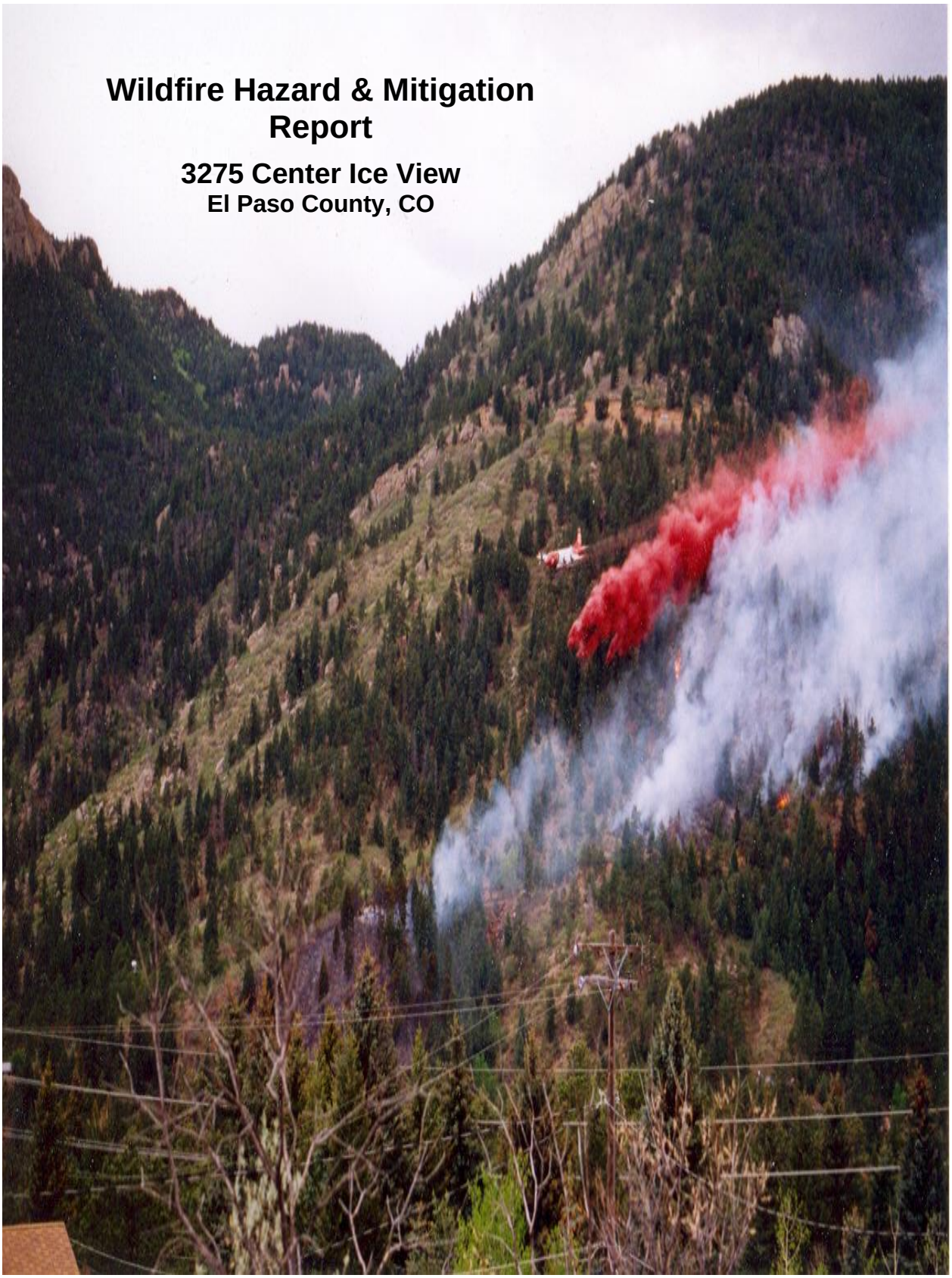
Wildfire Hazard & Mitigation Report

3275 Center Ice View

El Paso County, CO



Wildfire Hazard Evaluation Report

For

3275 Center Ice View

El Paso County, CO

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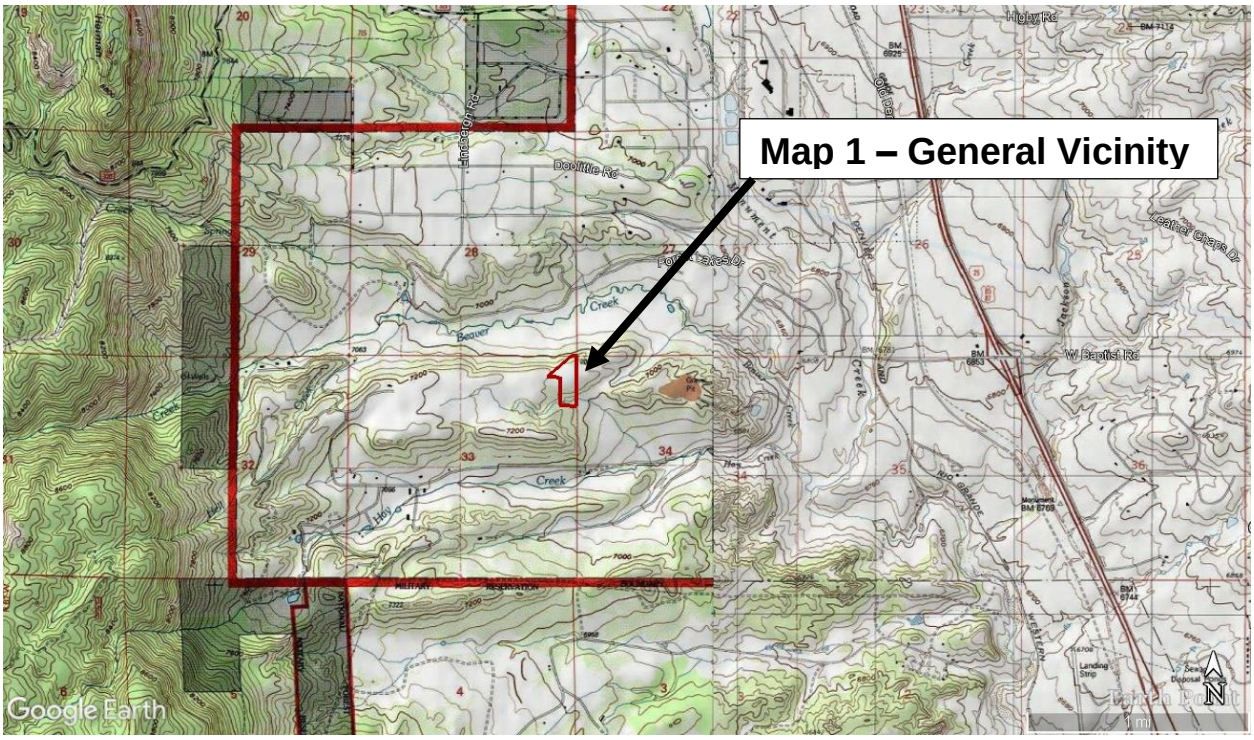
Warning and Disclaimer: The degree of protection from wildfire hazards intended to be provided by this plan is considered reasonable for planning purposes. It is based on accepted forestry and fire science methodology. This plan is intended to aid the Hay Creek Valley subdivision in minimizing the dangers and impacts from wildfire hazards. Fire is a natural force and a historical part of the ponderosa pine and native grassland ecosystems. Therefore, unforeseen or unknown wildfire conditions, natural or man-made changes in conditions such as climate, vegetation, fire breaks, fuel materials, fire suppression or protection devices, and ignition sources may contribute to future damages to structures and land uses even though properly permitted within designated wildfire hazard areas.

