher number of fire starts.

Position on the slope where a fire starts will help determine its eventual size. The mountainous terrain will allow a **thermal belt** condition to set up. The midslope area along the ridges will remain warmer and drier at night, so that fuels don't recover moisture. High elevation areas are also subject to **subsidence inversions** aloft during times of high pressure systems. This happens when air within the high pressure system

sinks; as it sinks it compresses, becoming warmer and drier, thus drying the forest fuels.

The general lay of the land will effect and can be effected by the general weather patterns. Major mountain ranges, canyons and ridges often channel the wind affecting the fire behavior of wildland fires. Steep draws and canyons can act as chimneys and accelerate fire spread up them.

**Forest fuels:** The vegetation present is the fuel that will feed any wildland fire. For vegetation to become

available as fuel for a fire, it must either be cured to the point where combustion can occur (grasses, shrubs) or dead. All vegetation will burn when the right environmental conditions are present. The composition of the fuel source will determine how readily a fire can ignite, the intensity with which it will burn, and how fast a fire can spread. The fuel characteristics described in Table 3-1 will all contribute to how a wildland fire will burn. The fuel and vegetative component is the only one that can be treated to reduce or modify the wildland fire hazard.

<b>FUEL CHARACTERISTICS</b>	
<u>Characteristics</u>	<u>Description</u>
<b>Fuel Load</b>	Fuel load refers to the amount of vegetation, both live and dead, available for burning in an area. Measured in Tons/acre.
<b>Fuel Moisture</b>	Fuel moisture is the amount of water present in fuels. The fuel moisture of dead fuels is constantly changing and is influenced by relative humidity and precipitation. Changes in live moisture content are less dynamic. The lower the fuel moisture, the greater the fire hazard.
<b>Size and Shape</b>	The size and shape of the fuel directly affect how easy it is to ignite and how fast a fire will spread. Smaller fuels, especially those less than ½ inch in diameter (grass, pine needles, and twigs) present a greater hazard than larger fuels.
<b>Vertical Arrangement</b>	Vertical arrangement refers to the manner in which fuels occur at different heights above the surface. A continuous vertical arrangement from the surface fuels to the tree crowns (shrubs, lower tree branches, young tree saplings, etc.) would enable a surface fire to be carried into the tree canopy presents a hazardous condition. These are referred to as “ <b>ladder fuels</b> ”.
<b>Horizontal Continuity</b>	Horizontal continuity describes the distribution of fuels on the same plane or similar heights such as the ground surface. Continuous grass, a dense stand of shrubs, or a forest of trees with interwoven branches would have a high degree of horizontal continuity. The higher the degree of horizontal continuity, the greater the wildland fire hazard.

Table 3-1. Fire Characteristics

**Weather:** The most variable and one indicative factor for how a fire will react and behave is the weather. The immediate or current weather factors such as temperature and relative humidity will affect the moisture in the fine fuels. This will have a direct effect on the fuel’s ignition and rate of combustion. Wind contributes significantly to the the amount of moisture in the fine fuels thus increasing the intensity and the rate of fire spread. The long term effects of the weather determine the fuel moisture contents of all the

forest vegetation and fuels. All live vegetation, such as grasses, shrubs, and trees, along with the large dead woody fuels, respond much more slowly to the weather but will contribute greatly to a fire’s potential and intensity. A moist spring and summer will keep fuel moisture high in the live and large dead fuels and not readily available to be consumed by fire. Drought conditions along with hot and dry summers will reduce the moisture in the live vegetation and large fuels. This allows these fuels to become available to burn and will

contribute to the potential for large uncontrollable wildland fires.

### Wildland Fire Types

The most common types of wildland fires can be described as ground fires, surface fires and crown fires, in order of severity. These usually occur in combination with one another. Smoldering ground fires can ignite surface material and become flaming surface fires. Surface fires can ignite ladder fuels which may ignite aerial fuels and become crown fires. The type of wildland fire will become more severe as weather conditions become more severe or extreme. The characteristics of each of the following wildland fires are:

**Ground fire:** These fires normally burn at or below the surface of the ground. This type of fire consumes compacted litter, roots, and decomposing organic and woody material. It is a smoldering fire which generates little heat and sometimes no flames.

**Surface fire:** Surface fires consume fuels that are located above the ground surface but below the tree canopy. Fuels consumed include surface litter, shrubs, grasses, immature trees, and down dead woody material. Surface fires can spread rapidly and burn intensely depending on the amount of fuels. These are the most common type of fires.

**Crown fire:** Wildland fires that consume the tree canopies are referred to as crown fires. These fires can spread rapidly through the tree canopies and burn at great intensities. They usually are supported by a

surface fire but can spread independently. Crown fire occurrence increases within the timber types as environmental conditions become dryer, surface and ladder fuels increase, and wind or slopes increase. Compared to other types of fires, crown fires are relatively rare, but their impact is more severe.

Other wildland fire characteristics are **torching** and **spotting**. Torching refers to individual trees or clumps of trees where the entire tree canopy is consumed by flames from the base to the top in a few seconds. Spotting occurs when burning embers or firebrands are lofted by the convection column high into the air and are carried and deposited beyond the fire. This is common and is associated with torching or crown fires. New spot fires will develop from these embers if they land on forest debris. Depending on a fire's intensity and the winds, these firebrands can travel up to half a mile downwind and sometimes further under extreme conditions. Torching increases in frequency as conditions become drier and the surface fire becomes more active, usually later in the day.

Fire behavior descriptors and interpretations of wildland fires have been compiled for fire suppression strategy, prescribed fire and long range fire planning. Key fire behavior descriptors are rate of spread, flame length, and fireline intensity. Rate of spread (**chains**/hour), is the forward rate of spread at the head of a surface fire. Flame length (feet), is the length of the flame at the head of the fire. Fireline intensity (Btu/ft/s), is the amount of heat released per second by a foot-wide slice of the flaming front and is indicative of the heat experienced by a person working near the fire.

Fire Suppression Interpretations of Flame Length and Fireline Intensities		
<u>Flame length</u>	<u>Fireline intensity</u>	<u>Interpretation</u>
< 4 feet	< 100 Btu/ft/s	Fire can generally be attacked at the head or flanks by persons using hand tools. Handline should hold the fire.
4 to 8 feet	100 - 500	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to hold line. Equipment such as plows, dozers, pumbers, and retardant can be effective.

8 to 11 feet	500 -1000	Fires may present serious control problems - torching, crowning, and spotting. Control efforts at the fire head will probably be ineffective.
> 11 feet	> 1000	Crowning, spotting, and major fire runs are probable. Control efforts at head of fire are ineffective.

Table 3-2. Fire Behavior Interpretations.

## FIRE BEHAVIOR ASSESSMENT

Buildings within any forest environment have a high exposure to wildland fires. This report analyzes the local topographic influences, fuel conditions and weather to assess the potential fire behavior within the Big Sky corridor.

Fire behavior assessments will be made and analyzed for the different fuel types subjected to normal and extreme environmental conditions. The following fuel types are modeled and used for analyzing potential fire behavior.

**Fuel Model # 1:** This represents the grass group which is dominated by short grass where very little shrubs or timber is present over less than one third of the area. Fire spread is governed by the fine, porous, and continuous fuels that have cured or are nearly cured. This model represents the harvested land that is now covered with grasses and newly regenerated pine and fir, the high mountain meadows, and low lands covered with short grass and scattered sagebrush. (See Photo 3-1, page 1 of Chapter 3.)

**Fuel Model # 2:** Grass with open timber overstory that cover one-third to two-thirds of the area. This model represents the open grass and Douglas-fir stands and harvested areas where a overstory of timber remains. Fire spread is primarily by surface fire through the curing or dead grasses with the litter and dead down stemwood from the open shrub or timber overstory contributing to the fire intensity. (See Photo 3-2, page 1 of Chapter 3.)

**Fuel Model # 8:** This model has a closed canopy timber stand of short-needle conifers with a compact litter layer of needles, leaves, and twigs that has little

undergrowth present within the stand. This model is represented in the areas of immature young lodgepole pine, Douglas-fir stands that have little down-dead ground fuels and the higher elevation stands of Whitebark pine. Slow burning ground fires with low flame lengths are generally the case, although a fire here may encounter an occasional “jackpot” or heavier fuel concentration that can flare up. Late season fires in drought years may cause these fuels types to burn with the same intensities as fuel model 10. (See Photo 3-3, page 2 of Chapter 3.)

**Fuel Model # 10:** This model is representative of the older mature timber areas that have large loads of dead material on the forest floor. This would include areas that are insect or disease ridden, wind-thrown stands and over mature situations with dead fall or heavy accumulations of debris. Ladder fuels are usually present. Fires burn in the surface and ground fuels with greater intensity than the other timber types. Crowning, spotting, and torching of individual trees are more frequent in this fuel type. This is the fuel type that sustained the 1988 fires of Yellowstone Park. (See Photo 3-4, page 2 of Chapter 3.)

**Weather:** Weather records from the National Fire Danger Rating Site at Mammoth, WY in Yellowstone National Park were evaluated to arrive at the probable weather that could be expected within the Big Sky area. The Mammoth site is the closest site that is similar in topography and elevation as the Big Sky area. A relatively new site located at Yellowmule (9200' elevation) on the southern edge of the Big Sky Fire Planning Area was also reviewed, however its data is for only the last three years and is incomplete. The Big Sky area is located at a high elevation where the temperatures are cooler, relative humidities higher, winds stronger and fire seasons shorter. Records

show that weather systems usually arrive during the second week in September and will put an end to the fire season. Weather averages (normal) for August through mid September are compared with extreme conditions such as those observed during the 1988 drought year (See Table 3-3).

The weather that led to the extreme conditions in 1988 started with drought conditions the previous fall. A low snowpack combined with a warm, dry spring and a hot, dry summer, led to the very low fuel moistures and a severe fire season. High wind associated with the passage of dry frontal systems then added to the spread of existing fires. A repeat of these conditions can and will be experienced when similar weather conditions exist, as happened again in late August and early September of 1994.

**Fire behavior assessment:** Fire behavior calculations for the four fuel types within the Big Sky corridor were made using the environmental

c o n d i t i o n s most probable for the area. The conditions presented in the weather section for weather and fuel moisture were for what can best be described as a normal summer and fall, and for what could be described as extreme due to very dry or drought conditions. These conditions would be present in late August and September when all the vegetation had cured and dried and was available to be consumed by fire. A 20 percent slope with the wind moving straight up slope was used for each fuel type.

The calculated fire size at 1 hour assumes a continuous fuel bed with constant conditions. To demonstrate how differently fire behaves within the different fuel types and different weather conditions, they are compared in Tables 3-4 and 3-5.

<u>Weather</u>	<u>Normal Conditions</u>	<u>Extreme Conditions (1988)</u>
High Temperatures	60-80 F	70-90 F
Low Relative Humidity	15-35%	10-25%
Wind Speed	5-15 mph	25-40 mph
	<u>Fuel Moistures</u>	
Fine Fuels, 0-1/4" dia	4-8%	2-5%
Small Fuels, 1/4"-1"	7-12%	3-7%
Medium Fuels, 1"-3"	7-14%	5-8%
Large Fuels, 3"-8"	10-16%	7-9%
Shrubs, Live	50-80%	30-50%
Trees, Live	70-100%	50-70%

Table 3-3. Weather Conditions and Fuel Moistures.

Normal Conditions

Weather and fuel for normal conditions:

Temperature: 70 degrees

Relative Humidity: 20 %

Wind Speed: 8 mph

Fuel Moisture's: Fine - 4%

Small - 8%

Med - 10%

Live - 90%

Fuel Model	Rate of Spread	Flame Length	Size at 1 hour
FM 1, Short Grass	53 ch/hr	3.6'	139 acres
FM 2, Grass w/overstory	16 ch/hr	4.5'	14 acres
FM 8, Timber, immature	1 ch/hr	0.8'	<0.1 acres
FM 10, Timber, mature	2-3 ch/hr	2.9-3.3'	.4-.7 acres

Table 3-4. Normal Conditions.

Extreme Conditions

Weather and fuel for extreme conditions:

- Temperature: 90 degrees
- Relative Humidity: 10 %
- Wind Speed: 25 - 40 mph
- Fuel Moisture's
  - Fine - 2%
  - Small - 5%
  - Med - 7%
  - Live - 70%

Fuel Model Type	Rate of Spread	Flame Length	Size at 1 hour
FM 1, Short Grass	578 ch/hr	11.9'	7000+ acres
FM 2, Grass w/overstory	123 ch/hr	12.4'	431 acres
FM 8, Timber, immature	1 ch/hr	1.1'	.1 acre
FM 10, Timber, mature	7-14 ch/hr	5.1'-7.2'	2.5-7.6 acres

Table 3-5. Extreme Conditions.

Reviewing the results in the tables and in Figure 3-1

shows that the short grass type is very sensitive to the wind. Its relative heat output is lower but its spread rate can be very high. The grass with timber overstory has a lower rate of spread due to the partial sheltering effect of the overstory timber; however its heat output and flame lengths are much higher. The closed immature timber with a compacted litter layer has very low output values compared to the other fuels. This is because the litter has light fuel loadings and is sheltered by the closed tree canopy. The mature timber with heavier loadings of down, dead fuels will exhibit much higher intensities and flame lengths but lower rates of spread. The accumulations of litter and dead debris over the years contribute to these fire intensities.

Fires have the potential to transition into crown fires given sufficient ladder fuels, dry conditions, and fire intensities. Under the normal conditions, fires would have little chance of a crown fire, but torching is possible if ladder fuels are present allowing the surface fire to reach the crowns. Many environmental factors or combinations can determine if torching or crowning is likely. Once fireline intensities and flame lengths reach six to eight feet the chances of torching or crowning are much higher. Under the extreme weather conditions the transition into a crown fire would have the following characteristics depending upon the vegetative fuel cover.

Fuel Model Type	Flame Length	Rate of Spread
FM 2 - Grass w/overstory	75 to 95'	96 -144 ch/hr
FM 10 - Timber, mature	80 to 130'	80 - 160 ch/hr

Table 3-6. Crown Fire Characteristics.

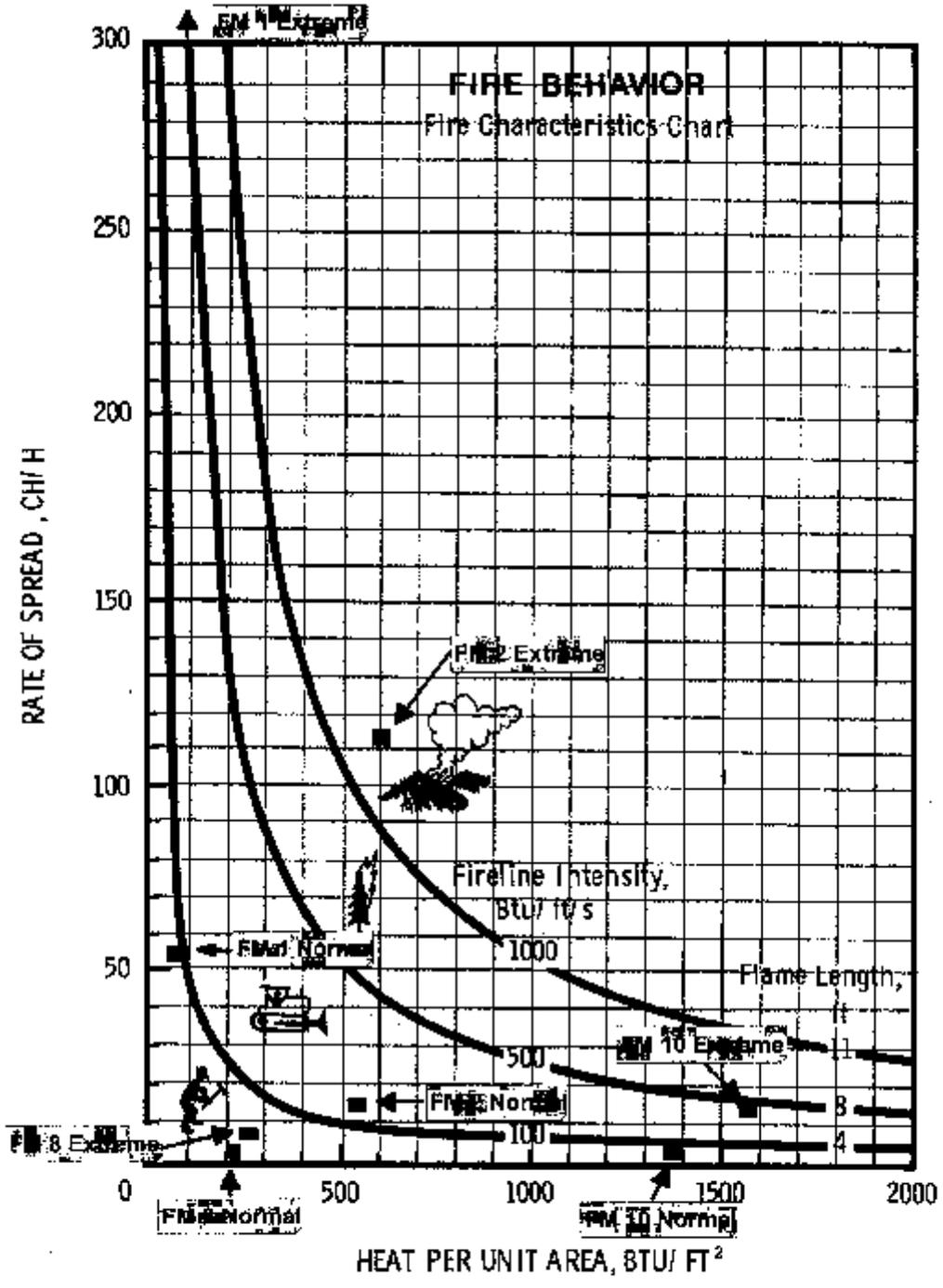
This type of severe fire behavior would also lead to fire spotting down wind. Torching and crown fire runs will loft burning embers that can result in spot fires, increasing the forward rate of spread. The probability of ignition for embers falling on a favorable fuel source under normal and extreme conditions, and the spotting

distance ahead of a fire, would be:

<u>Normal Conditions</u>		
<u>Fuel Model Type</u>	<u>Probability of Ignition</u>	<u>Spotting Distance</u>
FM # 2, Grass w/overstory	70%	0.15 - 0.2 mile

FM # 10, Timber, mature	70%	0.1 miles
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Table 3-7. Spot Fire Probability.



