4. Wildland Fire Management Primer

Introduction

Wildland fire is defined as any fire burning in wildland fuels and includes prescribed fire, wildland fire for resource benefit, and wildfire events. Prescribed fires are planned controlled fires ignited by land managers to accomplish specific natural resource improvement objectives. Fires that occur from natural causes, such as lightning, that are used to achieve management purposes under carefully controlled conditions with minimal suppression costs are known as wildland fire for resource benefits. Wildfires are unwanted and unplanned fires that result from natural ignition, unauthorized human-caused fire, or escaped prescribed fire.

Wildland fires may be further classified as ground, surface, or crown fires (see Appendix B for the glossary of terms). Ground fire refers to burning/smoldering materials beneath the surface including duff, tree or shrub roots, punky wood, peat, and sawdust that normally support a glowing combustion without flame. Surface fire refers to loose fuels burning on the surface of the ground such as leaves, needles, and small branches, as well as grasses, forbs, low and medium shrubs, tree seedlings, fallen branches, downed timber, and slash. Crown fire is a wildland fire that moves rapidly through the crowns and canopy of trees or shrubs. Crown fires are usually the most devastating and dangerous of the three fire types because of their rapid spread rates and difficulty to suppress.

When assessing wildfire hazard and risk, wildfire hazard refers to vegetation or wildland fuel in terms of its contribution to problem fire behavior and its resistance to control. Risk is the probability of an actual ignition of wildland fuels. Values at risk include human welfare, infrastructure, structures, and natural resources that are likely to suffer long-term damage from the direct impacts of a wildfire.

Wildland Fire Behavior

Fire behavior is the manner in which a fire reacts to the influences of fuel, weather, and topography. Fire behavior is typically evaluated at the fire line and described most simply in terms of intensity, flame length, and in rate of forward spread. The implications of observed or expected fire behavior are important components of suppression strategies and tactics, particularly in terms of the difficulty of control and effectiveness of various suppression resources. The fire behavior chart described in the table below is an excellent tool for measuring the safety and potential effectiveness of various fire line resources given a visual assessment of active flame length. The chart is valuable because it infers the relative intensity of the fire behavior to identified action stages for decision makers. Specific trigger points can indicate when to mobilize various resources, change fire suppression strategies, or request additional specialized equipment and/or assistance. It is important to note that the listed categories do not to be used for personnel safety measures. Wildfire events are dangerous and can shift rapidly, putting first responders and staff at risk. According to Wilson (1977), most firefighter fatalities occur in small fires.

Table 2: Fire Behavior Characteristics Chart and Fire Suppressions Interpretations

Flame Length (Ft)	Fire Line Intensity (BTU/Ft/Sec)	Interpretation
0-4	0−100	Fires can generally be attacked at the head or flank by persons using hand tools. Handline should hold the fire.
4-8	100−500	Fires are too intense for direct attack on the head by persons using hand tools. Handline cannot be relied on to hold fire. Equipment such as dozers, engines, and retardant aircraft can be effective.
8-11	500−1,000	Fires may present serious control problems such as torching, crowning, and spotting. Control efforts at the head of the fire will probably be ineffective.
11+	1,000+	Crowning, spotting, and major runs are common; control efforts at the head of the fire are ineffective.

Source: Fireline Handbook Appendix B (National Wildfire Coordinating Group (NWCG) 2006)

Fire risk is the chance of fire starting, as determined by the presence and activity of causative agents (NWCG 2012). Fire hazard is a fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree of ease of ignition and of resistance to control. Fire severity, on the other hand, is the degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time.

The characteristics of fuels, topography, and weather conditions combine to dictate fire behavior, rate of spread, and intensity. Wildland fuel attributes refer to both dead and live vegetation and include such factors as density, bed depth, continuity, density, vertical arrangement, and moisture content. Structures with flammable materials are also considered a vegetation-fuel source.

Fuels may also be described in terms of size. The terms one-hour, ten-hour, one-hundred-hour, and one-thousand-hour timelag fuels refer to the amount of time required for the water content of the fuel particle to reach equilibrium with the ambient environment. This timelag corresponds to the diameter of the fuel particle.