August 2023

General Description

The 3275 Center Ice View is a single residence planned for the Monument area in unincorporated northern El Paso County, Colorado. The development plan proposes the construction of a single structure on 10.54 acres.

The property is located east of Haycreek Road at its intersection with Diamondback and Plateau Drives. The parcel referred to under this report is identified with the El Paso County Assessor's Schedule Number as 7133007024.



The Green Mountain Ranch Estates lies to the south and the west. To the east, the property is bordered by the Dellacroce Ranch, LLC. The north boundary is bordered by the Forest Lakes subdivision and Beaver Creek. .

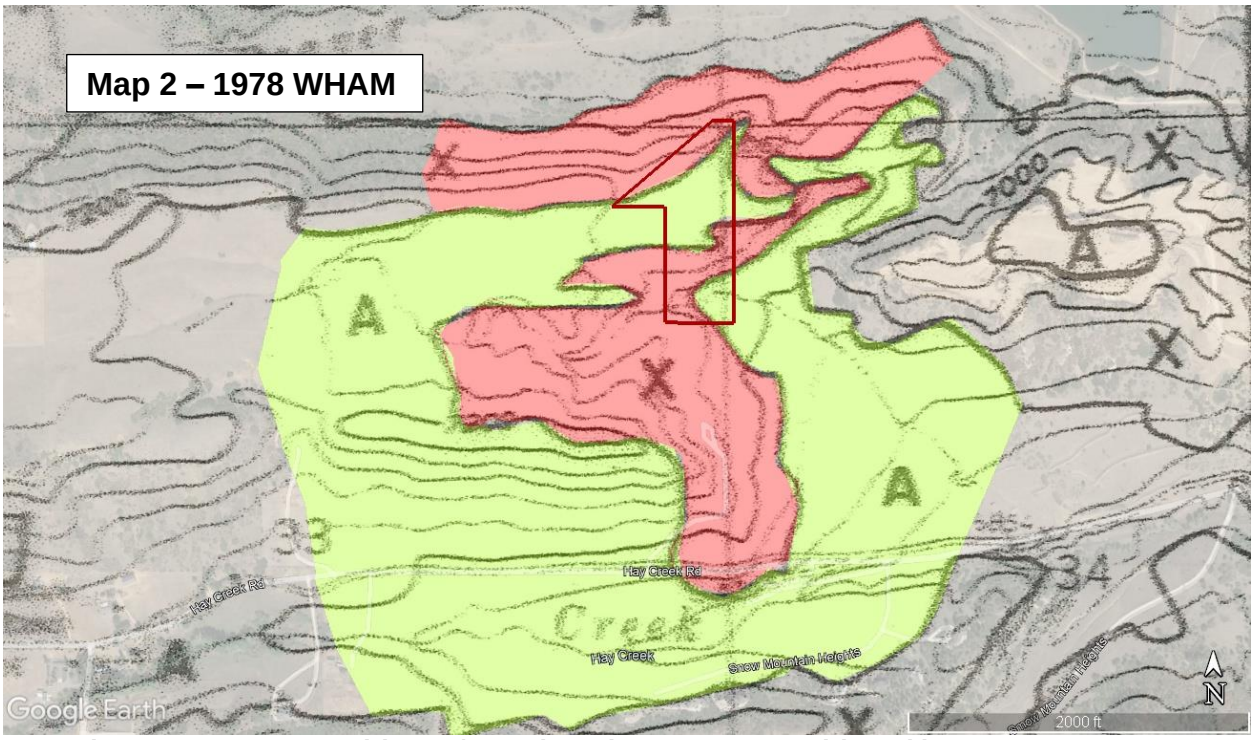
The northern portion of El Paso County area does have a wildfire history. Most notably, the Black Forest Fire burned in June of 2013. It was the most destructive fire in Colorado history until the Marshall Fire in Boulder County in 2021. Over 14,000 acres burned, and 509 structures were destroyed.