GTA-INT-131 Charts for Interpreting Wildland Fire Behavior Characteristics

Figure 3-1. Fire Characteristics Chart

<u>Extreme Conditions</u>		
<u>Fuel Model Type</u>	<u>Probability of Ignition</u>	<u>Spotting Distance</u>
FM # 2, Grass, w/overstory	100%	0.4 - 0.6 mile
FM # 10, Timber, mature	100%	0.3 - 0.45 mile

Table 3-8. Spot Fire Probability.

**Outside threat of fire:** The threat of fire spreading into the Big Sky corridor from an adjacent area outside is always real, but analyzing the local topography, weather patterns, and the fire history indicates that this will most likely be a rare event.

Along Big Sky’s northern boundary with the Spanish Peaks Wilderness Unit there is a mostly continuous zone of high elevation rock and scree which will prevent most fires from coming out of the wilderness. The fires would have to move downslope and against the prevailing up slope and general wind patterns. The most probable threat along this northern Big Sky boundary would be from fire starts within Big Sky spreading in a northeast or easterly direction into the Spanish Peaks. A wildland fire on the south slopes of this boundary in the heavy timber, with the large amount of beetle killed lodgepole available, could easily move along the flanks of the Spanish Peaks Range, being pushed by the prevailing westerly winds. With northwest winds this type of fire could back down into some developed areas of Big Sky under very dry, drought conditions. A fire backing downhill could be successfully contained, but a flanking fire being pushed by westerly winds causing torching and crowning with spot fires could create difficult containment and control problems.

The chance of fires advancing out of the Taylor-Hilgard Wilderness Unit into the Big Sky corridor are higher than those coming from the north but still low. Most of this boundary is assessed as either low or

moderate risk in fire severity due to the amount of Fire Group 0, (scree rock, forested rock, meadow or grassy bald). This group is not susceptible to fire except under the driest conditions and the available fire history shows very little past fire activity. Weather patterns with the southwest and west winds are favorable to push a fire towards Big Sky if the required conditions of drought and wind are present. The most likely areas where fires would originate, would be the timbered areas of continuous fuels in the South Fork of Jack Creek, McAtee Basin area, and Buck Creek.

Fires originating to the south in the Taylor Creek area could spread to the north down the Gallatin River drainage and into the lower Big Sky corridor if pushed by a south wind that precedes the arrival of a frontal system.

The passage of a dry cold front through the area, which occurs two or three times per year with winds moving from the southwest to the northwest after the passage of the front, may have unpredictable results. These occur in late August and early September with high winds and no moisture. These dry cold fronts frequently defy predictions and change normal fire behavior patterns. Most of the large fire activity in the Northern Region has been associated with the passage of these types of cold fronts.

**Fuels modification and fire potential:** Modifying or reducing any vegetative cover will eliminate fuels and reduce the potential for a wildland fire or its severity. Fuels reduction through the removal of ground fuels, removing encroaching ladder fuels such as tree saplings and pruning lower limbs, and thinning standing trees so that the crowns are not touching will greatly reduce fire intensities, spread rates and the chance of torching, crowning, and spotting. Reducing the grass fuels through grazing, mowing, or irrigating will eliminate or greatly reduce the fire threat. For most forests in the Big Sky area, openings in the canopy of a mature stand of trees will eventually become

occupied with an understory of dense seedlings and sapling sized trees. This type of forest condition could increase the probability of a high intensity stand replacing wildland fire, with the seedlings and saplings acting as ladder fuels to the overstory canopy. Continual maintenance, i.e., removal or reduction of seedlings and saplings would reduce the chances of a high intensity stand replacing wildland fire.

The fire potential should not change significantly with no modification of fuels within 5 years. A change will be visible in the amount of saplings within the logged areas and encroaching within the open timber stands but the suppression effort should remain about the same.

At 15-20 years there will be significant change noticed that will also have some effect on fire potential and intensities during severe conditions. The saplings would add to fire intensities and would definitely become ladder fuels for an overstory. Fire suppression efforts would be affected but manageable except under very severe conditions again.

At 20 plus years with no modification the open grass areas would be gone and now be considered young timber stands. The continual establishment of trees within the open or closed timber stands would be a continuous source of fuel for the overstory crowns. Wildland fires on the surface would have less intensities and spread rates due to the shading of the ground fuels and the protection from the wind. However in drought or severe conditions these trees would be very susceptible to crown fires or would carry the fire to the overstory and aid in severe crown fire development.

**Fire Modeling:** Several sites were selected within the Big Sky corridor for representative fires. These fires were simulated using the topography on site, actual fuels present, and most probable weather under normal and extreme weather conditions. Fire predictions were made and plotted on the map with fire behavior interpretations. All fires assume no

suppression action is being taken and they are burning freely. The normal and extreme conditions described earlier were used for each wildland fire. All winds were projected to be out of the southwest. All fires were started in the afternoon at 2 PM or 1400 hrs which would be the warmest and driest part of the day and were run until 1800 hrs or 6 PM.

Fire A, South Fork West Fork Gallatin River:

Fire A- Normal : Starts in FM 1 (short grass) which is the primary carrier of the fire. Fire spread is 62 chains/hour with flame lengths of 3.9'. At 12 minutes the forward spread is 12.5 chains and is 7.3 acres in size with a perimeter of 33 chains. The size in 1 hour is 180 acres with a perimeter of 160 chains, the forward spread distance is about 62 chains or 3/4 of a mile. The fire has spread into FM 8 (immature timber with a compact litter layer) which reduces the fire behavior characteristics. This fuel type will cause the fire to start having a very irregular shape. The fire continues to spread in the grass type and in 2 hours will have a forward spread of 125 chains or 1 1/2 miles and will be approximately 400 acres. At 4 hours the fire is now into FM 8 and 10 (mature timber with accumulations of dead down material). The spread rate is now 1 or 2 chains/hour with maximum 3' flame lengths. The fire now has a very irregular shape and has burned approximately 500 acres of which most has been grass. See Map 3-2. Fire A - Normal Conditions.

Fire A, Extreme: Same as the above fire, but with drier conditions and higher wind speeds. This fire exhibits extreme fire behavior and within 12 minutes has a forward spread of 117 chains or 1.4 miles with a size at 319 acres. The spread rate in the grass is 588 chains/hour or just over 7 mph with flame lengths at 12'. At this rate the fire has already spread into the timber fuel types where the spread and fire intensities will be greatly reduced. After 1 hour the fire is into FM 8 and 10. In FM 8 the spread rate is only 1 chain/hour with 1' flame lengths and in FM 10 the spread rate is from 6 to 13 chains/hour with flame

lengths of 4.8' to 7' and a size of approximately 600 acres. After 2 hours the spread is now primarily in the timber types with a spread distance of 140 chains or 1.8 miles. The size would be around 700 acres. Torching and crowning are now a concern with spotting from .1 to .3 miles downwind. At 6 PM (1800 hrs), after 4 hours the spread distance is now at about 2 miles with a size at an estimated 900 to 1,000 acres. See Map 3-3. Fire A. Extreme Conditions.

Fire B, Middle Fork of the West Fork Gallatin River:

Fire B, Normal: This fire starts in mature timber (FM 10) on a 28% slope. Spread is up slope at 4 ch/hr with flame lengths of 3.4'. The fire's size at 1 hour is 1 acre. After 2 hours (1600 hrs) the size has increased to 3.5 acres. After 4 hours the up slope winds have pushed fire B to 14 acres with a forward distance of 14 chains. See Map 3-4. Fire B. Normal Conditions.

Fire B, Extreme: With the drier conditions and higher winds, the up slope spread is 15 ch/hr with 7.4' flame lengths. The fire will be at the ridge top in 1 hour with a size of 8 acres. Torching and crowning are possible with spotting up to .3 miles. At 2 hours (1600 hrs) the spread and intensities are the same with a size of 30 acres and forward spread of 28 chains. After 4 hours it has spread 54 chains (.67 miles) and is about 100 acres in size. Spotting .3 of a mile across the draw would speed the spread. See Map 3-5. Fire B. Extreme Conditions.

Fire C - Beaver Creek:

Fire C - Normal: This fire starts in the short grass (FM 1) with continuous fuels and spreads down hill towards the valley from southwest winds of 8 mph. After 1 hour the size is 100 acres and ½ mile long. Spread rates are 45 ch/hr with flame lengths of 3.4'. At 2 hours (1600 hrs) the spread has been in the short grass, but has just reached FM 2 (grass with timber overstory). Spread distance is now 90 chains (1.1 miles) at 440 acres. At 6 PM (1800 hrs) the fire is still in the grass with timber overstory but the spread rate

has slowed to 23 ch/hr with increased intensities to 5.4' flame lengths. The total spread distance is now 1.7 miles and the fire is 990 acres. See Map 3-6. Fire C. Normal Conditions.

Fire C, Extreme: The dry fuels and 25 mph winds have pushed this fire downslope at 345 ch/hr or 4.3 mph with flame lengths at 8.6'. Within 15 minutes it will have traveled 1 mile into the grass with timber overstory fuels and will already be 200 acres. At this point the spread will slow to 2.5 mph (199 chains/hr) but the intensities will increase to 15.5' flame lengths. There will be definite torching and crowning with spotting up to .7 of a mile. This will increase the overall spread rate. At 1 hour (1500 hrs) the spread distance is at 2.9 miles, size about 1,100 acres and into mature timber fuel type. The forward spread is now into FM 10 which is slower at 13 ch/hr and flame lengths of 7'. Torching, crowning, and spotting are still present but the spotting is down to .3 miles. At 5 PM (1700 hrs) the fire is now 3.3 miles long and 2,700 acres. Most of the growth in size is attributed to the lateral spread on the flanks that are still in the grass. After 4 hours of fire spread (1800 hrs) the fire has traveled 3.5 miles with an estimated size of 2,900 acres. With the high probability of ignition and spotting the fire could be close to Big Sky Meadow Village and the mouth of the West Fork Gallatin River. If this is the case, the chance of spotting across the West Fork onto the dry south slopes and fine fuels north of the West Fork is a very real possibility, where the fire could spread into the Spanish Peaks Wilderness Unit. See Map 3-7. Fire C. Extreme Conditions.

## **Vegetation/Fuel Treatment**

A vegetation management plan, properly implemented, reduces the amount of fuel available for a wildland fire, thus mitigating the probability of a rapidly spreading wildland/urban interface fire. The potential for a devastating crown fire is reduced by a properly implemented vegetation management plan (See Figure 3-2).

Past logging, road building, fires, and other activities have modified the vegetation in the area. These changes have resulted in a variety of mosaics on the landscape. These mosaics have been mapped into four fuel types that represent different degrees of fire hazard due to the composition of the vegetation within those fuel types.

Within the fire environment of fuels, weather and topography, the fuel component is the only one which can be modified in the attempt to reduce or eliminate the wildland fire threat. Changing the fuel characteristics can effectively reduce the fire hazard or the fire intensities to a point where the fire threat is manageable. Fuel treatment options include elimination of all fuels to create a fuel break and reducing the fuels' quantity. These options will be effective in breaking up a fuels' continuity and isolating fuels or homes and/or developments, thereby creating a **defensible space**.

Several techniques are available to manage vegetation for fire protection including hand clearing, grazing, irrigation, prescribed burning, logging, etc., these techniques are described in detail in Chapter 4.

### FUEL BREAK SYSTEM

A detailed fuel modification plan should be developed and maintained for the open spaces in the Big Sky area that will protect the structures from an

**BEFORE MANAGEMENT**



**AFTER MANAGEMENT**



Figure 3-2. Vegetation management

approaching wildland fire.

### Fuel Breaks

Fuel breaks are strips or areas of land in which the volume of vegetative fuels are reduced to an acceptable level and maintained in that condition. A properly designed fuel break will use the existing land form, line, form, color and texture to provide a sweeping, visually pleasing break in the vegetation. The fuel break design will create more edge for fauna while reducing fuel loading, fuel bed continuity, and provide an access for fire protection and suppression when needed.



Figure 3-3. Fuel Break.

Fuel break opportunities within the Big Sky area that already exist or will be developed are new and existing roads, trails, ski runs, ski access trails, ski lifts, and utility corridors. Fuel breaks can be used as hiking trails, jogging paths, horseback riding trails, ATV paths, and cross country skiing trails. Maintaining these fuel breaks or trails is important not only for the users but for fire protection. Further development of the fuel break system needs to be coordinated, by the fire agencies, along with the development of the properties in the Big Sky area to ensure that the fuel beds are manageable from a fire protection prospective.

## Demonstration Project(s)

A demonstration area should be established to show landowners and others suggested methods used in treating unwanted fuels and in reducing the fire hazard.

Logging, thinning, pruning, prescribed burning, and others methods that are recommended could be shown in areas that would aid landowners in using these methods on their properties.

## Chapter IV. Wildland/Urban Interface



What is the wildland/urban interface? The wildland/urban interface is defined as the line, area or zone where structures and other human development meet or intermingle with undeveloped

wildland or vegetative fuels.

**Photo 4-1 Urban Interface.**

### Introduction

The Big Sky area is typical of many areas in Montana having potential wildland fire and wildland/urban interface fire problems. With all of the new development occurring in the Big Sky area, now is an appropriate time to introduce fire protection guidelines to current landowners, future homeowners, architects, contractors, and developers.

A major goal of the Big Sky Fire Planning committee is the protection of life, property and resources; everyone involved needs to become part of a cooperative fire protection effort. Through planning, safety and protection of Big Sky's scenic beauty can be achieved without sacrificing the goals of fire protection organizations and the community members.

It is the responsibility of fire agencies to plan suppression and mitigation efforts and to create awareness of potential fire protection problems and their consequences. **Yet it is ultimately the responsibility of the landowners and homeowners to become educated concerning mitigation strategies they can employ and self-protection techniques to use when faced with the dangerous conditions that a wildland/urban interface fire will pose in the Big Sky area.** In addition, it is the responsibility of the homeowner to ensure that they have structural fire suppression provided to their homes in the wildland/urban interface settings of Big Sky. Wildfire suppression cost associated with a fire initiating on private land could be the responsibility of the private landowner where the fire initiated.

### Wildland/Urban Interface "Watch Outs"

There are nine factors that fire fighters, both wildland and structure, use to determine whether structures are safe to defend in a wildland/urban interface fire. They are:

- Structures located in chimneys, box or narrow canyons, or on steep slopes in flashy fuels.
- Wooden construction and wood shake roofs.
- Inadequate water supply.
- Natural fuels 30 feet or closer to structures.
- Poor access and narrow congested one way roads.

- Bridge load limits.
- Strong winds.
- Extreme fire behavior.
- Need to evacuate the public.

If the area in which you live or your home has any of these characteristics, you need to consider working on your home and property or working with the community to mitigate the problems and enhance your fire protection.

If the area that in which you reside or your home does not have any of these characteristics, then your home may be defensible by fire fighters in a wildland/urban interface fire.

### **Defensible Home Factors**

Ten major areas need to be addressed by landowners, architects, developers, and homeowners in the planning phase of a development or purchase of a home.

1. Non-combustible roofing materials.
2. Buildings utilizing **fire resistant construction** materials and design principles.  
See Appendix 3.
3. **Fire resistant landscaping** components (See Appendix 3) are used in the landscape plan.
4. Creating a defensible space - mainly through vegetation reduction and clearance.
5. Water storage & supply - adequate fire hydrants, water mains, individual water storage areas and residential sprinklers.
6. Roads & driveways - Easy ingress and egress for the residents and for emergency vehicles

7. Road signs and addresses - clearly displayed and visible from the road.
8. Fuel breaks and greenbelts.
9. Building spacing and densities - dependent on fuels and slope of the area.
10. The development or home is located in the boundaries of a structure fire entity.

## **THE CURRENT SITUATION**

### **Planning & Zoning Organizations**

The Big Sky Fire Planning area is covered by two planning organizations. The Madison County Planning Board has jurisdiction for the lands in Madison County, and the Gallatin Canyon/Big Sky Planning and Zoning District encompasses lands within the planning and zoning district boundaries in Gallatin County.

Both organizations have adopted regulations to manage the development of lands in their respective counties. For more information on subdivision requirements or zoning in the Big Sky area, contact the Planning Office in either Madison or Gallatin County.

### Sprawl vs. Cluster Development

The large number of existing parcels, platted prior to the legislative change in the subdivision regulations, creates a significant fire protection planning problem. The problem created by these existing parcels is that they were not subject to any review by the subdivision regulations at the time and now they can be further subdivided, but the roads and other existing condition may not necessarily be required to be improved to today's standards. There is some ability to manage the impacts of developments in these existing parcels in

Gallatin County through the Gallatin Canyon/Big Sky Planning and Zoning District; there is no existing method of managing the impacts of the development of the existing parcels in Madison County.