When fire burns in the forest understory or through grass, it is generally a surface fire. When fire burns through the canopy of vegetation, or overstory, it is considered a crown fire. The vegetation that spans the gap between the forest floor and tree crowns can allow a surface fire to become a crown fire and is referred to as ladder fuel.

For fire to spread, materials such as trees, shrubs, or structures in the flame front must meet the conditions of ignitability. The conditions needed are the presence of oxygen, flammable fuel, and heat. Oxygen and heat are implicitly available in a wildland fire. However, if the potential fuel does not meet the conditions of combustion, it will not ignite. This explains why some trees, vegetation patches, or structures may survive a wildland fire and others in the near vicinity are completely burned.

Groupings of trees comprise a mosaic and effective management of the mosaic can influence fuel loads, such as with Pinion/Juniper stands. Forestry managers may increase spacing between groups to reduce potential crown spread. However, in some species of trees, root interdependency is an important element for trees survival (rhizome interactions).

Potential surface fire behavior may be estimated by classifying vegetation in terms of Fire Behavior Fuel Models and using established mathematical models to predict potential fire behavior under specific climatic conditions. Weather conditions such as high ambient temperatures, low relative humidity, and windy conditions favor fire ignition and high-intensity fire behavior. Under no-wind conditions, fire burns more rapidly and intense on upslope than on level terrain. The effects of terrain can be particularly pronounced in steep narrow canyons often referred to as “chimneys” due to their convective characteristics. Wind tends to be the driving force in fire behavior in the most destructive WUI fires. Gusting or sustained winds can be problematic for firefighters.

Ecological Benefits of Wildfire

Lightning-induced fire is a historic component of ecosystems in Garfield County, and its occurrence is important to maintaining the health of rangeland and forest ecosystems. Native Americans used fire as a tool for hunting, improving wildlife habitat, land clearing and warfare. As such, many of the plant species and communities have adapted to recurring fire through phonological, physiological, or anatomical attributes. Some plants, such as lodgepole pine and western wheatgrass, require reoccurring fire to persist.

European settlers, land use policy, and changing ecosystems have altered fire behavior and fuels accumulation from their historic setting. Euro-American settlers in Garfield County changed the historic fire regime in several interrelated ways. The nature of vegetation (fuel) changed because of land use practices such as homesteading, livestock grazing, agriculture, water development, mining, and road construction. Livestock grazing reduced the amount of fine fuels such as grasses and forbs, which carried low-intensity fire across the landscape. Mining activities led to large scale deforestation and removal of individual tree stands that formed the historical forest mosaic. The removal of the naturally occurring vegetation also facilitated the invasion of nonindigenous grasses and forbs, some of which create more flammable fuel beds than their native predecessors. Cheatgrass is an example of an introduced grass that is problematic for firefighters as it is highly flammable and burns rapidly. Because of its continuous nature in many vegetation types it can easily carry fire across the landscape.

In addition, more than a century of fire-suppression has resulted in large accumulations of surface fuels, ladder fuels, and canopy fuels in western forests and shrublands. Fuel loads also increased as forests and shrublands encroached into grasslands. This increase in fuel loading and continuity has created hazardous situations for public safety and fire management, especially when found in proximity to communities. These hazardous conditions will require an array of tools, including prescribed fire and thinning treatments in order to manage vegetation to more desirable situations.

Prescribed Fire

Prescribed fire is a, typically small scale, planned fire and may be used as a resource management tool under carefully controlled conditions. This includes pre-treatment of the fuel load and close monitoring of weather and other factors. Prescribed fire ultimately improves wildlife habitat, helps abate invasive vegetation, reduces excess fuel loads, and lowers the risk of future wildfires in the treatment area. These and other fuel management techniques are employed to protect human life, economic values, and ecological values. The use of prescribed fire in the WUI is carefully planned and enacted only under favorable weather conditions and must meet air quality requirements of the Colorado Department of Public Health and Environment (CDPHE) Air Pollution Control Division (CAPCD). Burn Permits are required to conduct prescribed fires and can be obtained through the local FPD. Residents living outside a FPD may obtain a Burn Permit from the Garfield County Sheriff's Office.