Prior to the Black Forest Fire, in 1989, a wildfire ignited below Mount Herman which was referred to as the Berry Fire. On April 14, 2022, a small fire was suppressed in the same

vicinity. Ignitions have repeatedly occurred in the area, with 2022 experiencing several fires occurring along Interstate 25.

Wildfire Hazard

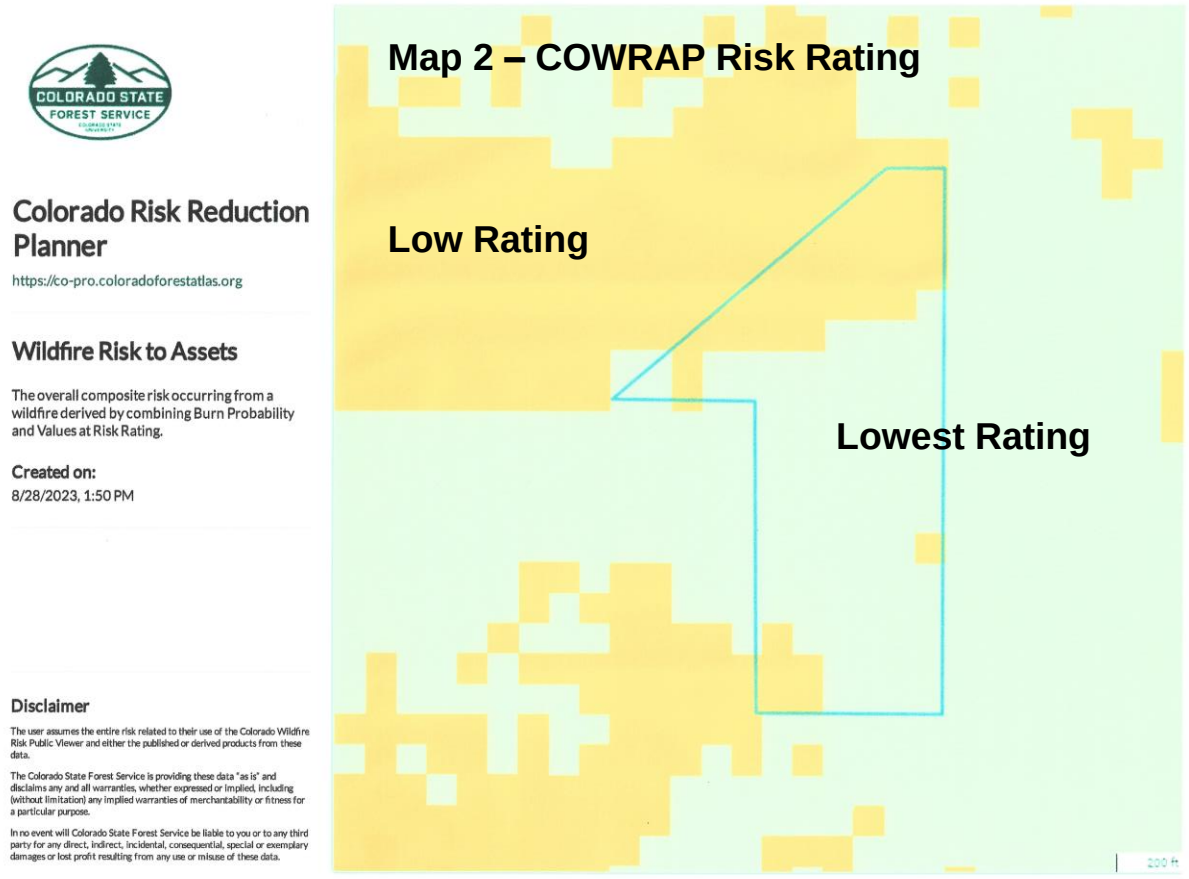
Based upon the Wildfire Hazard Area Map (WHAM) developed by the Colorado State Forest Service (CSFS) in 1978, the site of the proposed residential structure at 3275 Center Ice View contains a low hazard for grass and a severe hazard for brush (see Map 2).