### Subdivision covenants

Extensive use of conditions, covenants and restrictions (CC & Rs) as a part of the development process has occurred over the past few years. CC&Rs are an internal subdivision development control and typically the “authorities having jurisdiction” do not have the ability to enforce the conditions, covenants and restrictions. However, CC & Rs that put in place fire protection requirements in a development are better than having no fire safety requirements at all. A list of model covenants is listed in Appendix 4 for use by developers and landowners who are planning a development project.

### **Values at Risk**

The values at risk in the Big Sky Fire Planning area are:

1. Lives of the residents, guests, and responding fire fighters.
2. Developed properties, including infra-structure.
3. Natural Resources

The population at risk at any given time in the Big Sky Fire Planning area varies by day. The Big Sky Chamber of Commerce estimates permanent resident population is 1,200 residents. The visitor population during the summer season is estimated by the Chamber at 3,600.

The estimated values at risk of residential and commercial property for 1998 in the Big Sky Fire Planning Area are approximately \$250-300 Million. These figures do not include any projects or developed or built in 1999, such as The Yellowstone

Club, Gallatin Peaks Land & Development, and other recently approved developments.

The natural resources at risk are the timber, view sheds, and scenic vistas — primary reasons why the residents and visitors come to the Big Sky area.

### **HOMEOWNERS INSURANCE PRIMER**

Homeowners insurance is and always has been a way to protect what may be the most important investment of your life — your home.

Insurance, in some form, has existed for centuries. Fire could devastate a family’s ability to survive, and citizens recognized some kind of protection was needed to help one another.

To ensure you have enough insurance to cover the costs associated with a fire, insurers recommend you insure for replacement cost. Check your policy to see if you have actual cash value or replacement cost coverage for your home and possessions. Replacement cost coverage means you will be paid for a new like and kind item. Actual cash value means you’ll receive what the item would be worth today.

Insurance companies are very concerned about their customers in high-risk fire areas and encourage homeowners to take measures to ensure the safety of their families and properties. Every insurance company has slightly different requirements for fire safety, but the key issues when determining if a property is insurable are access, type of construction, and vegetation management.

When purchasing or building a home, buyers or builders should be aware of the property’s fire risk. You should also inquire about whether structural fire protection is available to your home or property.

### **VEGETATION AND FUELS**

Vegetation as it relates to wildland fire can be

classified into four primary fuels groups. These groups are classified as: grass, brush, timber and slash. Within the Big Sky corridor, the dominate groups are grass and timber with areas that are a combination of each.

For a more detailed information of the vegetation in the Big Sky Fire Planning Area, see Chapter 3.

## THE FUTURE AT BIG SKY

### Risk rating for homeowners

For the homeowner to have an understanding of the wildland/urban interface fire problem associated with their home and the surrounding vegetation and terrain, a risk assessment tool is needed to develop a risk rating for your home.

The *Wildland/Urban Interface Fire Hazard Assessment Methodology* developed by the National Wildland/Urban Interface Fire Protection Program provides guidance to the homeowner for conducting a risk assessment for their home.

The guide provides a description of the three ignition sources of concern to a structure in the wildland/urban interface environment:

- radiation
- convection and
- firebrands.

It offers a five-step method for the homeowner to assess the hazards of living in a wildland/urban interface area. The guide provides suggestions for the homeowner to reducing the fire potential using the following approaches:

- building a home or altering an existing home to reduce its chance of ignition and,
- completing mitigation measures on the surrounding wildland area.

To obtain an on-line copy of the document, visit the Firewise web site at [www.firewise.org](http://www.firewise.org). At the Firewise web site the home owner can also conduct a simple risk rating for their home.

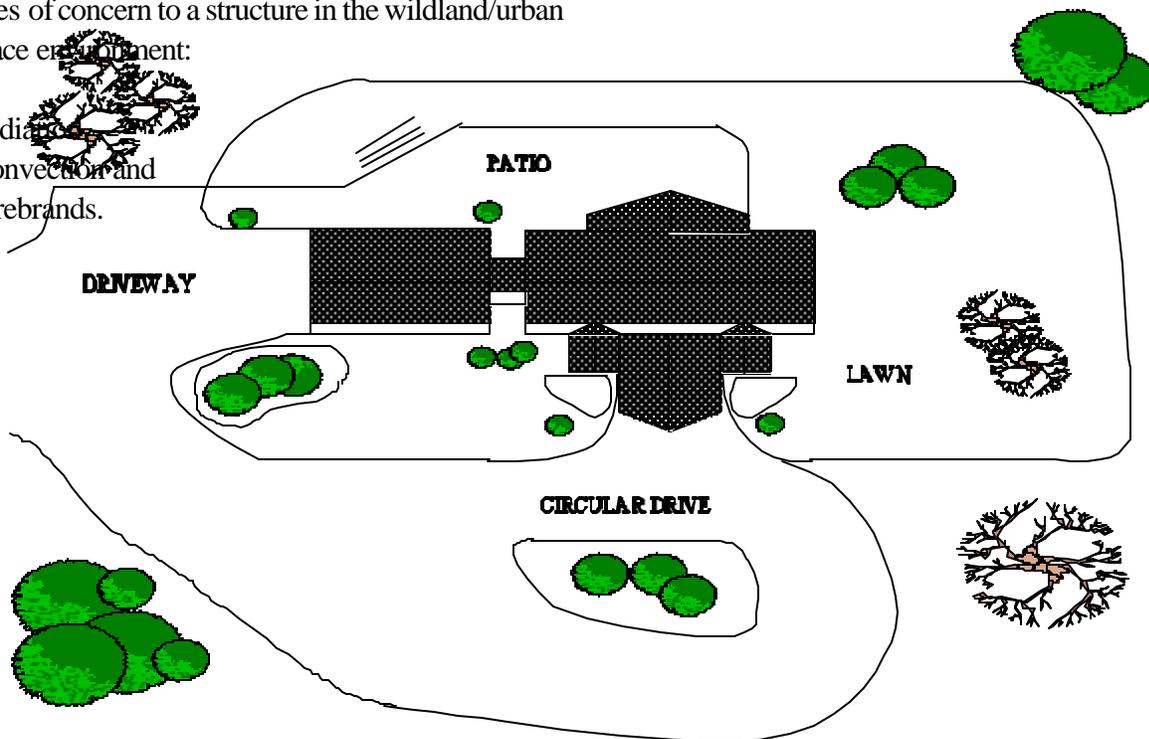


Figure 4-1. Defensible space.

## Defensible space

Each year many families lose their homes and possessions to the ravages of wildland fires throughout

What is defensible space? Defensible space refers to an area around the home where the native vegetation has been modified to reduce the fire threat to the home and provides a safe area for fire fighters to work effectively and safely. There are three benefits to defensible space:

1. the fire department will be more likely to successfully defend the home.
2. the home is more likely to survive a wildland-urban interface fire without structure protection.
3. a fire is less likely to spread from the home to the surrounding vegetation.

If native vegetation is properly modified, a wildland fire can be slowed down, the lengths of the flames shortened, and the amount of heat reduced, all of which contribute to a home surviving a wildland fire.

### Guidelines For Creating Defensible Space

Slope affects the size of the defensible space. Homes near steep slopes will need to clear additional vegetation to mitigate the effects of the radiant and convective heat currents and flame lengths. Table 4-1 shows appropriate defensible spaces distances by percent slope and by location, i.e., uphill, downhill or on the side of the home. The downhill distance is particularly important because the slope will increase the flame lengths.

As an example, a home located on a 30 percent slope, as in Figure 4-2, will have a defensible space of 200 feet downhill from the home and 100 feet on the uphill and sides.

Percent slope is the amount of vertical drop or rise of a slope over a given horizontal distance. A

the West. Chances for the home's survival can be greatly increased if the homeowner performs some basic fire safety activities such as creating a defensible space (see Figure 4-1).

convenient way for the homeowner to calculate percent slope is shown in Figure 4-3.

To create a defensible space, the homeowner must:

- Determine the amount of defensible space necessary. Keep in mind property boundaries and ownership of adjacent parcels. **Do not implement defensible space actions on adjacent property without obtaining permission of the landowner!**

DEFENSIBLE SPACE			
Percent Slope	Distance from Home		
	Uphill*	Sides*	Downhill*
Level to 20%	30-100 ft.	30-100 ft.	100 ft.
21% to 40%	100 ft.	100 ft.	200 ft.
41% to 60%	150 ft.	150 ft.	300 ft.

Table 4-1. Defensible Space.

\* Refers to direction of slope from the home.

- Evaluate the area surrounding your home in terms of defensible space and identify problem areas for correction.
- Develop a plan for correcting the problems, coordinate with adjacent land owner(s) if necessary, and incorporate existing formal landscape features.
- Secure necessary permits and have trees marked for removal by a qualified forester (if applicable).

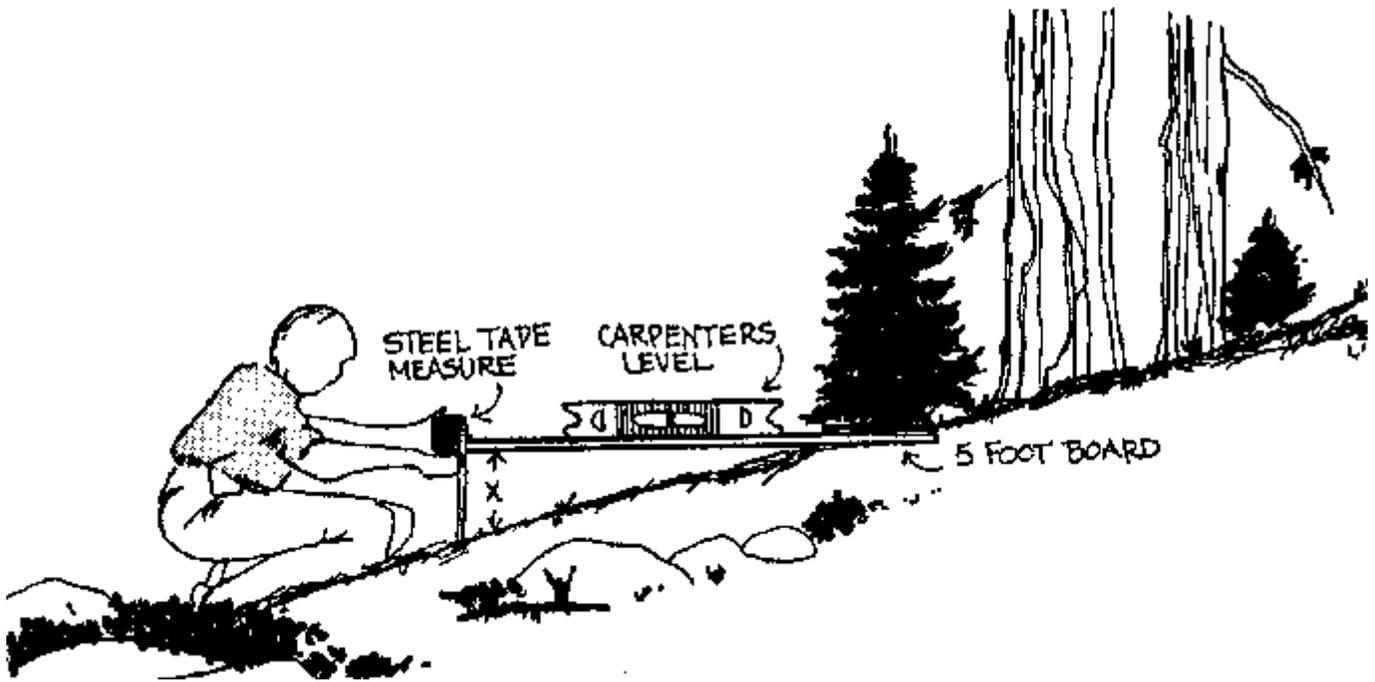


Figure 4-3. Guide to Calculating Percent Slope

You can determine percent slope with a straight five-foot (i.e., 60 inches) long board, carpenter's level, and steel tape measure. Place the board level with one end lying on the slope. Measure the distance from the other end of the board to the ground. Be sure to hold the tape measure perpendicular to the board. Divide the distance to the ground ("x") in inches by 60 and multiply by 100 to determine percent slope.

- Implement your plan.
- Remove all slash generated by fuel modification efforts, as soon as possible
- Maintain the defensible space on a routine basis.

If there is any doubt about whether or not you have planned enough defensible space, put yourself in the shoes of the fire fighters. Stand against your home and pretend the have a hose in your hand. The fire is coming at you and the flame lengths are 1 ½ times the height of the vegetation. Would you feel safe? If not, plan more work!

## Landscaping

The landscaping plan is an integral component of the defensible space. Improper landscaping worries fire officials because it can greatly increase the risk of damage to the home from a wildland/urban interface

fire. Landscaping can be thought of in terms of three zones, with each zone having a different purpose and emphasis in the overall defensible space concept for the property (see Figure 4-4). Also see Fire Resistant Plants in Appendix 3.

Zone A consists of the area within 5 feet of the home. The primary purpose of this zone is to have the least flammable type of landscaping

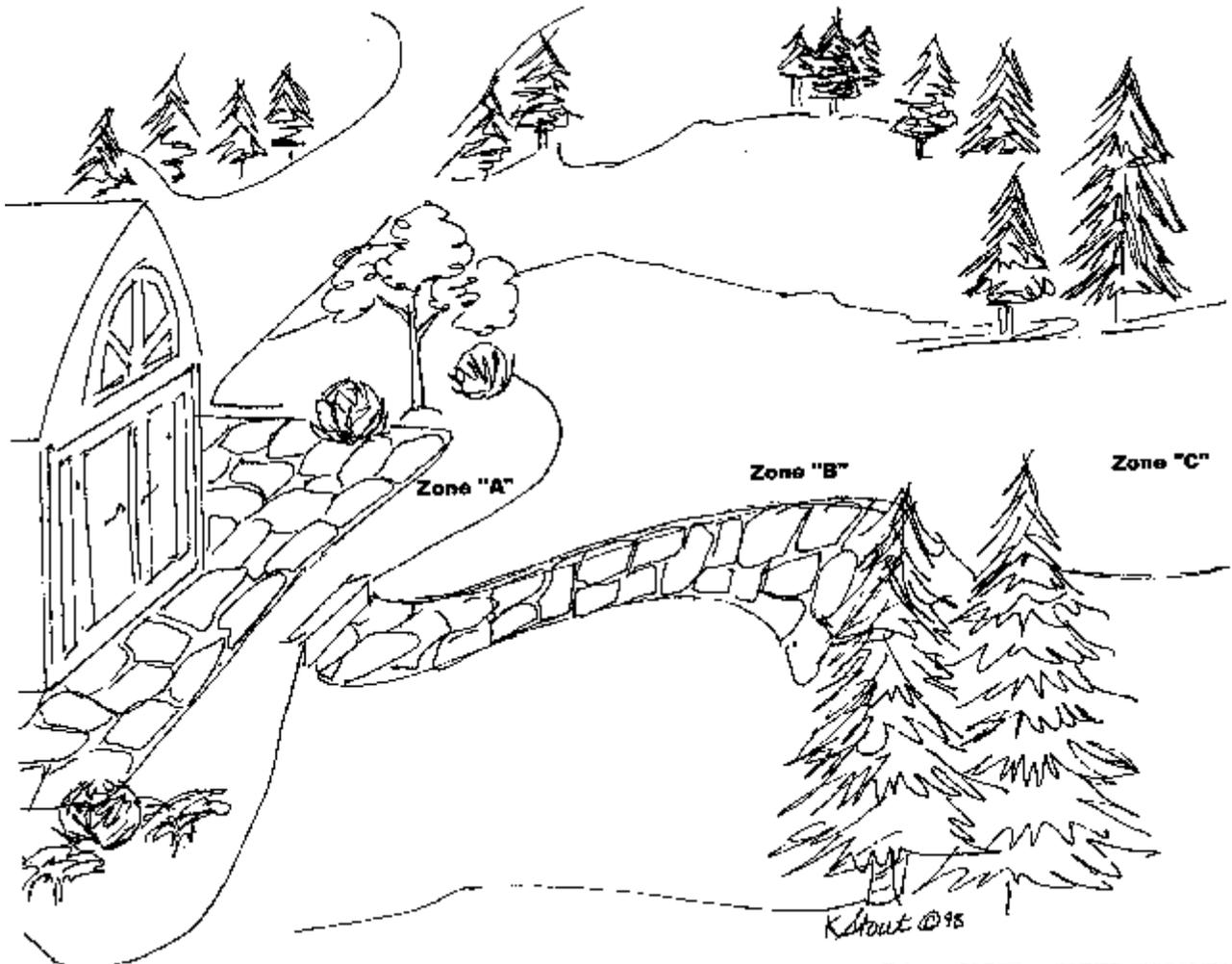


Figure 4-4. Landscaping Zones.

immediately adjacent to the home to prevent ignition from firebrands and direct flame contact.

Considerations for Zone A are:

1. Remove native shrubs and trees due to their flammability, unless they are deciduous or low growing.
2. Remove pine needles and redistribute to bare areas elsewhere to reduce soil erosion.
3. Plant low growing, high moisture content vegetation such as lawn, flowers, and ground



Figure 4-2. Defensible space on a slope

<b>MODIFYING FUELS: THE THREE R's OF DEFENSIBLE SPACE</b>	
<b>REMOVAL</b>	This technique involves the elimination of entire plants, particularly trees and shrubs from the site. Examples of removal would be the cutting down of a dead tree or the cutting out of a flammable shrub.
<b>REDUCTION</b>	The removal of plant parts, such as branches or leaves, would constitute reduction. Examples of reduction are pruning dead wood from a shrub, removing low tree branches, and mowing dried grass.
<b>REPLACEMENT</b>	Replacement is the substitution of less flammable plants for more hazardous vegetation. For example, removal of a dense stand of flammable shrubs and planting an irrigated, well maintained flower bed would be a type of replacement.