Prescribed fire may be conducted either in a defined area, as a broadcast burn, or in localized burn piles. Broadcast burns are used to mimic naturally occurring wildfire but only under specific weather conditions, fuel loads, and expert supervision. Burn piles are utilized to dispose of excess woody material after thinning if other means of disposal are not available or are cost-prohibitive.

Hazardous Fuels Mitigation

Wildfire behavior and severity are dictated by fuel characteristics, weather conditions, and topography. Because fuel is the only variable of these three that can be practically managed, it is the focus of many mitigation efforts. The objectives of fuels management may include reducing surface fire intensity, reducing the likelihood of crown fire initiation, reducing the likelihood of crown fire propagation, and improving forest health. By breaking up vertical and horizontal fuel continuity in a strategic manner, fire suppression resources are afforded better opportunities to control fire rate of spread and contain wildfires before they become catastrophic. These objectives may be accomplished by reducing surface fuels, limb branches to raise canopy base height, thinning trees to decrease crown density, and/or retaining larger fire-resistant trees.

Improperly implemented fuel treatments can have negative impacts in terms of forest health and fire behavior. Aggressively thinning forest stands in wind-prone areas may result in subsequent wind damage to the remaining trees called wind-throw. Thinning can also increase the amount of surface fuels and sun and wind exposure on the forest floor. This may increase surface fire intensity if post-treatment debris disposal and monitoring are not properly conducted. The overall benefits of properly constructed fuelbreaks are, however, well documented.

The WUI is the zone where communities and wildland fuel interface, and is the central focus of this CWPP. Every fire season catastrophic losses from wildfire plague the WUI. Homes are lost, businesses are destroyed, community infrastructure is damaged, and most tragically, lives are lost. Precautionary action taken before a wildfire strikes often makes the difference between saving or losing a home.

Creating a defensible space around a home is an important component in wildfire hazard reduction. Defensible space is defined as an area around a structure where fuels have been treated, thinned, or removed in order to reduce wildfire intensity as it moves towards a structure. Defensible space reduces the chances of a structure fire moving to the surrounding wildlands, and to provide room for firefighters to do their jobs. Providing an effective defensible space can be as basic as pruning trees, applying low-flammability landscaping, and cleaning up surface fuels and other fire hazards near a home. These efforts are typically concentrated within 100 feet of a home but may significantly vary based on percent of slope adjacent to the structure. The minimum distance is 30 feet from a structure. Recommended guidelines for creating effective defensible space are outlined in the CSFS Home Ignition Zone Guide.

In addition to the creation of defensible space, fuelbreaks may be utilized to this end. These are strategically located areas where fuels have been reduced in a prescribed manner, often along evacuation routes, designated safety zones (for areas with limited evacuation routes) and community access roads. Fuelbreaks may be strategically placed with other fuelbreaks or with larger-area treatments. When defensible space, fuelbreaks, and area treatments are coordinated, a community and the adjacent natural resources are afforded an enhanced level of protection from wildfire.

While reducing hazardous fuels around a structure, it is very important to prevent fire loss. Recent studies indicate that, to a great extent, the structure hardening attributes determine ignitability. A report from the National Fire Protection Association in 2017 noted that home ignition during extreme wildfire is primarily determined by the condition of the home in relation to its immediate surroundings (National Fire Protection Association, 2017). Studies of home survivability indicate that homes with noncombustible roofs and a minimum of 30 feet of defensible space had an 85 percent survival rate. Conversely, homes with wood shake roofs and less than 30 feet of defensible space had a 15 percent survival rate (Foote 1996).

Site Restoration

Many times, it is necessary to seed an area with an appropriate seed mix after a fuel treatment or fire because of the paucity of desirable plant seed or other propagules in the soil or from adjacent undisturbed vegetation. Reseeding the treated area with desirable species can be necessary to combat the establishment of weedy vegetation such as cheatgrass and annual mustards, which can exacerbate hazardous vegetation-fuel situation. Establishing a desirable plant cover as quickly as possible will also reduce the chances for soil erosion and is beneficial to restoring watershed quality and wildlife habitat. The seed mix should be adapted to the ecological conditions of the site and meet land management objectives. An appropriate seed mix can be developed through discussions with the CSFS, local conservation district, or Natural Resources Conservation Service (NRCS).

THIS PAGE INTENTIONALLY BLANK