Legend: Green = Low Hazard (Trees/Grass) Red = Severe Hazard (Brush)

Since the publication of this hazard map series, the CSFS developed a wildfire risk assessment tool in 2012 referred to as the Colorado Wildfire Risk Assessment Web Portal (CO-WRAP). This assessment was recently updated to include events up to 2017. The Web Portal is unable to print a full report; the results are summarized here.

Within the assessment report, the Wildfire Risk to the property is classified as low to lowest. Wildfire risk is a composite rating which identifies the probability of loss or harm from a wildfire. Risk identifies the greatest impacts from a wildfire to a range of assets, such as the level of Wildland Urban Interface. Wildfire Risk is determined uniformly across the entire state.



The low rating includes the Gambel oak that is found on the north facing above Beaver Creek. Despite the slope exceeding 25%, up to 30% or more at some locations, the fuel type is composed of short and height stunted Gambel oak. A wildfire in this fuel, coupled with the slope, should spread rapidly but not pose a significant difficulty to suppression response (see Photo 1).

Photo 1. A view of the slope rising out of the Beaver Creek drainage. While it would appear to be a high-risk area, the oak is stunted in height.

The Burn Probability is the annual probability of any location becoming subjected to a wildfire event. The assessment gives the Center Ice View a high ranking in this regard. This is not unexpected due to the number of ignitions locally on private and Federal lands in the local area. The Waldo Canyon Fire of 2012 and the Marshall fire in 2021 weigh heavily on recent memory. The Delacroix Ranch to the east buffers this probability with a low to moderate ranking in the assessment.

One distinction that can be drawn from the assessment is the selection of the fuel models used in determining the wildfire hazard. The WHAM (Map 2) uses a simplistic approach and delineates between grass, shrub and tree fuel beds.

The CO-WRAP assessment uses a detailed and distinct series of fuel models. This is a more dynamic approach, but it does not delineate between smaller fuel beds but considers them uniform across large areas. So even though there may be clusters of shrubs or grasses present, a refined timber fuel model is described incorporating these variations.

A field inspection was performed on August 24, 2023, to determine if any change should be made to the original wildfire hazard area map conclusions or the CO-WRAP assessment. Based upon the field inspection, **the wildfire risk was confirmed as low in the oak brush/ponderosa pine areas and lowest in the grazed meadow area**. There does not appear to be any extreme wildfire hazard as suggested in the WHAM of 1978.

Photo 2. A view looking across the property towards the west. This area is composed of a grass fuel which has been impacted by cattle grazing.

Wildfire Behavior

This rating considers the role of the three major components that affect wildfire behavior: fuels, topography and weather. These three components will be examined in relation to the Center Ice View development plan.

Fuels

The area was field checked, and the results of the WHAM were modified and the COWRAP Assessment was confirmed based upon the observed fuel models on the property. The USDA – Forest Service Intermountain Forest and Range Experiment Station in Ogden, Utah, developed these fuel model descriptions. They are used as aids in estimating fire behavior (see Appendix A).

The criteria for choosing a fuel model reflects that a wildfire will burn in that fuel type which best supports that fire and carry its spread to other locations. There may be more than one fuel model represented on any given area of land. In addition, current and expected weather conditions will influence the condition of these fuels.

The Gambel oak stands can be described under Fuel Model 6, “Fires carry through the shrub layer where the foliage is more flammable…but this requires moderate winds greater than 8 mi/hr. Fire will drop to the ground at low speeds or at openings in the stand.” This can be seen on the north facing slope above Beaver Creek (see Photo 1). Note that only a narrow band of the oak is on the property.