Table 4-2. Modifying Fuels

covers. Remove plant material once it has cured. Use supplemental irrigation to keep plants green in this zone.

4. Consider using gravel or decorative rock mulches or rock gardens.

Zone B lies between five feet and 30 + feet from the home. This zone provides the critical area where fire fighters can defend the home and where the fuels have been substantially reduced in height and volume. Considerations for Zone B are:

1. Remove all dead plant material including branches.
2. If desired, leave small groups of existing native shrubs. Keep well maintained. Reduce height and remove branches that are near the ground. Remove all other native shrubs.
3. Provide for at least a 10 to 15 foot separation between individual shrubs and/or groups of shrubs.
4. Native trees are acceptable so long as there is a large separation between the crowns of adjacent trees and ladder fuels are removed.
5. A thin layer of pine needles that is compact and

laying flat to the ground is acceptable.

6. Use lawn, ground covers, erosion control grasses, low growing deciduous shrubs, and mulches in this zone. Mow grasses (or remove with a weed-eater) to keep them low, a maximum of 4 inches high. Keep plants green during fire season. Use supplemental irrigation if necessary. Remove cured plant material.
7. A few deciduous shrubs used as specimen plants are acceptable.
8. Dispose of all slash in this area by piling and burning, chipping or hauling it away.

Zone C represents the remainder of the property that lies outside the formal landscaped area. This zone should be modified to create the remainder of your defensible space by pruning, thinning, or other strategies for modifying the native fuels. Limit the number or dead trees in this zone. Wildlife need only two or three dead trees per acre. Be sure these snags cannot fall onto the home or block access roads or driveways.

### **Strategies for Modifying Fuels**

Within the fire environment of fuels, weather and

topography, the fuel component is the only one which can be modified in the attempt to reduce or eliminate the wildland fire threat. Changing the fuel characteristics can effectively reduce the fire hazard or the fire intensities to a point where the fire threat is manageable. Fuel treatment options range from elimination of all fuels to create a fuel break to reducing the fuel's quantity (see Table 4-2). These options will be effective in breaking up the continuous fuels and isolating fuels or your home or development.

Techniques available to manage vegetation for fire protection are:

1. Hand Clearing - The most common method for the homeowner. Common tools include rakes, axes, shovels and pruning saws.
2. Mechanical - A quick method to reduce or remove large amount of flammable vegetation. Tools and machinery include tractors, lawn mowers, chippers and the power-string trimmer.
3. Grazing - A simple and often overlooked method. Grazing can be a useful method to reduce some grasses and shrubs thereby reducing fuels. Cattle, sheep, goats, and other grazers can be employed depending on terrain and vegetation type.
4. Irrigation - During prolonged dry weather, homeowners should irrigate their landscape and surrounding vegetation to increase its live and dead fuel moisture content.
5. Chemical - The application of herbicides either to kill existing plants or to prevent the growth of undesirable vegetation.
6. Piling - Piling of the residues created by the thinning and pruning is one way to dispose of the fuel that results from these operations. Piling can be done either by hand, or by machine if there is enough room to operate. Normally, unusable boles, limbs, etc., can be bucked up into pieces small enough to hand pile. Piles must be kept away from any live vegetation, if the piles are to be burned after they dry out.
7. Chipping - Another method to reduce the slash is to chip the excess material. This operation leaves small, easily disposed, chips.
8. Pruning - Pruning is usually done at the same time as thinning. After the trees to be removed are thinned out, the remaining trees are pruned. Pruning can be used to reduce fuels by removing the lower portion of tree crowns. Both dead and live lower branches are removed during the pruning operation. This removes unwanted ladder fuels that can carry fire from the ground to the tree tops. Pruned trees should retain a minimum of 30% live crown after pruning. That means that at least 30% of the total tree height is composed of live branches. Pruning can be used effectively in combination with thinning by pruning the leave trees where desired.
9. Thinning - Thinning involves removing a portion of the trees in a given area while leaving others. Various spacing of the leave trees can be used depending on objectives. Spacing will usually vary from 10 feet to 20 feet between leave trees. Some species, i.e., lodgepole, are better suited to thinning than others. Spruce, for example, are more shallow rooted and therefore prone to blow down if they are spaced to far apart in the thinning operation.
10. Logging - Selective logging under carefully prescribed conditions will reduce the fuels on a site, and in some locales provide a profit from the harvested trees. Depending on size class and stand conditions, different harvest methods should be used. Methods vary from removing all trees in a given area to removing only selected trees. Logging will leave tops and other debris that should be piled and burned, chipped, or taken care of in other ways.

11. Prescribed Burning - The application of fire to natural vegetation under controlled conditions of weather, fuel, moisture, etc. to burn out flammable vegetation. Prescribed burning should be carried out in compliance with local policies and regulations.

Combinations of all of the above treatments can be

The roof is the most vulnerable feature of a structure to a wildland fire. Replacing untreated wood shake or shingles with a fire resistant (Class “A” or “B”) roof covering is the only long term solution to reducing the wildland fire threat to the structure.

- T Spray on or brush treatment of fire retardant chemicals to combustible roofs may provide short term protection, if applied on a periodic basis, i.e., yearly.
- T Combustible siding also reduces the survivability of a structure to wildland fire.
- T Ensure the availability of outdoor water supplies with spigots, hoses, and nozzles.
- T All exterior vents should be covered with ¼ inch wire mesh.
- T Chimneys are required to have a spark arrester.
- T Windows should be double-paned or tempered glass and have fire resistant drapes.
- T Pre-cut plywood panels should be available to cover windows, if a fire approaches, to prevent the windows from breaking.
- T The area beneath wooden decks should be screened or enclosed, be free of flammable vegetation and clear of combustible materials.
- T Smoke detectors should be installed within the home, with at least one near sleeping areas, and tested regularly.

## **OTHER CONSIDERATIONS**

### **Trash**

The property should be free of large accumulations of combustible debris (e.g. cardboard, waste paper and

used effectively depending on vegetation, terrain, and desired objectives.

### **Steps to Make Your Home More Fire Resistant**

In addition to defensible space, there are several other steps a homeowner can take to make a home more fire-resistant, including:

**T**

scrap wood).

### **Storage of Combustible Materials**

Firewood and lumber should be stored at least twenty feet away from, preferably uphill, structures. The best practice is to cover the firewood and/or lumber with a fire resistant material or store inside to prevent firebrands from igniting them. Flammable vegetation should be removed from around wood piles for a distance of ten feet.

Store flammable liquids in approved containers and place them inside a garage or shed when not being used.

### **Access**

The address to your property should be prominently displayed. This assists firefighters in locating the property and passers by in reporting a fire. The address should be easily read from the street, both day and night. Address signs and posts should be constructed of non-combustible materials.

Make sure driveways are wide enough for fire apparatus. Circular driveways provide both an excellent access and non-combustible defensible space. (Reference the “Fire Protection Guidelines for Wildland Residential Interface Development” publication, Montana Department of Natural Resources and Conservation).

Post load limits on bridges.

## **Propane tanks**

If applicable, keep propane tanks clear of flammable vegetation and combustible materials for at least ten feet.

## **Debris Burning**

A burning permit is required to burn yard debris from March 1 to November 1 each year; no open burning is allowed outside this period. Check the weather, don't burn on dry, windy days. Debris to be burned should be:

- Placed in small piles in a cleared area.
- Located away from overhead branches.
- Attended by an adult with a shovel or rake and water, until the fire is dead out.

Consider the alternatives to burning. Some yard debris such as leaves, grass, and needles may be of more value as compost if they are not burned.

Burning of yard debris is a big decision! If a fire escapes your control, you may be liable for the suppression costs and damage to other people's property. Contact your local fire protection agency for burning permit information.

## **Tree limbs**

Tree limbs located within 20 feet of the chimney should be removed. If tree limbs are encroaching on power lines, contact the power company and have them removed.

## **Roofs and Rain Gutters**

Regardless of the type of roofing materials involved, keep the roof and rain gutters free of debris. Routinely remove pine needles, leaves, and litter from these locations during the fire season.

## **Tools**

During the fire season, the property owner should have the following tools readily available:

- T At least one shovel and one rake.
- T A ladder tall enough to access the roof.
- T Hoses connected to all exterior faucets and neatly rolled up to prevent kinking. Preferably, the hoses should be at least 5/8 inches in diameter and long enough to provide complete coverage of the property. A spray nozzle attachment should be available.
- T One or more five-pound multi-purpose fire extinguishers.
- T At least one bucket.

## **HOMEOWNERS WILDFIRE RESPONSE PLAN**

Every household should have a wildland fire response plan that includes:

- Evacuation routes from the neighborhood.
- Identification of "safe areas" in the vicinity if evacuation is not possible. Safe areas include those areas which possess little or no fuels, such as golf courses, parks, and parking lots.
- Identification of an individual who resides outside of the community who will serve as a contact for relaying telephone messages. If a wildland fire occurs when the family is separated, they can contact this individual to determine the status of other family members.
- Establish a prearranged meeting place should evacuation be necessary while family members are separated.
- Take a disaster kit containing:
  - T a supply of drinking water.
  - T one change of clothing and footwear for each family member.
  - T a blanket or sleeping bag for each person.
  - T a first aid kit, including prescription medicines.
  - T emergency tools, including a battery-operated radio, flashlight, and spare batteries.
  - T extra car and house keys, credit cards, cash, and/or traveler's checks.
  - T extra eyeglasses or other special items for

infants, elderly, or disabled family members.

- Assign tasks to family members to prepare the house for being exposed to wildfire.

### **Preparation For an Approaching Wildfire**

Should a house be threatened by a wildfire, the occupants may be advised to evacuate or to “shelter-in-place” by fire or law enforcement officials. The purpose of evacuation is to protect people from life-threatening situations. Homeowners, however, do have the right to stay on their property if they so desire and so long as their activities do not hinder fire fighting efforts. If the occupants are not contacted in time to evacuate or if the owners decide to stay with their homes (shelter-in-place), the suggestions provided in a checklist (see Appendix 3) will assist in protecting their property and the lives of their family.

### **Steps to Take If Fire Surrounds Your Home**

1. **Do not jeopardize your life!** No material items are worth your life!
2. Retreat to the inner most part of the house.
3. Stay away from all windows.
4. Stay low on the floor to avoid as much smoke as possible.
5. Have a water supply and wet towels with you.
6. Do not panic and leave house at the last minute - you cannot outrun a fire.
7. After fire has passed, check cautiously outside to see if radiant heat and smoke has decreased to the point that it would be safe to exit structure.

8. Check outside for burning embers or spot fires around the structure, under the eaves or on the roof. Extinguish the spot fires, but do not attempt to fight a fire on the roof if more than 25% of the roof is involved.
9. If the structure becomes involved in fire, move to an outside area that has already burned over and is black.

### **Evacuation Procedures**

If you are ordered to evacuate, due to a wildfire in the vicinity of your home, the following points will be helpful:

- Take a minimum of belongings, i.e., only the non-replaceable items, with you.
- If you have time, tape a list to the front door giving your name and telephone where you can be reached after evacuation. (This is only if there are not any designated check-in points.)
- Close up but do not lock your residence.
- Leave lights on in your home.
- Know appropriate evacuation route(s).
- When driving out, have vehicle headlights on.
- Watch for incoming fire equipment or personnel.
- Drive carefully and safely - remain calm.
- Do not drive off road into areas of unburned fuel.
- Know escape routes and safety zones.
- Know the location of Evacuation Check-in Point or Evacuation Gathering point.
- Check in with the proper authorities so they know that you have safely left the area and where you are planning on going.

# Chapter V. Pre-planning

## Introduction

Risks to public and to fire fighters - Public and firefighter safety are the first priority during any wildland fire event. The level of fire fighting response will vary depending on: weather conditions; resources available; current and predicted fire behavior; structure location; and defensible space surrounding the structure. Based on the risk assessment guidelines, under certain conditions, fire fighting personnel and resources will **not** be put at risk in order to save a structure.

The assignment of structure protection is often interpreted by a fire agency officer as one that cannot be declined, even without proper size-up, triage, making a fire behavior prediction, or determining if safety zones are present for apparatus and personnel.

Each fire agency officer receiving an assignment of structure protection should immediately convert this assignment to structure triage. Upon arrival at the structure, the officer should rapidly analyze the components of LACES. LACES is an acronym, which means:

- **Lookout(s)**
- **Awareness**
- **Communication(s)**
- **Escape Route(s)**
- **Safety Zone(s)**

The first component of LACES that should be analyzed is the safety zone. Having determined if there is an adequate safety zone for fire suppression apparatus will allow the officer to rapidly determine if additional options for safety zones exist.

It is the ultimate responsibility of the fire agency officer to verify the safety of an assignment, and to accept or deny the assignment on the merits of safety for his/her subordinates.

## Sites of Refuge

Sites of refuge for sheltering people from a wildfire may be required because evacuation routes are not accessible. A site of refuge should meet these criteria:

- be a large open area with low fuel loadings.
- have the infrastructure to handle a large number of people:
  - water
  - restrooms
  - communications
  - feeding facilities
- be pre-identified and pre-designated with Sheriff's Offices, Disaster and Emergency Services Coordinators, Red Cross and Fire Officials.

Sites of refuge may include areas such as:

- schools
- parks
- golf courses

Agencies will need to provide adequate resources to protect the people in the refuge site and to maintain calm.

## Evacuation

Evacuation is a complex process flowing from a simple concept; protection of persons and their property by temporarily removing them from the path of a threat. Appropriate evacuation efforts include planning, coordination, and compassion. Evacuation is labor intensive, and for some emergencies may become larger, in scope, than the response to the original threat.

The *Field Guide to Evacuation Planning and Implementation*, available at Madison and Gallatin County Department of Emergency Services (DES) Offices, is a useful tool for emergency managers charged with assessing what segments of the public, if

any, are at risk during an emergency and how best to protect them. The process outlined in the *Field Guide* forces objective evaluation and is intended to eliminate unwarranted reactions to the possibility of erroneous perceptions of the risk to the public.

### Evacuation Stages

The evacuation planning process will follow these stages:

- Pre-evacuation contacts and briefings of residents.
- Evacuation warning - movement of special needs residents, livestock and large mobile property.
- Evacuation requested - occupants asked to leave within a specified time frame.
- Evacuation ordered - official disaster declaration initiated and order for evacuation issued. Access to area prohibited to anyone not authorized by **Incident Commander (IC)**.
- Area controlled - perimeter roadblocks maintained and patrolled.
- Area re-entry - Evacuees allowed to return.

### Responsibilities

Since the Big Sky area encompasses two counties, the responsible entities from both counties will need to determine “who is in charge” and have mutual aid agreements in place to ensure there are no potential conflicts during an wildland fire. The following responsibilities will be based on those agreements:

#### A. Chief Elected Officials (CEO)

The chief elected officials (sheriffs in Gallatin and Madison counties) are responsible for ordering an evacuation in a disaster situation. In the case of a rapidly developing life threatening emergency, a fire chief, incident commander or law enforcement can order an emergency evacuation until the CEO can be notified.

Responsibilities include:

- Declare an emergency. Follow the guidelines as covered in the *Montana Local Government Disaster Information Manual*, available at Madison and Gallatin County DES Offices.
- Coordinate with the IC to develop a written evacuation plan and objectives based on the nature of the emergency.

#### B. Incident Commander (IC)

The IC is responsible for overall incident operations, which may or may not include responsibility for the evacuation efforts.

Evacuation responsibilities may include:

- Ensuring an evacuation plan is developed.
- Initiate evacuation procedures.
- Utilize evacuation planning information or protocols as developed by the local Disaster and Emergency Services Coordinator (DES) and/or law enforcement agency.

#### C. Law Enforcement

In the event that a wildfire threatens life and/or property, county law enforcement will have the primary responsibility of notification of residents and the movement of the public from the danger areas. All evacuation efforts must be coordinated with other agencies on the scene to ensure maximum protection of persons and property.

Responsibilities include:

- Assist IC with evacuation planning.
- Common roles that are assigned to law enforcement include:
  - notification of public.
  - designating evacuation routes or traffic control plans.
  - staffing evacuation routes and road blocks.
  - preventing unauthorized traffic from entering the area.

- protect security of the area and property to the extent possible during evacuation.
- patrol evacuated area.
- provide reassurance to the public to maintain order.
- Document any contacts with the public and have individuals that refuse to evacuate sign a “Refusal Form”.

#### D. County Disaster and Emergency Services Coordinators

Responsibilities include:

- Assist CEO & IC with the disaster declaration process and the evacuation planning.
- Plan Evacuation Routes.
- Determine capability of road system to handle evacuation traffic plus response traffic.
- Set up alternate Emergency Operations Center (EOC), if necessary. Gallatin Canyon Consolidated Rural Fire District (GCCRFD) Fire Station at Meadow Village is a potential site.
- Designate potential additional EOCs or Command Posts in case the GCCRFD building is not feasible.
- Identify any equipment, supplies or additional communication devices needed to set up as EOC.
- Notify the State Disaster and Emergency Services office of developments.
- Assist in obtaining additional resources as needed.
- Prepare a list of shelters with the following information - capacity, type of facility and capabilities - i.e. bathrooms, kitchen, sleeping, etc. A map should be developed indicating the locations of these facilities.
- Develop a list of subdivisions with corresponding appropriate **trigger points** listed.
- Document responses, damage assessment, and response and recovery costs.

#### **Shelter in Place vs. Evacuation**

Wildland fire research is now closely examining the issue of evacuation vs. shelter-in-place alternatives. With the topography, fire behavior history, and limited road access to some of the subdivisions and population centers in the Big Sky area, fire managers need to seriously consider the advantages of not evacuating residents. For instance, there may be short term threats in which mass movement of evacuees may prove more hazardous than staying in place and waiting out the fire. Many wildland fires will not require a full-scale evacuation and residents can be given instructions on protecting themselves at home. Factors to consider when deciding whether to evacuate residents or shelter-in-place are listed in a resource sheet in Appendix 3.