These oak stands can be narrowed further under SH5, High Load, Dry Climate Shrub. This fuel load represents approximately 1 acre. Mountain mahogany is also included in this fuel load as well.

The grass land type is broadly considered as Fuel Model 1 where wildfire spread is governed by fine, very porous and continuous herbaceous fuels that have cured or nearly cured. This grassland fuel can further be refined in description as GR2, Low Load, Dry Climate Grass, and GR4, Moderate Load, Dry Climate Grass (see Photo 2).

Both grass fuel models will exhibit a rapid rate of spread anywhere from 13 feet per minute up to 67 feet per minute. In wetter seasons, grass growth may produce flame lengths in the range of 10 – 12 in the moderate load grass (GR4).

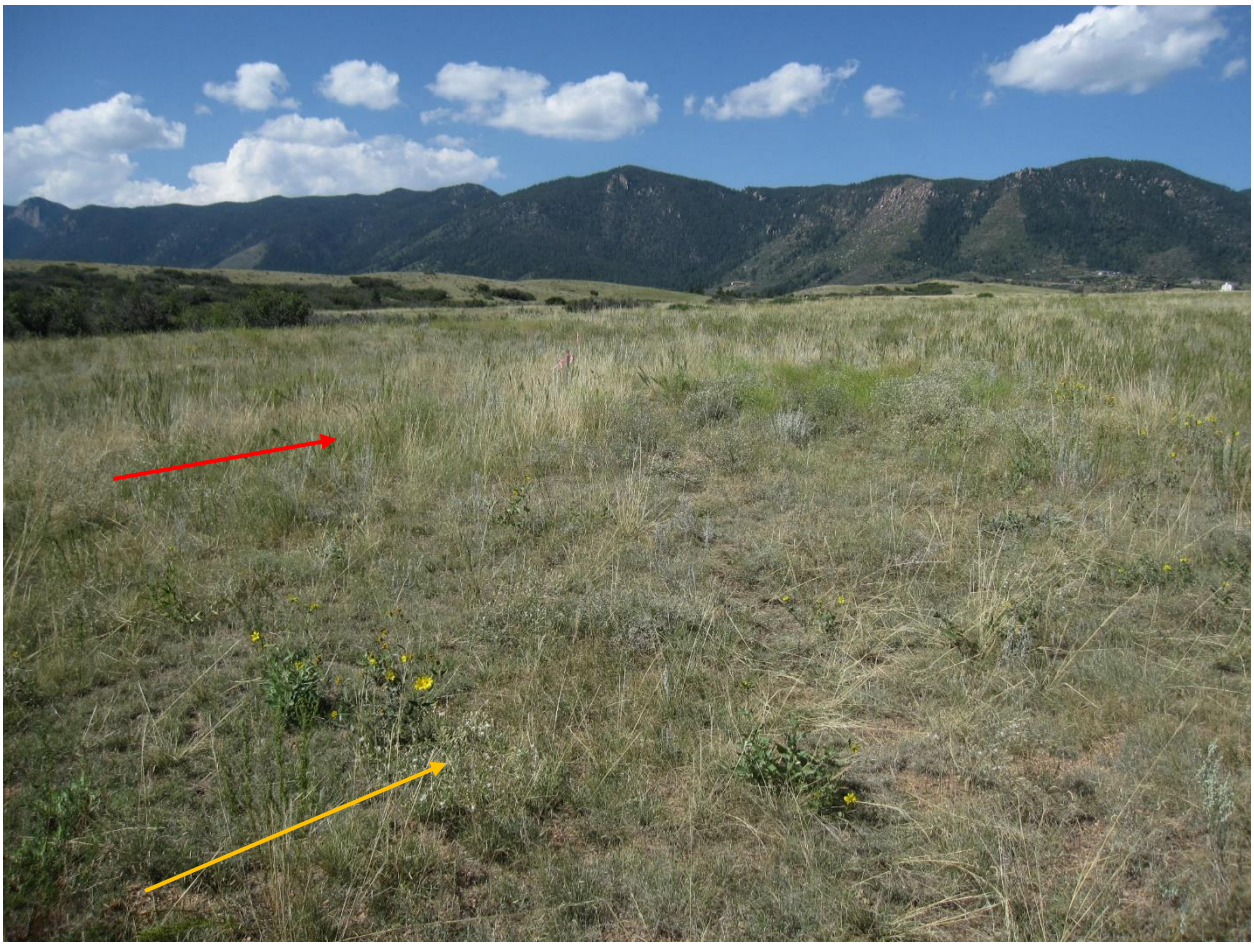


Photo 2. This depicts an example of both grass fuel models. The red arrow is most likely GS4. The yellow arrow represents GS2, low load. This photo was taken overlooking the property towards the west.