#### **Pre-event Strategies for Shelter-in-place**

When considering shelter-in-place, there are several strategies to consider prior to a wildfire event where it might be used.

First, educate agency and elected official to ensure that those individuals making evacuation decisions understand all of the ramifications of their decisions.

Education of the public about fire behavior, self-protection, risk assessment and promote community involvement, including neighbor concern and support.

Develop an understanding, by agency officials, of disaster sociology and capacity of individuals and families to withstand threat and hardship.

Ensure the provision and availability of facilities to enable residents to be more effective as self-protectors (e.g. guaranteed water supplies, reliable radio or communications access, and other sources of information, such as weather radio or fire channel scanners).

High-risk residents need to be pre-identified and reach prior agreement for their safety, including agreement for early evacuation if warranted.

The development of fire weather warnings to act as a trigger for protective action.

### **Needed Fire and Law Enforcement Resources**

The *Field Guide to Evacuation Planning and Implementation* provides law enforcement personnel planning tools for estimating the number of resources required to effectively manage the evacuation of the Big Sky area.

The *Fire Operations in the Urban Interface* course establishes rules of thumb, widely used by the fire service, for resources needed in a wildland/urban interface fire. They are:

- For separated homes mostly surrounded by wildland fuels: one fire engine per home.
- For continuous structures in a development, less than fifty feet apart: one fire engine per two homes.
- For every five engines assigned to specific homes: provide an additional engine to float.
- For clusters of homes, less than fifty feet apart, count the number of homes on the perimeter and divide by four; that equals the number of single fire engines required, plus one **strike team** of five fire engines.
- When roofs are combustible: add one additional strike team of engines.
- For each engine strike team: three water tenders.

The total fire suppression resources available within two hours to provide protection are: 12-14 structural engines, 15-17 water tenders, 20-24 wildland engines, 18 structure crews, 8-12 smokejumpers; 1-4 airtankers; 1-2 Type III helicopters with modules; 12-15 incident management staff, and various command vehicles.

A response, to a significant wildland/urban interface fire, under extreme weather conditions, will not only require the resources of the GCCRFD, GNF, B-DNF, Gallatin County and Madison County fire agencies, it will require resources from outside the

area. For those resources outside of the Gallatin and Madison County area, response times over two hours should be anticipated.

### **Communications**

The cooperating partners on the Big Sky Fire Planning Steering Committee have agreed to utilize the South Central Zone Communication Plan for incident communications on fire incidents in the Big Sky Area. The communications plan is included in Appendix 3.

Communication capabilities need to be tested in different locations of the Big Sky Fire Planning Area, especially cell phone coverage.

Contact numbers and radio frequencies are listed in the agency contact list in Appendix 2.

A recommended sample frequency sharing agreement is included in Appendix 6.

### **Pre-fire plans**

The local agencies need to pre-plan the following elements on a map of the area:

- Risk assessment of homes and developments - if possible enlist the assistance of the homeowners to complete their own risk assessment.
- Evacuation routes and reporting areas in case of evacuations.
- Location of staging areas.
- Location of command post areas.
- Alternate Emergency Operation Center locations.
- Trigger points for different drainages and housing developments to initiate warning and notification procedures.

The Colorado State Forest Service has developed a standard pre-plan format for use in wildland/urban interface areas, the contents of which are listed in Appendix 5.

## **Interagency Cooperation**

The cooperating partners in the Big Sky Fire Planning Steering Committee need to facilitate on-going regularly scheduled inter-agency meetings to discuss:

- Agency responsibilities.
- Who is in charge” issues.
- Response capabilities.
- Financial responsibilities.
- Coordinated training.
- Mutual aid and other agreements.
- Status of public education efforts.
- Policy updates.

# Chapter VI. Public Education

## Introduction

Big Sky residents must be made aware of the inevitable nature of fire, the limitations of fire suppression technology and the opportunity for fire preparedness. Property owners need to be motivated into modifying homes and landscapes before a wildland fire occurs. Architects and contractors must be educated to build homes with wildland fire protection and defensible space concepts in mind. The public outreach effort must be widespread, innovative, continuous and multi-faceted with emphasis on landowner and homeowner responsibilities.

## Goals

The goals of the public education program are:

- To create realistic expectations of the kind of conditions which might be expected on the day a wildland fire will burn through the Big Sky Area. Fire departments and agencies also need to emphasize to the homeowner that under certain conditions, there might not be protection for their homes, because of safety concerns for the responding fire fighters and their inability to safely fight the fire in those conditions.
- To create expectation on the part of the homeowner, that they should protect themselves by utilizing defensible space, fire resistive construction, fire resistant vegetation, etc.
- To educate public on the US Forest Service prescribed burning and wildland fire use program.
- To develop public education materials specific to the Big Sky area, addressing fire protection and fire prevention issues, including private landowner responsibilities and liabilities.

## Target Audiences

The target audiences for public education programs in the Big Sky Fire Planning area, include many diverse groups and interests:

- Architects
- Appraisers
- Contractors
- County Planners
- Developers
- Elected Officials
- Engineers
- Foresters
- Insurance Agents
- Landscapers
- Financial Lenders
- Media
- Realtors
- Homeowners
- Homeowner Associations
- Landowners
- Students & Teachers

## General Recommendations

It traditionally has been difficult to convince landowners to make major changes to their homes to make them more “defensible” after they are built. With this in mind, it would be advisable to make a major effort at influencing the architects, contractors, and developers to implement fire resistant strategies when building new homes. This would be especially effective in the Big Sky area since so much development is now in the initial stages.

Investigate tax, insurance, or other financial incentives for new homeowners or developers, for example, a fire department in Minnesota has an innovative “Zero Interest Loan Program” for funding residential sprinkler installations.

Initiate comprehensive educational effort with the county planning boards about wildland/urban interface

fire as well as elements of this plan.

The fire agencies should be extremely pro-active in enlisting the assistance of the media in delivering the “fire message.” The chief of Gallatin Canyon Consolidated RFD writes articles in the papers and has a morning radio show; perhaps predetermined articles or messages could be used during particular times of the year, especially as the fire danger increases.

Make sure that mutual aid agreements and annual operating plans are updated.

Let the public know when, where and why there will be prescribed burns. This needs to be done in conjunction with the structure fire departments so no conflicts are created by the messages provided to the public.

### **Public Education Techniques**

As a short term goal, the agencies need to continue their current efforts of public education. A list of techniques and suggestions which might be utilized in the Big Sky area is included in Appendix 3.

### **Tips for Working with Community Organizations**

Start early. Many community organizations may meet only once or twice a month and it could take some time to get a place on their meeting agenda.

Do your homework. Know the particular agenda, or mission of the group you are addressing. Present a strong case showing how support for or participation in the proposed program furthers their mission - not simply how they can help you further yours.

Be careful not to imply blame or single out the area as one with a problem. Instead, appeal to community pride and position the program as one to promote community empowerment - the attitude that people can make a difference and can work together to solve

a community problem.

Be willing to come back again to address other members or subcommittees. Be patient and respect the organization’s decision-making process, which may seem painfully slow at times.

Ask for the organization’s advice and listen to it. Be specific about what you would like each organization to do, whether it is to recruit ten volunteers for a community canvass, to display posters, to distribute literature, or to provide volunteers to be trained as neighborhood project leaders.

If an organization is unable to “officially” support the program, encourage individual members to participate.

### **Specific Long Range Recommendations**

These activities will involve considerable time, commitment, and planning. To accomplish these objectives, the agencies may have to look at the possibility of cooperatively hiring personnel to be in charge of public education and outreach. They will also probably have to explore opportunities for funding.

Studies of how a new idea gains broad acceptance and adoption show that it normally begins with a few “early adopters” then moves to broader audiences through communications channels within the society itself, i.e., diffusion. The goal is to get people to adopt our ideas faster and change behaviors in a desired way. New methods need to be explored in order to speed up the “adoption” and “diffusion” process.

Research has identified five qualities that affect the rate at which a new idea or innovation is adopted by people. Framing the public education efforts to take maximum advantage of the following factors is likely to increase adoption speed.

- **Relative advantage** - the perceived advantages people see in the new idea. Their perceptions may

or may not be accurate, but the greater the perceived relative advantage of a new idea or course of action, the faster it is likely to be adopted.

- **Compatibility** with existing attitudes, ideas, values and norms of the people being asked to adopt it is important. The more compatible it is, the faster it will be adopted.
- **Simplicity.** The more complex and hard to understand a new idea is, the less likely people are to adopt it. Keep things simple.
- **Field Test.** If an idea can be tried on a small area, or without great expense or risk on the part of the tester, it is much more likely to be adopted than if it must be done all at once to be effective.
- **Visibility of results** - If the results are readily visible, both to the person applying the idea and to their neighbors, the idea will be adopted much more readily because people will tend to talk about it more.

### **Implementation Concepts**

The following are suggestions that use the above concepts to implement the public education program.

### **Demonstration Projects**

These projects could include any of the following:

- Model “Firesafe Community” projects.
- Signs put up to designate individuals or developers that incorporate defensible space concepts in their developments, i.e., a “certification” for marketing efforts.
- Fuel treatment projects that may include prescribed burning and/or mechanical treatments.

- Award program for homeowners incorporating new concepts.
- Explanatory signs at strategic points to help public understand wildland treatment projects, etc.

### **Focus Groups**

One of the major obstacles to public education in the Big Sky area is the fact that a high percentage of the population does not live there year round. This population is difficult to reach and even more difficult to get to adopt new ideas and to change behavior. In order to conduct an effective education campaign, there needs to be grass roots community involvement along with considerably more research and information concerning the target audience.

Focus group research is one of the most important elements of community-based fire safety education. We need to learn more about residents of the target area, their attitudes toward fire safety and about the fire department and fire agencies. We also seek information about the community itself, where people get information and who they already trust; the people and organizations with credibility who would be the best messengers for the program.

### **Basic Steps:**

1. Utilize a professional facilitator. The facilitator should be someone not connected with the issue, a “neutral person” that people are willing to talk to and be honest with. The individual has to be trained and have skill and experience in facilitating this specialized type of group process.
2. Determine focus group participants and conduct the focus groups.
3. Analyze the discussion results and formulate program strategy recommendations.

NOTES: Focus group participants need to be chosen

carefully so as to represent the target audience. In choosing you could try to identify an individual from each subdivision, i.e., the chair of the homeowners' association board. This individual might be the one who would then initiate the pilot demonstration projects that could serve as the "model" for the rest of the neighbors to emulate. Also some incentives need to be identified to "encourage" individuals to take on this role. Suggestions include: assistance in completing building modification and defensible space ideas, recognition as "fire-safe" homes, and etc.

### **Guidelines For Focus Groups**

The following are potential questions that could be utilized to develop moderator/facilitator guidelines for focus groups in the Big Sky community. The product would be a detailed discussion outline that a focus-group consultant or moderator could use to help fire agencies formulate program strategies.

**The Community** - Include questions to learn more about the target area and its residents. Find out who they trust, how they get information, and if language or other factors need to be carefully considered.

**Background Knowledge** - Try to determine the level of background knowledge of participants regarding wildland fire, wildland/urban interface fires, and some

of the common terminology that is used.

**Fire Safety** - Probe for current fire safety attitudes and behavior. Are the fire safety attitudes realistic? What misconceptions do people have?

**The Fire Department/Agency** - Identify the community knowledge and understanding of the local fire departments and agencies. What is their image with target area residents? Are there community relations challenges? What experiences have residents had? If there have been any recent incidents, issues or controversies involving the fire department, county government or state or federal agencies in general, include questions to gauge their effects on people's attitude. Gauge awareness of current or past fire education efforts.

**Test Materials** - Test brochures, posters, messages, or graphics you plan to use or which may provide models for development of program materials. Show samples to participants one at a time and ask for their reactions.

**Sponsorship** - Ask questions to determine which potential cosponsors or partners are most respected and if there are potential sponsors that would be viewed so negatively that their participation actually could hurt the program.

## Chapter VII. Recommended Implementation, Monitoring, & Evaluation

Implementation, monitoring and evaluation are important aspects of any fire management planning effort.

### IMPLEMENTATION

**Action Item # I.1 -** Formally charter the Big Sky Fire Planning Steering Committee, and consider implementing appropriate task groups, i.e., Operations, Fire Prevention, Training, and Administration, to implement the work outlined in this report.

Person & Agency Responsible: Gallatin National Forest and Montana Department of Natural Resources & Conservation

Target Date: 06/01/2000

**Action Item # I.2 -** The boundaries of both the Gallatin Canyon Consolidated RFD and the Madison Valley RFD need to be updated to ensure their accuracy by obtaining the exact legal descriptions of the boundaries of the fire districts from the counties.

Person & Agency Responsible: Gallatin Canyon Rural Fire Department and Madison Valley Rural Fire Department

Target Date: 08/01/2000

**Action Item # I.3 -** The fire agencies, both structural and wildland, should work with the planning offices in Madison and Gallatin Counties to develop subdivision regulations that ensure adequate access routes, fuel management activities, defensible space, adequate water supply and fire resistant construction.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: On-going

**Action Item # I.4 -** The fire agencies, both structural and wildland, need to conduct coordinated reviews of subdivisions within their fire protection boundaries using a standard set of criteria.

Person & Agency Responsible: Gallatin National Forest, Beaverhead-Deerlodge National Forest, Gallatin Canyon Rural Fire Department, and Madison Valley Rural Fire Department

Target Date: On-going

**Action Item # I.5 -** A task group of the Big Sky Fire Planning Steering Committee should be charged with exploring all alternatives for interagency partnerships and opportunities and developing plans to implement them.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: 03/15/2001

**Action Item # I.6 -** The Big Sky Fire Planning Steering Committee, in conjunction with the Gallatin Canyon Consolidated Rural Fire District Board of Trustees, needs to develop strategies for providing structural fire protection to the lands outside the boundaries of the rural fire district **Or**, assist the land and homeowner's in determining how they can best be provided structural fire protection.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee and Gallatin Canyon Consolidated RFD

Target Date: 08/01/2000

**Action Item # I.7 -** The fire protection agencies, both structural and wildland, need to the work with the planning offices, Boards of County Commissioners, major landowners and developers, to develop a coordinated fuel break system in the Big Sky area.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: 12/31/2002

**Action Item # I.8 -** The Gallatin Canyon Consolidated RFD and the Gallatin National Forest need to identify landowners who are willing to create a defensible space as a demonstration project.

Person & Agency Responsible: Gallatin National Forest, Montana Department of Natural Resources & Conservation, and Gallatin Canyon Consolidated RFD

Target Date: 12/01/2000

**Action Item # I.9 -** Develop or adopt a residential fire safe evaluation process for the Big Sky area.

Person & Agency Responsible: Gallatin National Forest, Montana Department of Natural Resources & Conservation, and Gallatin Canyon Consolidated RFD

Target Date: 12/01/2000

**Action Item # I.10 -** The County DES Coordinators in both Madison and Gallatin Counties need to develop, in cooperation with each other, a single evacuation process and plan for the Big Sky area, including shelters, evacuation routes, trigger points and Sites of refuge.

Person & Agency Responsible: Gallatin and Madison County Disaster and Emergency Service Coordinators

Target Date: 06/01/2001

**Action Item # I.11 -** The fire agencies, in cooperation with the Sheriff's Department and DES Coordinators, need to adopt and develop Wildland/Urban Interface Fire Hazard Mitigation and Response Plan(s) for the Big Sky area.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: 06/01/2001

**Action Item # I.12** - The fire agencies, both structural and wildland, need to work with the agency administrators and Boards of County Commissioners to inform and clarify entities of their roles and responsibilities, especially their financial responsibilities.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee  
Target Date: On-going

**Action Item # I.13** - Review existing fire prevention publications (evaluate, up-date, and re-publish) as needed.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee  
Target Date: 06/01/2001

**Action Item # I.14** - Review existing public fire education programs (evaluate, up-date, and re-publish) to ensure an interagency approach.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee  
Target Date: 06/01/2001

**Action Item # I.15** - Establish an interagency public fire education display at the Big Sky Chamber of Commerce office.

Person & Agency Responsible: Gallatin National Forest, Montana Department of Natural Resources & Conservation, and Gallatin Canyon Consolidated RFD  
Target Date: 06/01/00

**Action Item # I.16** - Evaluate re-design all electronic media programs and messages to ensure an interagency approach and message specific to the Big Sky area.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee  
Target Date: 06/01/2001

**Action Item # I.17** - Ensure that the US Forest Service provides public education materials, messages, and accurate and timely information regarding all prescribed burns that are up-wind and up-drainage from Big Sky, to the fire agencies and media outlets covering the Big Sky area.

Person & Agency Responsible: Gallatin National Forest and Beaverhead-Deerlodge National Forest  
Target Date: Prior to burning

**Action Item # I.18** - Set up a National Fire Danger Rating System with fire danger signs displaying the Fire Danger within the Big Sky Fire Planning Area. Establish preparedness levels for resources, public awareness and prevention programs and restrictions.

Person & Agency Responsible: Gallatin National Forest, Beaverhead-Deerlodge National Forest, Montana Department of Natural Resources & Conservation, Gallatin Canyon Consolidated RFD, and Madison Valley

RFD

Target Date: 06/01/2000

**Action Item #I.19 -** The fire agencies, both structural and wildland, should work with the planning offices in Madison and Gallatin Counties and developers to develop a range of acceptable trade-offs that might be used in a subdivision development.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: 12/01/2000

**MONITORING**

**Action Item # M.1 -** The fire agencies need to update their resource lists on an annual basis to facilitate an efficient response to fire incidents in the Big Sky area.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: Annually by 06/01.