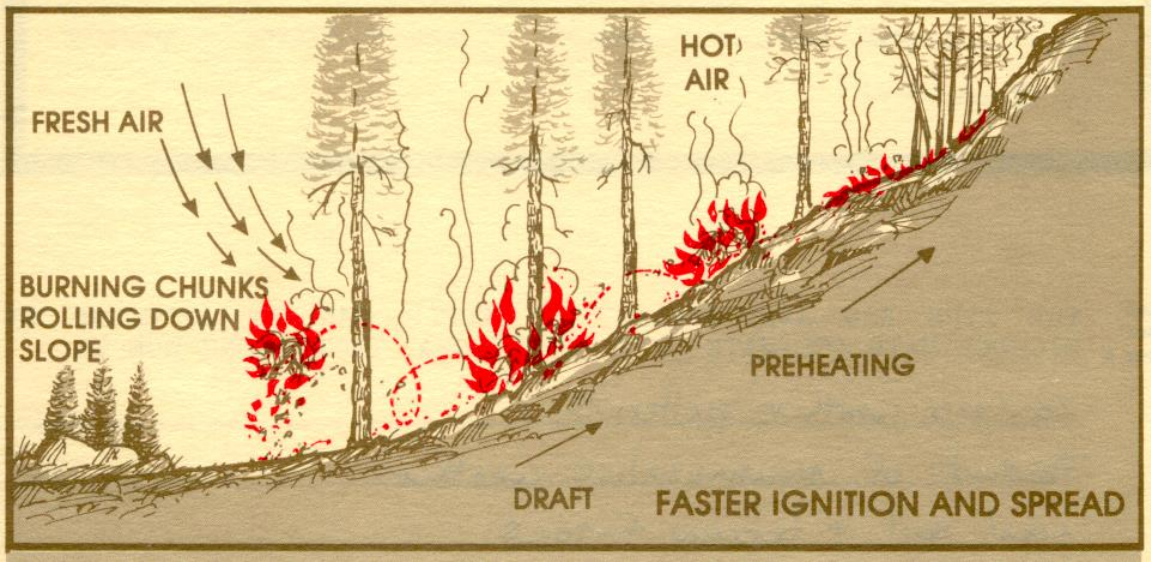
Topography

The topography of the site is one of the main factors that will influence a fire to spread. The aspect or compass direction that any slope faces influence the fuel type that exists and the amount of preheating these fuels receive by the sun. Aspect can also influence the effects of diurnal winds, as they move upslope during the daylight hours and downslope during the evening and early morning hours.

In this instance, one of the most important attributes of topography is the percentage of slope adjacent to where residence is proposed. Although the oak is not found past the top of slope, high intensity flame lengths at the top of the slope could reach upwards of twenty-five (25) feet.

Also, as the percent of slope increases, the rate of fire spread by convection increases. In other words, wildfires burn faster moving uphill (see Figure 1).