**Action Item # M.2 -** The fire agencies need to update the radio communications plan on an annual basis to ensure effective communications during an incident in the Big Sky area.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: Annually by 06/01.

**Action Item # M.3 -** On an annual basis, the Big Sky Steering Committee should review the goals and objectives established in the committee's yearly work plan.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: Annually by 06/01.

**EVALUATION**

**Action Item # E.1 -** Three years from the publishing date of this plan, the Big Sky Steering Committee should commission a review of this report and revise it as necessary.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: 04/31/2003

**Action Item # E.2 -** On an annual basis, the Big Sky Steering Committee should provide, to the Chartering Agencies, a written evaluation of the Committee's performance and accomplishments.

Person & Agency Responsible: Big Sky Fire Planning Steering Committee

Target Date: Annually

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## Appendix 1. Glossary of Terms

**Affidavit system** - a system where private lands, which are not included in a Forest Fire Protection District, and which the landowner has agreed to pay a standard fee through the county tax base system for wildland fire protection by the recognized protection agency.

**Air tanker** - a fixed wing aircraft capable of transport and delivery of fire retardant solutions.

**Aspect** - The direction (north, south, east, west) toward which a slope faces.

**Chimney(s)** - Canyons can act as a chimney by funneling heated air up the canyon and creating strong up slope drafts. This accelerates the rate at which a fire moves up the canyon.

**Chain** - 1 chain equals 66 feet. See rate of spread.

**Classified forest land** - lands which have a ten percent or greater tree canopy cover or are located within one half mile of such as defined by the a Montana Department of Natural Resources & Conservation.

**County Coop program** - a program of the Montana Department of Natural Resources & Conservation, under which a County will provide wildland fire protection for areas not covered by a designated fire protection entity.

**Critical fire weather** - is a set of weather conditions whose effects on fire behavior make control difficult and threaten fire fighter safety.

**Crown** - a tree crown is the primary and secondary branches growing out from the main stem, together with twigs and foliage.

**Crown fire** - a fire that advances from tree crown to tree crown, more or less independently of the surface fire.

**Decadent** - in regards to vegetation, it refers to plants of declining vigor; and deteriorating health.

**Defensible space** - is an area, either natural or person-made, which lies between a structure and an encroaching wildfire where the vegetation has been modified to reduce the wildfire threat and which provides an opportunity for fire fighters to safely defend the structure.

**Ecological Land Units**- are defined by elevation and fire groups, and describe environmentally similar conditions, utilized by the US Forest Service in landscape planning.

**Engine** - a ground firefighting vehicle with specific amounts of pumping, water, and hose capacity.

**Fire behavior** - the manner in which a fire reacts to the variables of fuel, weather, and topography.

**Fire group**- a vegetation classification system combining fire frequency information, fire ecology and habitat types.

There are twelve fire groups.

**Fire resistant construction** - construction designed to resist the spread of fire. For descriptions, see the *Uniform Building Code*.

**Fire resistant landscaping** - vegetative management that removes flammable fuels from around a structure to reduce the structure's exposure to radiant heat. The flammable fuels may be replaced with green lawn; gardens; decorative stone; certain, individually spaced, green, ornamental shrubs; individually spaced and pruned trees.

**Fire weather** - weather conditions which influence fire ignition, behavior, and suppression.

**Fire weather watch** - a fire weather watch will be issued whenever the potential for red flag conditions exist and the fire danger is in the High to Extreme category. A fire weather watch is normally issued 12 to 72 hours in advance of the expected onset of red flag conditions.

**Flame length** - a measurement of the intensity of a fire and is measured in feet. This measurement is related to the heat felt by a person standing next to the flame and is commonly used to gauge potential fire suppression options, such as fire fighters using hand tools or mechanized equipment, i.e., dozers.

**Forest fire protection district** - a district established by a vote of 51% of the landowners who own 50% of the private lands in the proposed district. Private landowners pay an established fee through the county tax base for which, in return, they receive wildland fire suppression (Montana Code: MCA 76-13-204).

**Fuel** - any combustible material. With respect to wildland fire, fuel typically refers to living and dead vegetation. With respect to a wildland/urban fire, fuel typically includes the living and dead vegetation and the structures.

**Fuel break** - an area, strategically located for fighting anticipated fires, where the native vegetation has been modified or replaced so that fires burning into it can be more easily controlled.

**Fuel loading** - the amount of vegetation, both live and dead, available for burning in an area. Measured in tons/acre.

**Fuel modification** - a method, or methods, of modifying a fuel load by reducing the amount of non-fire-resistive vegetation or altering the type of vegetation to reduce the fuel load.

**Grazing** - the eating of vegetation by animals.

**Heat per unit area** - the heat released from a square foot of fuel while the flaming front is in the area.

**Horizontal continuity** - the degree to which fuels form a continuous layer on a horizontal plane.

**Incident Commander** - the person responsible for overall management of an incident. On most incidents there is normally a single Incident Commander, however, when there is overlapping jurisdictions, there may be more than one Incident Commander. This is referred to as Unified Command.

**Insurance Services Office (ISO)** - an agency that recommends fire insurance rates based on a grading schedule which incorporates evaluation of fire fighting resources and capability. The grading schedule is equally rated, giving 50% credit for water supply and 50% for the fire department. A Class 1 rating is the very best fire protection capability, a Class 10 rating equates to no fire protection.

**Ladderfuel** - fuels which provide vertical continuity between strata, thereby allowing fire to carry from surface fuels into the crowns of trees or shrubs with relative ease.

**Limb-up** - removing lower branches from trees to break the ladder fuels continuity.

**Logging** - the felling and removal of all or a part of the trees in a given area.

**Non-forest zone** - areas in which the concentration of residences and other buildings makes the primary fire protection problem one of structural fires rather than forest fires.

**Northern Region** - the Northern Region includes twelve National Forests in northern Idaho, northeastern Washington, and Montana; and one National Grasslands in North Dakota and northwestern South Dakota -- approximately 25.395 million acres.

**Mosaic** - a fuel modification system that provides for the creation of islands and irregular boundaries to reduce the visual and ecological impact of fuel modification.

**Prescribed burning** - controlled application of fire to wildland fuels in either their natural or modified state, under specified environmental conditions which allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to attain planned resource management objectives.

**Prescribed fire** - any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist, and National Environmental Protection Act requirements must be met, prior to ignition.

**Pruning** - the removal of live and dead branches in the lower portion of the tree crown.

**Rate-of-spread** - the forward movements of a fire at its head or front and is measured in "chains per hour," a measurement use by surveyors where one chain equals sixty six feet.

**Red Flag Conditions** - red flag conditions consist of: 1.) Dry thunderstorm activity during extremely dry periods or when a marked increase in dry thunderstorm activity is forecast during a drier than normal period; 2.) Surface winds are expected to increase to 20 mph or higher or change directions abruptly due to the approach and passage of a cold front, squall line, or other weather phenomena other than isolated thunderstorms; 3.) Prolonged hot and dry conditions (RH below 20%) in combination with a Fire Danger Rating of High or greater; 4.) A combination of conditions listed above; 5.) Anytime the forecaster foresees a change in weather that would result in a significant increase in fire danger.

**Red Flag Warning** - a red flag warning will be issued whenever red flag conditions are imminent and the fire danger is in the high to extreme category. The red flag warning will generally be issued within 24 hours of the expected onset

of the red flag conditions.

**Rescue** - a vehicle capable of providing emergency medical services.

**Seral** - an ecological sere, e.g., a series of ecological communities formed in ecological succession.

**Slope** - the variation of terrain from the horizontal; the number of feet rise or fall per hundred feet measured horizontally, expressed as a percentage.

**Specimen trees** - Vigorous trees left within a fuel break to enhance the visual characteristics of the fuel break without compromising its objective.

**Strike team** - a specified combination of the same kind and type of fire fighting resources, with common communications and a leader, i.e., five engines make an engine strike team.

**Structure fire suppression** - interior or exterior actions taken to suppress and extinguish a burning structure or improvement.

**Structure protection** - action to protect the structure from the threat of damage from an advancing wildfire. This normally does not include an attack of fire that is inside the structure. It involves the use of fire control lines (constructed or natural) and the extinguishment of spot fires near or on the structure. This protection can be provided by the structural or wildland fire fighter.

**Subsidence inversion** - a slow sinking motion of a high level air mass over a broad area. Often associated with the presence of a high-pressure system. Frequently results in very limited atmospheric mixing conditions.

**Thermal belt** - an area of a mountain slope where a nighttime inversion layer “bathes” it with warmer and drier air. Typically experiences the least variation in diurnal temperatures and has the highest average temperatures and lowest relative humidities.

**Thinning** - a cutting made in an immature stand of trees to reduce the number of trees, and to provide additional room for the growth of the remaining trees.

**Torching** - the burning of the foliage of a single tree, or a small group of trees, from the bottom up.

**Trigger point** - a pre-determined point or line on a map. When a fire hits the trigger point, actions such as evacuations take place.

**Water tender** - a ground vehicle capable of transporting specified quantities of water and pumping capacity.

**Wildfire** - a fire occurring on wildland that is not meeting management objectives and thus requires a suppression response, i.e., any unwanted wildland fire.

**Wildland fire** - any non-structure fire, other than a prescribed fire, that occurs in the wildland.

**Wildland/urban interface area** - the line, area, or zone where structures and other human development meet or intermingle with undeveloped wildland or vegetative fuels.

## Appendix 2. Agency Contact Lists

<b>Agency:</b> Beaverhead-Deerlodge NF		<b>Emergency Number:</b> 406-683-3975	
<b>Address:</b> 420 Barrett Dillon, MT 59725		<b>Contact by:</b> Business number: 406-683-3975 Fax: 406-683-3955 Email: mtddc/r1_b-d@fs.fed.us	
<b>Radio Frequencies:</b>			
Transmit	Tone	Receive	
171.425		171.425	
172.325	123.0	171.425 (Lazyman Repeater.)	
<b>Resources</b>			
<b>Station</b>	<b>Resource</b>	<b>Type</b>	<b>Notes</b>
Dillon	Helicopter	Type 2	A national resource

<b>Agency:</b> Madison Ranger District		<b>Emergency Number:</b> 406-683-3975 (Dillon)	
<b>Address:</b> 5 Forest Service Road Ennis, MT 59729		<b>Contact by:</b> Business number: 406-682-4253 Fax: 406-682-4233 Email:	
<b>Radio Frequencies:</b>			
Transmit	Tone	Receive	
171.425		171.425	
172.325	123.0	171.425 (Lazyman Repeater)	
<b>Resources</b>			
<b>Station</b>	<b>Resource</b>	<b>Type</b>	<b>Notes</b>
Sheridan	Engine # 261	Type 6	4 x 4
Ennis	Engine # 262	Type 6	4 x 4

Lyons Work Center	Engine # 263	Type 6	4 x 4 slipon-backup only
Ennis	Crew	5 person	

<b>Agency:</b> Gallatin Canyon Consolidated RFD		<b>Emergency Number:</b> 911	
<b>Address:</b> P.O. Box 160382 Big Sky, MT 59716		<b>Contact by:</b> Business number: 406-995-2100 Fax: 406-995-2104 Email: bsfire@imt.net	
<b>Radio Frequencies:</b>			
Transmit	Tone	Receive	
155.700	192.8	158.790 (South Repeater)	
155.815		154.995 (North Repeater)	
154.175		154.175 (Tactical)	
<b>Resources</b>			
<b>Station</b>	<b>Resource</b>	<b>Type</b>	<b>Notes</b>
Meadow Village	Engine	Type 1	Structural
Meadow Village	Ambulance	Type 1	Structural
Meadow Village	Engine	Type 6	Wildland
Meadow Village	Water tender	Type	Both
Mountain Village	Engine	Type 1	Structural

<b>Agency:</b>	Gallatin National Forest	<b>Emergency Number:</b> after hrs. 1-800-326-2454	
<b>Address:</b>	P.O. Box 130 Bozeman, Mt 59771	<b>Contact by:</b> Business number: 406-587-6719 Fax: 406-587-6977 Email: mtbzc/r1_gallatin@fs.fed.us	
<b>Radio Frequencies:</b>			
Transmit	Tone	Receive	
164.825	None	164.825 (Direct)	
164.125	123.0	164.825 (Eaglehead Repeater)	
<b>Resources</b>			
<b>Station</b>	<b>Resource</b>	<b>Type</b>	<b>Notes</b>
West Yellowstone	Smoke jumpers	Type 1	A national resource
West Yellowstone	Air tanker	Type 1	A national resource Mid-July - September
Squaw Creek	Helicopter w/5	Type 3	Mid-July - September
<b>Resources located on the West Zone</b>			
<b>Station</b>	<b>Resource</b>	<b>Type</b>	<b>Notes</b>
Bozeman	Engine 6-1	Type 6	Mid-May - end September
Bozeman	Engine 6-2	Type 6	Mid-May - end September
Bozeman	Prevention, P6-1	Type 6	w/50 gallon slip-on
Big Sky	Engine 6-3	Type 6	Mid-May - end September
West Yellowstone	Engine 7-1	Type 6	Mid-May - end September
West Yellowstone	Prevention P7-2	Type 6	w/50 gallon slip-on

<b>Agency:</b> Madison Valley RFD		<b>Emergency Number:</b> 911	
<b>Address:</b> P.O. Box 278 Virginia City, MT 59755		<b>Contact by:</b> Business number:406-843-5301 Fax: 406-843-5351 Email:	
<b>Radio Frequencies:</b>			
Transmit	Tone	Receive	
155.625	141.3	155.025	
154.070	None	154.070 (Red)	
<b>Resources</b>			
<b>Station</b>	<b>Resource</b>	<b>Type</b>	<b>Notes</b>
Ennis	Engine 721	Type 1	Structural 1000 gal. tank & 1000 gpm
Ennis	Engine 722	Type 2	450 gal. tank & 750 gpm
Ennis	Engine 723	Type 5	Wildland 4x4 1200 gal. tank & 350 gpm
Ennis	Water Tender 724	Type 3	1800 gal. tank & 350 gpm
Ennis	Engine 726	Type 6	Wildland 4x4 250 gal. tank & 250 gpm
South Valley	Engine 725	Type 2	Structural 750 gal. tank & 750 gpm

<b>Agency:</b> Madison County DES	<b>Emergency Number:</b> 911	
<b>Address:</b> P.O. Box 278 Virginia City, MT 59755	<b>Contact by:</b> Business number: 406-843-5301 Fax: 406-843-5351 Email: jallhands@3rivers.net	
<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
155.025	141.3	155.025
153.935	141.3	155.025

<b>Agency:</b> Madison County Sheriff	<b>Emergency Number:</b> 911	
<b>Address:</b> P.O. Box 278 Virginia City, MT 59755	<b>Contact by:</b> Business number: 406-843-5301 Fax: 406-843-5351 Email:	
<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
155.025	141.3	155.025
153.935	141.3	155.025

<b>Agency:</b> Gallatin County DES	<b>Emergency Number:</b> 911	
<b>Address:</b> P.O. Box 640 Bozeman, MT 59771-0640	<b>Contact by:</b> Business number: 406-582-2350 Fax: 406-582-2355 Email: aholdt@Bozeman.net	
<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
155.820		155.820 (Brown)

<b>Agency:</b> Gallatin County Sheriff	<b>Emergency Number:</b> 911	
<b>Address:</b> 615 S. 16th Bozeman, MT 59771	<b>Contact by:</b> Business number: 406-582-2000 Fax: 406-582-2100 Email:	

<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
155.700	192.8	158.790 (South Repeater)
155.815		154.995 (North Repeater)

<b>Agency:</b> Madison County Fire Warden	<b>Emergency Number:</b> 911
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<b>Address:</b> P.O. Box 278 Virginia City, MT 59755	<b>Contact by:</b> Business number: 406-843-5301 Fax: 406-843-5351 Email:
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<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
155.025	141.3	155.025
153.935	141.3	155.025

<b>Agency:</b> Dillon Unit - DNRC	<b>Emergency Number:</b> 406-683-3975
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<b>Address:</b> 730 N. Montana Dillon, MT 59725	<b>Contact by:</b> Business number: 406-683-6305 Fax: 406-683-3925 Email:
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<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
151.175	None	151.175
151.475	114.8	151.175 (Maurer Repeater)

<b>Agency:</b> Bozeman Unit - DNRC	<b>Emergency Number:</b> 406-587-6719
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<b>Address:</b> 151 Evergreen, Suite C Bozeman, MT 59715	<b>Contact by:</b> Business number: 406-586-5243 Fax: 406-587-9726 Email:
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<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
151.175	None	151.175 (Direct)
159.404	127.3	151.175

<b>Agency:</b> Gallatin County Fire Warden	<b>Emergency Number:</b> 911
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<b>Address:</b> 205 E. Main Street Belgrade, MT 59714	<b>Contact by:</b> Business number: 406-388-4480 Fax: 406-388-6270 Email: belruralfire@mcn.net	
<b>Radio Frequencies:</b>		
Transmit	Tone	Receive
155.815		154.995
154.385		154.385 (Co. Fire Tac)

### Appendix 3. Resources

#### Resources to Utilize For Public & Agency Education

*“Wildfire Are You Prepared?”* - Red Cross, Federal Emergency Management Administration, US Fire Administration

Shelter in Place video

*Field Guide to Evacuation Planning and Implementation*, Mc<sup>2</sup> Consulting, 1994.

Gallatin County & Beaverhead County Emergency Operations Plan - Gallatin and Madison County Department of Emergency Services

Local Government Disaster Information Manual & Chief Executive Officer’s Disaster Survival Kit

Internet - <http://www.firewise.org>

*Fire Protection Guidelines for Wildland Residential Interface Development* - Montana Department of Natural Resources and Conservation & Montana Department of Justice

*“Firewise Landscaping for Woodland Homes”* - Keep Montana Green

*“Protect Your Home and Family From Wildfires”* - Montana Department of Natural Resources and Conservation

*“Wildland Fires”* - Montana Disaster & Emergency Services

*“The Fire Education Team”* - for kids - a flash card game - Department of Interior

*Fire Risk Rating for Existing and Planned Interface Developments* - Montana Department of Natural Resources and Conservation

*Protection of Life and Property from Wildfire*, NFPA 299. National Fire Protection Association, 1991.

*Urban-Wildland Interface Code* - International Fire Code Institute

*Wildland/Urban Interface Fire Hazard Assessment Methodology* - Developed by National Wildland/Urban Interface Fire Protection Program

*"Fire Safe Home"* - California Department of Forestry and Fire Protection.

Extension Forestry Specialist - Forest Stewardship program

*"Burning Issues"* CD-ROM, USDI Bureau of Land Management and Florida State University

*Wildfire Prevention Homeowner's Guide*, USDI Bureau of Land Management

*Fireworks Trunk*, USDA Forest Service.

*The Wildland/Urban Fire Hazard*, ISO Insurance Issues Series, Insurance Services Office, 1997.

*Promoting Community Action: Campaign Strategies and Communication Guidelines*, California Department of Forestry and Fire Protection, 1998.

*WILDFIRE: Feel the Heat*, A Study Guide, Discovery Communications, Inc., 1996

**Fire Retardants Sources:**

Contact your local fire department or your local extension agent.

## Fire Resistant Plants for the Northern Rockies

All plants will burn under extreme fire weather conditions such as drought. Fire resistive plants burn at relatively low intensity, with slow rates of spread and short flame lengths. The following are characteristics of fire resistant plants:

- " Growth with little or no accumulation of dead vegetation — either on the ground or standing upright.
- " Non-resinous plants.
- " Low volume of total vegetation.
- " Plants with a high live fuel moisture — plants that contain a large amount of water in comparison to their dry weight.
- " Drought tolerant plants.
- " Stands without ladder fuels.
- " Plants requiring little maintenance.
- " Plants with woody stems and branches that require prolonged heating to ignite.

The following plants represent some of the common species found in the Northern Rockies that may be used in a fire resistant landscape in wildland/urban interface areas.

### Ground Covers

Creeping Juniper\* (*Juniperus horizontalis*)  
 Cotoneaster-Creeping (*Cotoneaster adpressa*)  
 Mahonia-Creeping (*Mahonia repens*)  
 Phlox-Borialis  
 Sedum-variety  
 Snowberry-occidentalis  
 Strawberry-Somanets  
 Thyme-Creeping (*Thyme serpyllum*)

### Perennials

Hens & Chicks  
 Columbine-Blue (*Aquilegia coerulea*)  
 Lupine  
 Mum-hardy  
 Sedum-variety  
 Shasta Daisy  
 Silver Mounds  
 Yucca (*Yucca glauca*)

### Very Small Shrubs

Almond-Dwarf Russian (*Prunus tenella*)  
 Barberry-Crimson Pygmy (*Berberis thundersgii*)

Cinquefoil-Shrubby or Bush (*Potentilla fruticosa*)  
 Cotoneaster-Rockspray (*Cotoneaster horizontalis*)  
 Cranberry-Dwarf European (*Viburnum opulus 'Nanum'*)  
 Currant-Sticky (*Ribes viscosissimum*)  
 Horsebrush (*Tetradymia canescens*)  
 Silver Sagebrush (*Artemisia cana*)  
 Spirea-Blue Mist (*Caryopteris clandonensis*)

### Medium to Small Shrubs

Almond-Dwarf  
 Barberry-Korean (*Berberis koreana*)  
 Barberry-variety (*Berberis thunbergii*)  
 Burning Bush (*Euonymus 'Compactus'*)  
 Cotoneaster-Many Flowered (*Cotoneaster multiflora*)  
 Currant-Alpine (*Ribes alpinum*)  
 Currant-Golden (*Ribes aureum*)  
 Dogwood-Redtwig (*Cornus stolonifera*)  
 Hydrangea-Hills of Snow (*Hydrangea arborescens 'Grandiflora'*)  
 Lilac-Early Korean (*Syringa oblata dilatata*)  
 Potentilla-Variety (*Potentilla* spp.)  
 Roses  
 Sandcherry (*Prunus besseyi*)  
 Snowberry (*Symphoricarpus albus*)  
 Spirea-variety (*Caryopteris* spp.)

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### Tall to Medium Shrubs

Alder-Thinleaf (*Alnus sinuata*)  
Buffaloberry-Silver (*Shepherdia argentea*)  
Burning Bush (*Euonymus alatus*)  
Chokecherry (*Prunus virginiana*)  
Cranberry-European Highbush (*Viburnum opulus*)  
Cranberry-Highbush (*Viburnum trilobum*)  
Elder-American (*Sambucus canadensis*)  
Honeysuckles (*Lonicera* spp.)  
Lilacs (*Syringa vulgaris* and others)  
Mountain Ash-Green's (*Sorbus scopulina*)  
Plum-Flowering (*Prunus triloba*)  
Serviceberry (*Amelanchier alnifolia*)  
Silverberry (*Elaeagnus commutata*)  
Willow-Silver Leaf

### Small Trees

Cherry-Black  
Crabapples-dwarf (*Malus* spp.)  
Lilac-Japanese Tree (*Syringa amurensis japonica*)  
Maple-Amur (*Acer ginnala*)  
Plum-Wild (*Prunus americana*)  
Willow-Native

### Medium to Small Trees

Apple  
Chokecherry (*Prunus virginiana melanocarpa*)  
Crabapple (*Malus* spp.)  
Elm-Siberian (*Ulmus pumila*)  
Maple-Norway (*Acer platanoides*)  
Mountain Ash- (*Sorbus* spp.)  
Olive-Russian (*Elaeagnus angustifolia*)  
Plum-American (*Prunus americana*)

### Tall to Medium Trees

Alder-Mountain (*Alnus tenuifolia*)  
Ash-variety (*Fraxinus* spp.)  
Aspen-Quaking (*Populus tremuloides*)  
Black Locust (*Robinia pseudoacacia*)  
Birch-variety (*Betula* spp.)  
Elm-American (*Ulmus americana*)  
Maple-Silver (*Acer saccharinum*)  
Mountain Ash (*Sorbus aucuparia*)  
Poplar  
Willow-Peachleaf (*Salix amygdaloides*)

\* A good ground cover for erosion control if used away from the home.

# LANDSCAPING & DEFENSIBLE SPACE

## LANDSCAPING AND DEFENSIBLE SPACE CHECKLIST

When designing and installing a fire resistant landscape, consider the following:

- " Area fire history.
- " Site location and overall terrain.
- " Prevailing winds and seasonal weather.
- " Property contours and boundaries.
- " Native vegetation.
- " Plant characteristics and placement (duffage, water and salt retention ability, aromatic oils, fuel load per acre, and size). See Fire Resistant Plants.
- " Irrigation requirements. **Consider having your irrigation system designed to provide perimeter fire protection to your yard and home.**

To create a fire resistant landscape, remember that your primary goal is fuel reduction. Initiate the zone concept, Zone A is the closest to the structure; Zones B & C move progressively further away from the home.

- " Zone A consists of the area from immediately adjacent to the home out to a distance of approximately five (5) feet. Fire resistant plants should be used here. Plants should meet the characteristics of fire resistant vegetation. See Fire Resistant Plants.
- " Zone B extends from approximately five (5) feet to about thirty (30) feet from the home. This well-irrigated area encircles the structure for at least 30 feet on all sides, providing space for fire fighting operations in the event of a wildland/urban interface fire. Place low-growing plants and well-spaced trees in this area, remembering to keep the fuel volumes low.
- " Zone C is the area outside of the primary landscaped area of the yard and is probably kept as a natural area. Thin selectively here, and remove the highly flammable vegetation.

Also remember to:

- " Be sure to leave a minimum of 30' around the home to accommodate fire fighting operations.
- " Carefully space the trees you plant. Remember no tree crown should be within 10' of the roof of your home.
- " Remove the "ladder fuels" — vegetation that is a link between the ground fuels and the trees.
- " Give yourself added protection with "fuel breaks" like driveways, gravel walkways, and lawns.

When maintaining a fire resistant landscape:

- " Keep trees and shrubs pruned. Prune all trees up to 15' or  $\frac{1}{3}$  of the live crown height.
- " Remove needles and dead and overhanging branches.
- " Mow and water lawn regularly.
- " Dispose of cuttings and debris promptly, according to local regulations.
- " Store firewood away from the home during fire season.
- " Be sure your irrigation system is well maintained.
- " Use caution when refueling garden equipment and maintain it regularly.
- " Become familiar with the Homeowners Association requirements for defensible space, vegetation management and other fire safety requirements.

For additional information on living in a wildland/urban interface area, see the Firewise home page: [www.firewise.org](http://www.firewise.org) or contact your local fire department.



# CONSTRUCTION CHECKLIST

When designing and constructing a fire resistant home, consider the following:

- “ Choose a location giving due consideration to a wildland fire.
- “ Design and build a fire resistant structure.
- “ Employ fire resistant landscaping and maintenance.

To select a firewise location, observe the following:

- “ Slope of the terrain; be sure to build on the most level portion of your site, since fire spreads rapidly, even on minor slopes.
- “ Set your home at least 30' back from any ridge or cliff; increase the distance if your home is higher than one story.

In designing and building your fire resistant home, remember that the primary goals are fuel and exposure reduction:

- “ Use construction materials that are fire-resistant or non-combustible whenever possible.
- “ For roof construction, using materials such as Class-A asphalt shingles, slate or clay tile, metal, cement and concrete products, or terra-cotta tiles.
- “ Constructing a fire resistant sub-roof can add protection, as well.
- “ For exterior wall coverings, fire resistive materials such as stucco or masonry are much better than vinyl which can soften and melt.
- “ Consider both the size and materials for your windows; smaller panes hold up better in their frames than larger ones, double pane glass and tempered glass are more effective than single pane glass; plastic skylights can melt.
- “ Cover windows and skylights with non-flammable screening shutters.
- “ To prevent sparks from entering your home through vents, over exterior attic and underfloor vents with wire mesh no large than ¼ of an inch; make sure undereave and soffit vents are closer to the roof line than the wall; and box in eaves, but provide adequate ventilation to prevent condensation.
- “ Include a driveway that is wide enough — 12' wide with a vertical clearance of 15' and a slope that is less than 12% — to provide easy access for emergency vehicles. The driveway and access roads should be well maintained, clearly marked, and include ample turnaround space near the home. Also consider access to water supply, if possible.
- “ Provide at least two ground doors for safety exits and at least two means of escape — either a door or window — in each room, so that everyone has a way out.
- “ Keep gutters, eaves, and your roof clear of flammable debris.
- “ Make an occasional inspection of your home, looking for problems that may allow a fire to begin on or expose your home to a fire.
- “ See the Landscaping and Defensible Space Checklist.

Any structure attached to the home, such as decks, porches, fences, and outbuildings should be considered part of the home. These structures can act as fuses or fuel bridges, particularly if constructed from flammable materials. Consider the following:

- “ If you wish to attach an all-wood fence to your home, use masonry or metal as a protective barrier between the fence and your home.
- “ Use non-flammable metal when constructing a trellis and cover with high-moisture, non-flammable vegetation.
- “ Prevent combustible materials and debris from accumulating beneath patio decks or elevated porches; screen under roof box in areas below to the ground line with wire mesh no larger than ¼ of an inch.
- “ Make sure an elevated wooden deck is not located at the top of a hill where it will be in direct line of a urban/wildland interface fire moving up a slope; consider a terrace instead.

For additional information on living in a urban/wildland interface area, see the Firewise home page: [www.firewise.org](http://www.firewise.org) or contact your local fire department.

# CONSTRUCTION

## Preparing for an Approaching Wildland Fire

The following checklist will assist you in protecting your property and the lives of your family.

- Evacuate, if possible, all family members not essential to protecting the house, as well as all pets.
- Assign tasks to all family members that will be assisting with protecting the house. These should all be assigned and practiced, if possible, prior to an event.
- Contact a friend or relative and relay your plans.
- Arrange a meeting place and make sure family members are aware of its location.
- Tune into a local radio station and listen for instructions and updates.
- Place vehicles in the garage, have them pointing out, and roll up windows.
- Place valuable papers and mementoes in the car.
- Close the garage door, but leave it unlocked. If you have an electric garage door, disconnect it so that the door can be opened manually.
- Place combustible patio furniture in the house or garage.
- Shut off propane at the tank.
- Wear only cotton or wool clothes. Proper attire includes long pants, long sleeved shirt or jacket and boots. Carry gloves, a handkerchief to cover your face, water to drink, and goggles.
- Close all exterior vents. Seal attic and ground vents with pre-cut plywood or commercial seals.
- Prop a ladder against the house so fire fighters have easy access to the roof.
- Make sure that all garden hoses are connected to faucets and attach a nozzle set on “spray”.
- Soak rags, towels or small rugs with water to use in beating out embers or small fires.
- Inside, fill bathtubs, sinks and other containers with water. Outside, do the same with garbage cans and buckets. Remember that the water heater and toilet tank are available sources of water.
- Close all exterior doors, vents, windows and draw all Venetian blinds, shutters or non-combustible window coverings and heavy drapes.
- Remove lightweight and/or non-fire resistant curtains and other combustible materials from around windows.
- Attach pre-cut plywood panels to the exterior side of windows and glass doors.
- Close all interior doors.
- Open the fire place damper, but place the screen over the hearth to prevent sparks and embers from entering the house.
- Leave a light on in each room to increase the visibility of your home in heavy smoke.
- Turn off all pilot lights.
- Move overstuffed furniture (e.g. couches, easy chairs, etc.) to the center of the room.
- Continually check the roof and attic for embers, smoke, or fire.
- Gather fire tools, such as rakes, shovels, hoses, ladders and hoes.

**Most importantly, STAY CALM!**



## **EVACUATE or SHELTER-IN-PLACE**

### **Factors for Command**

- Current fire behavior and the predicted fire behavior.
  - The intensity of the fire and its threat.
  - The rate of spread of the wildland fire and the likelihood of spotting downwind.
  - The reliability of information about the location and movement of the fire.
  - The time frame of the wildland fire exposure to the homes and residents.
  - The ability to predict the area that is under threat.
  - The ability to predict the time frame for the threat in a particular area.
- The firefighting resources available to stage on the fire.
- Whether a pre-event risk assessment of the land and homes has been completed.
  - The results of a risk assessment - structure construction, location, defensible space, etc., which gives an indication of the safety of the homes and their occupants.
- The training or pre-education that has been completed with the threatened population.
- The age and vulnerability of the threatened population.
- The capacity of the road and transport infrastructure to carry the evacuees.
- The potential for injuries and fatalities that will result from people caught on the roads.
- The cost in lives and property of leaving people and houses unprotected.
- The effect of convergence, both official (firefighters, media) and unofficial (residents, people with other responsibilities for pets, business properties and assets, as well as sightseers).
- The time necessary and availability of communications systems to warn residents of the need for evacuation.
- The ability of residents to receive and understand the information and instructions.
- The unwillingness of individuals to give away their right to self determination, especially to official bodies.

### **Aspects of a “FIRE SAFE HOME”**

When making shelter-in-place decisions, consider these factors as an indication of a “Fire Safe Home”:

- Defensible space practices utilized - a carefully laid out garden with spaces cleared near the house.
- Building and roof construction of non-flammable materials.
- Structure not located in a narrow canyon or on a slope of 30% or more.
- Single story dwelling construction.
- The house should face away from a likely fire path.
- It should not have too many large windows.
- Sealed ventilators, eaves, etc.
- Adequate water, which does not rely on electrically driven pumps to get it to the base of the fire.

## Public Education Strategies

Informational articles in:

- Newspapers and newsletters.
- Big Sky Chamber of Commerce newsletter.
- Big Sky Owners' Association - quarterly newsletter.
- Other Homeowners' Assn. newsletters.
- Water District - semi-annual newsletter.
- School newsletter.
- Southwest Montana Building Industry Association newsletter.
- Montana Architects' Association newsletter.
- Gallatin County Realtors Association or Multiple Listing Service newsletter.
- Insert with water bills.
- Insert with power bills.

Participate in public meetings, including:

- Homeowners' Association meetings.
- Presentations by the Forest Service.
- Community meetings.
- School PTA Meetings.
- Presentations by Gallatin Canyon Consolidated Rural Fire District.
- Service Club Meetings, i.e., American Legion Post 99 and Gallatin Canyon Womens' Club.

Presentations in school for students and teachers.

Fire prevention trading cards for students.

Conduct Smokey Bear and Sparky appearances at public events.

Educational programs for elected officials, agencies, and the identified target audience for new building construction.

Use of model or demonstration projects to show homeowners and developers how to do something, for example, construct a defensible space that is visually pleasing, and will protect the home from a wildland fire.

Identify a key individual in each development, subdivision, or homeowners' association to work with, such as manager, caretaker, or security guard.

Create a visual display model - showing a home and trees on a slope built to scale with defensible space.

Develop an Internet Web site - could include maps of area with high risk zones labeled, information on creating defensible spaces, shelter-in-place steps, self-protection measures, fire prevention messages, information on prescribed burns, etc. Link to [http://: www.firewise.org](http://www.firewise.org).

Produce interactive video disk computer training program for homeowners and developers about fire safe homes and developments.

Develop a fire safety video targeting wildland fire issues in the Big Sky area and show it on local television stations.

Utilize the many handouts currently available from a variety of sources. These are listed in the appendix under “Resources.”

Youth group projects.

Implement high visibility fire prevention efforts in the following areas:

- Fire prevention patrols during holidays and extreme fire danger periods.
- A fire prevention display at the Big Sky Chamber of Commerce.
- Parades.
- Displays at annual meetings of Homeowners’ Associations.

Make homeowner’s and landowner’s aware of the Cooperative Extension Service program efforts through the Extension Forestry Specialist and Forestry Stewardship program.

Hire a public relations or marketing consultant to help identify the specific audience, design the fire prevention message and deliver it.

Adopt a Volunteers in Prevention program to conduct fire prevention programs in the Big Sky area.

Produce multi-media package program for all entities to utilize in education efforts.

Develop an information package to be:

- sent out with water bills, bank statements, tax bills, homeowners’ notices, etc.
- placed in the building permit office, clerk & recorder’s office and county planning offices, Big Sky Chamber of Commerce, and etc.

Develop and update annually a fire prevention sign plan.

Develop programs to recognize or reward individuals who utilize fire-wise practices.

Pursue corporate sponsorships/partnerships to fund fire prevention programs.

Offer programs as part of continuing education classes for professionals that require re-certification processes - i.e. Realtors, architects, etc.

Work with wildlife biologists to educate about the needed requirements for fire protection and cooperatively develop measures that accomplish both desired wildlife and fire protection needs.

Utilize effective fire information procedures during incidents, while stressing the importance of increased fire prevention

efforts.



## **Appendix 4. Sample Covenants**

### **Introduction**

Most of the privately held land in the Big Sky area within both Gallatin County and Madison County is forested and is thus subject to wildland fires. The purpose of these sample Wildland Fire Protection Covenants is to provide guidelines for use in preparing or amending the Covenants, Conditions and Restrictions governing property owners' associations in the area. For those property owners' associations in the formative process, these sample covenants should be used as the basis for drafting the section(s) of the Covenants, Conditions and Restrictions that pertain to wildland fire protection. Existing property owners' associations should modify these sample covenants as necessary to reflect the specifics of the association such as Existing Covenants, Conditions and Restrictions; By Laws; Dues; Administration; etc.

Property owners' associations should also consult with the Planning Department of the County within which the property subject to the association's jurisdiction is located to determine the regulations governing subdivisions and covenants, particularly those requirements concerned with wildland fire protection and control.

### **Disclaimer**

These sample covenants are not drafted by a lawyer and are not intended to provide legal advice. Each property owners' association should retain its own legal counsel for advice and assistance in drafting legally effective covenants appropriate to the particulars of the association. For these same reasons, these sample covenants are not intended to be adopted by a public body without the advice and assistance of legal counsel. Inasmuch as these sample covenants have not been drafted by a lawyer the use of the permissive terms "should" or "may" are used throughout. Use of the mandatory term "shall" should be determined by each property owners' association with the assistance of legal counsel.

### **Sample Wildland Fire Protection Covenants**

#### **1. Adoption of Wildland Fire Protection Covenants**

Each property owners' association in the area should formally adopt Wildland Fire Protection Covenants as an integral part or section of the overall Covenants, Conditions and Restrictions as may be required by applicable County Ordinances. Each property owners' association should tailor their Wildland Fire Protection Covenants to the specific characteristics of the particular landscape and conditions influencing wildland fire hazards on the property within the purview of the association (See Appendix 4, page 6).

In preparing their Wildland Fire Protection Covenants, the property owners' association should consult with and seek comments and recommendations from the relevant Fire Protection Authority and Jurisdiction (see Section 2), however the authority to approve and amend association documents rests solely with the property owners.

The property owners' association should maintain Common Open Space and other common land and/or improvements under its jurisdiction in a condition consistent with the Wildland Fire Protection Covenants. The

association may restrict the normal use of Common Open Space and other land and/or improvements during periods of high fire danger.

The property owners' association should utilize the technical services of a consulting forester or other consultant with expertise in wildland fire protection, as well as legal counsel in drafting Wildland Fire Protection Covenants for their particular properties.

## **2. Fire Protection Authority and Jurisdiction**

Each property owners' association is located within the jurisdictional boundary of a formally designated Fire Protection Authority, such as the Gallatin Canyon Rural Fire District and the corresponding Madison County jurisdiction). The US Forest Service has jurisdiction over extensive National Forest lands in the area, and the corresponding wildland fire protection authority over such public lands. Each association should consult with the relevant jurisdiction in the preparation of their particular Wildland Fire Protection Covenants. Property owners' associations with authority over property bordering public lands should also consult with the US Forest Service (Fire Management Officer, or other designated staff) in the preparation and/or revision of Wildland Fire Protection Covenants.

## **3. Fire Protection Plan**

Each property owners' association should prepare and adopt a Fire Protection Plan. The Fire Protection Plan should include, but should not be limited to the topics shown in Appendix 4, page 7.

The Fire Protection Plan may be embodied within other management plans of the property owners' association (e.g., Open Space Management, Forestry and Fire Protection, etc.), but should be an identifiable and separate part or section of such plans.

The relevant Fire Protection Authority, and if applicable, the US Forest Service (if public lands border the association lands), should be consulted during the formulation of the plan. The Fire Protection Authority should review and comment on the Fire Protection Plan. Comments made by the Fire Protection Authority on the Final Fire Protection Plan should be forwarded to the county for consideration in the review of applicable projects, including, but not limited to Subdivision Plats, CC&Rs, and Conditional Use Permits.

## **4. Fire Safety Committee**

The property owners' association should formally designate a person or persons, such as the Fire Safety Committee, with the authority to determine compliance with adopted Wildland Fire Protection Covenants and with the Fire Protection Plan. In the event of violations or non-compliance, appropriate sanctions should be applied (see Section 12).

The Fire Safety Committee should conduct periodic inspections of the subject property, both commonly held and in individual private ownership, to determine on-going compliance with the applicable covenants and the Fire Safety Plan. The Fire Safety Committee should review all development proposals and should inspect all completed developments for compliance. The Fire Safety Committee should also review the Wildland Fire Protection Covenants

and the Fire Protection Plan on a bi-annual basis and make recommendations to the association and/or Board of Directors regarding amendments and/or other necessary modifications.

Each property owners' association should determine the composition, requirements, period of service, etc. for the Fire Safety Committee. An association may designate the Board of Directors to serve as the Fire Safety Committee. The Board of Directors or the Fire Safety Committee may also chose to hire a qualified professional or consultant to oversee fire safety activities of the association.

## **5. Construction and Occupancy of Habitable Structures**

All fire control and fire protection measures and/or equipment required as a Condition of Approval for Preliminary Subdivision Plats by the County should be completed and/or installed in accordance with County requirements.

## **6. Road and Driveway Access**

All roads and driveways should be constructed in accordance with County requirements and Fire Protection Authority guidelines and/or standards. The property owners' association should maintain the road system, including emergency access, to ensure access by fire fighting equipment at all times. Individual property owners should maintain private driveways to ensure access by fire fighting equipment at all times. The property owners' association or the individual property owner should notify the Fire Protection Authority of any temporary road or driveway closures. Maintenance, repairs, upgrading, and reconstruction of temporarily closed roads and driveways should occur in a timely manner, and the Fire Protection Authority should be notified when full access is available.

## **7. Fire Safety Equipment**

Fire safety equipment should be provided in accordance with Fire Protection Authority guidelines and standards. The property owners' association should maintain all commonly held fire safety and fire fighting equipment and supporting infrastructure within the purview of the association (such as fuel breaks, fill-sites, storage tanks, water supply systems, wells, hydrants, etc.) in full operating condition and in accordance with approved standards at all times. All equipment and supporting infrastructure should be subject to periodic inspections by the Fire Protection Authority.

The property owners' association should notify the Fire Protection Authority of any shut off or temporary interruption in the proper operation of any fire safety equipment and/or supporting infrastructure system. Maintenance and servicing, repairs, upgrading, and replacement of such equipment or system should occur in a timely manner, and the Fire Protection Authority should be notified when equipment is again in full operating condition and in accordance with approved standards.

## **8. Maintenance of Common Open Space**

The property owners' association should maintain all common open space at a level of fire safety designated in the Fire Protection Plan at all times. Maintenance measures should include, but not be limited to fuel reduction, removal of flammable vegetation along roads, removal of deadfall and slash, etc.

Open fires not contained within a barbecue grill or structure, or as otherwise permitted upon prior approval by the property owners' association should be prohibited.

Fireworks should be prohibited in wildland areas at all times.

During periods of high and extreme fire danger as determined by the US Forest Service, the property owners' association, in consultation with the US Forest Service, may prohibit other activities likely to cause a fire.

## **9. Maintenance of Private Lots**

The individual property owner should maintain all land within the property ownership at a level of fire safety designated in the Fire Protection Plan at all times. Maintenance measures should include, but not be limited to fuel reduction, removal of flammable vegetation along roads, removal of downed woody fuels, maintenance of defensible space in accordance with prescribed standards, etc. Vegetation reduction and clearing should follow the guidelines of the *Fire Protection Guidelines for Wildland Residential Interface Development*.

Open fires not contained within a barbecue grill or structure, or as otherwise permitted upon prior approval by the property owners' association should be prohibited.

Fireworks should be prohibited in wildland areas at all times.

During periods of high and extreme fire danger as determined by the US Forest Service, the property owners' association, in consultation with the US Forest Service, may prohibit other activities likely to cause fire.

## **10. Building Construction and Fire Safety**

All buildings should be constructed to applicable current building standards adopted by the State of Montana and/or the subject County.

Commercial buildings in interface zones should have fire sprinklers. Sprinklers should be installed in accordance with the applicable NFPA fire sprinkler standard or other code currently adopted by the State of Montana or the subject County. Owners of commercial property should maintain all sprinkler systems and other building safety and fire fighting equipment (such as fire extinguishers, standpipes, on-site tanks, etc.) in operative condition at all times. The property owner should notify the Fire Protection Authority of any building fire safety equipment that is shut off or not in full operating condition. Maintenance and servicing, repairs, upgrading, and replacement of such equipment should occur in a timely manner, and the Fire Protection Authority should be notified when equipment is again in operative condition.

Residential buildings not served by a municipal domestic water system or a 10,000-gallon water supply (tank) with approved dry-hydrant type fittings for each building, should have fire sprinklers installed in accordance with the current edition of National Fire Protection Standard 13D. Residential property owners should maintain all sprinkler systems and other building safety and fire fighting equipment located on their respective individual private lots (such as fire extinguishers, on-site tanks, etc.) in operative condition at all times. The property owner should notify the Fire Protection Authority of any building fire safety equipment that is shut off or not in operative condition. Maintenance

and servicing, repairs, upgrading, and replacement of such equipment should occur in a timely manner, and the Fire Protection Authority should be notified when equipment is again in operative condition.

All buildings required to have fire sprinklers as a Condition of Approval, and in which the fire sprinkler system is not maintained in operative condition, should be deemed unsafe and should be abated per provisions set forth in the Covenants.

All roofs should be constructed of Class A or Class B fire-rated materials.

Rain gutters should be periodically inspected and annually cleaned of debris.

Spark arresters should be placed on all fireplace and woodstove chimneys.

All flammable materials should be stored as required by the Uniform Fire Code.

## **11. Funding**

Funding for fire protection and/or fire control measures should be determined by the property owners' association, and may include, but not be limited to dues, grants, gifts, and assessments as permitted under the Covenants, Conditions and Restrictions and/or By-Laws of the association.

## **12. Sanctions**

The property owners' association may bring actions for non-compliance with the Wildland Fire Protection Covenants and the Fire Protection Plan as provided for in the Covenants, Conditions and Restrictions and/or By Laws of the association. Such actions may include, but not be limited to notices, fines, liens, cease and desist orders, entry upon the property to enforce the Covenants, Conditions and Restrictions and/or Fire Protection Plan, and institution of legal proceedings to enforce compliance with the Covenants, Conditions and Restrictions, By-Laws and/or Fire Protection Plan.

## **Factors Influencing Wildland Fire Hazard**

### Vegetation:

- Mixed conifer forest
- Sagebrush
- Grassland
- Exposed rock
- Mosaic of several vegetation types

### Forest Condition (if within forested area):

- Recently Clear Cut
- Young Second-growth
- Mixed-age Stand
- Mature with significant deadfall
- Mature with on-going forest practices including removal of deadfall and slash

### Fire History:

- Occurrence
- Intensity

### Topography:

- Flat, Moderate, and Steep Slopes
- Ridge tops
- River bottoms

### Microclimate:

- Prevailing Winds

### Natural and Artificial Fire Breaks:

- Rivers and Streams
- Highways and Roads
- Existing Firebreaks

## **Contents of Fire Protection Plan**

Identification of Fire Protection Authority and Jurisdiction

Wildland Fire Hazard of Subject Property

Fire History

Existing Degree of Hazard

Wildland Fire Protection Measures—Existing and Proposed

Fuel Breaks

Forest Wildland Fire Safety Measures

Forest Canopy Fuel Management

Forest Floor Fuel Management

Defensible Space

Storage of Flammable Materials

Fire-rated Roofing Materials

Spark Arresters on Chimneys

Wildland Fire Control Measures—Existing and Proposed

Vehicular Access

Location and Capacity of Water Sources

Fill Ponds

Storage Tanks

Hydrants

Fire Sprinklers

Commercial Buildings

Residential Buildings

Other Fire Equipment

Maintenance of Fire Protection and Fire Control Equipment and Measures

Property Owners' Association Responsibility, Authority, and Sanctions

Individual Property Owner's Responsibility and Authority

**Appendix 5. Colorado State Forest Service**

**WILDLAND/URBAN INTERFACE FIRE**

**HAZARD MITIGATION**

**AND**

**RESPONSE PLAN**

**[Name of Subdivision]**

**Prepared by:**

**Date Prepared:**

# Table of Contents

- I. General Information**
  - A. Location**
  - B. Ingress/Egress**
    - 1. Routes
    - 2. Directions
  - C. Size and Status**
  - D. Topographic Features**
    - 1. Slope
    - 2. Aspect
  - E. Home Construction (General)**
  - F. Access (General)**
    - 1. Road System
    - 2. Driveways
  - G. Water Supply**
    - 1. Ponds/Creeks/Draft Points
    - 2. Hydrants
  - H. Utilities**
    - 1. Telephone
    - 2. Electrical
    - 3. Gas
    - 4. Water
  - I. Adjacent Property**
  - J. Hazard Evaluation**
    - 1. Subdivision
    - 2. Individual Lots
    - 3. Structures
- II. Mitigation Recommendations**
  - A. Individual Homeowner Actions**
    - 1. Now
    - 2. When the Fire Occurs
  - B. Subdivision/Homeowner Actions**
  - C. Fire Agency Actions**
  - D. Sheriff's Department Actions**
  - E. Other Agency Actions**
  - F. Adjacent Property**

### **III. Response Plan**

#### **A. Fire Protection Responsibilities**

1. Jurisdictional Agency(s)
2. Incident Command

#### **B. Goals/Objectives**

1. Strategic
2. Tactical

#### **C. Anticipated Problems**

1. Fire Fighter Safety
2. Wildland Fire Watch-Out Situations
3. Interface Fire Watch-Out Situations
4. LCES

#### **D. Expected Fire Behavior**

1. General Narrative
2. Wildland Fire Hazard Mapping
3. Specific Fire Behavior
4. Fire Behavior Characteristics Charts

#### **E. Alarm Response**

1. Agencies
2. Resource levels

#### **F. Radio Frequencies**

#### **G. Structure Defense**

1. General Guidelines
2. Triage Considerations

#### **H. Locations**

1. Command Post
2. Staging Area(s)
3. Safety Zone(s)
4. Helispot(s)
5. Emergency Operations Center
6. Others

#### **I. Evacuation**

1. Procedure
2. Evacuation Route(s)
3. Evacuation Shelter(s)
4. Evacuation Plan

#### **Appendices**

1. Glossary
2. Location Map(s)
3. Subdivision Map
4. Defensible Space Guidelines
5. Others

# Appendix 6. Sample Frequency Sharing Agreement

## Agreement to Share Radio Frequencies Between \_\_\_\_\_ And \_\_\_\_\_

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### Purpose

The purpose of this agreement is to provide for the sharing of specific radio frequencies that are authorized/licensed to each agency. This agreement is needed to provide efficient, cost effective radio communications and support in protecting life and property under the management of the agencies making this agreement.

### Authority

This agreement to share radio frequencies is entered under the authority of the NTIA Manual of Regulations Sections 7.3.1, 7.3.4, and 7.5.1 and FCC Rules and Regulation Part 90, Sections 90.405 and 90.407.

### Agreement

The parties to this agreement hereby agree that the following conditions govern the mutual use of their respective radio frequencies identified in an attachment to this agreement:

1. Each agency shall exercise control and be responsible for all radio transmissions on their authorized/licensed frequency. It shall be possible to immediately terminate the use of a specific frequency when it is deemed necessary by the controlling agency.
2. Local dispatch and management procedures between the agencies of this agreement will be used to provide for orderly control of each other's frequencies.
3. This agreement is for mobile, and portable radios only.
4. A radio frequency list for each agency is attached identifying the operating frequency, tones, power output limitations, and operational information regarding the use of the frequency.
5. Use of the listed frequencies under conditions other than identified in this agreement will be reported as interference, and appropriate action taken.

This agreement may be modified by written amendments with the mutual consent of the agencies.

Unless otherwise provided, this agreement continues indefinitely and is effective as of the date of the signatures. A party can terminate this agreement by providing 30 days written notice.

**Agency:**

**Agency:**

**Signed**

**Signed**

**Title:**

**Title:**

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**Date:**

**Date:**