Figure 1. Slope Affects Fire Spread

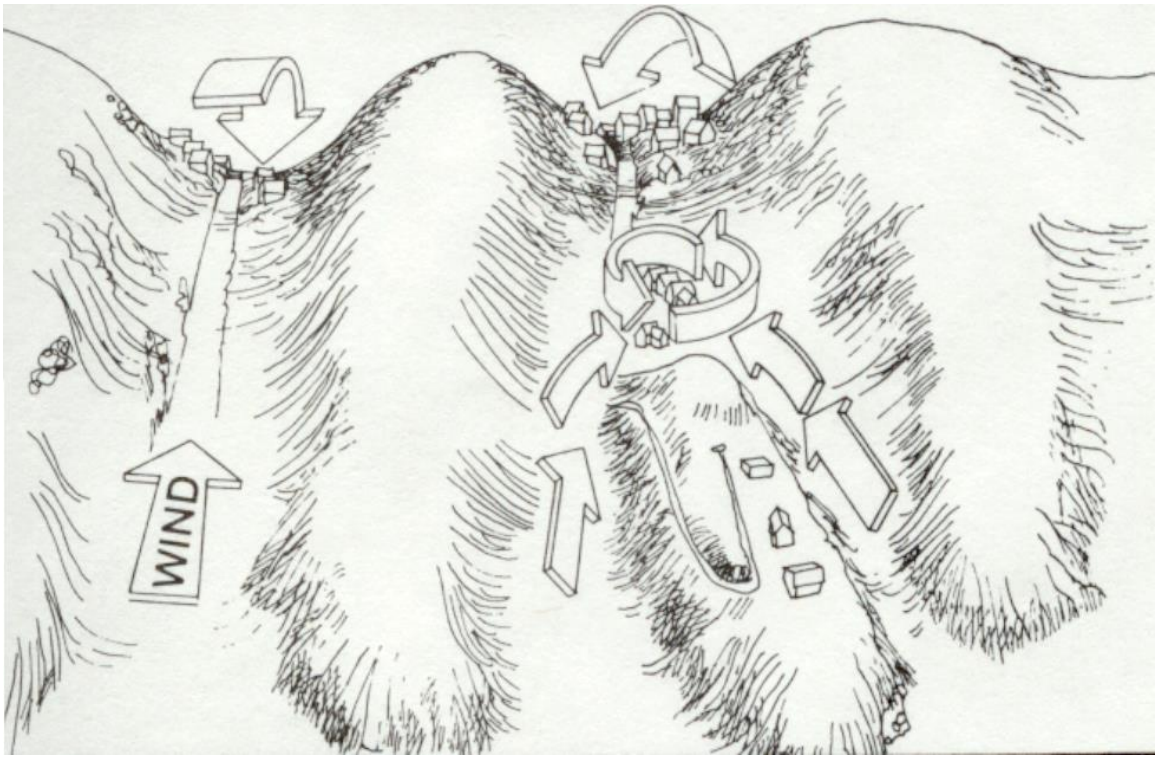


The specific topography of the slopes is steep over a relatively short distance of approximately 130 feet. The adjacent slope ranges in steepness from 20-35%. Slopes more than 25% are considered extreme slopes in their effect on wildfire behavior. The position of the slopes on the southern portion of the property do not pose a significant threat to the location of the proposed residence (see Photo 3).

Conversely, the slope profile within the meadow or grassland going from west to east is about 3.6%. It is less than 1% moving from the edge of the north facing slope southerly to the top of the next drainage.

Figure 2 depicts the effect the drainages or box canyons have on a fire. These topography features tend to funnel a wildfire uphill within a narrow profile and the preheating effect tends to ignite the side slopes of the drainage. Structures placed at the mouth of the drainage are most at risk from wildfire. Placing residential structures at the top of the slopes on the ridgeline should be avoided, where possible.

Figure 2. Drainages Tend to Draw in Fire



Graphic Courtesy of Colorado Springs Fire Department

Weather

Weather is the most variable of all the factors. The accumulative effects of weather over time can influence vegetation curing and fuel moisture content.

Grasses, for example, are described as being one-hour time lag fuels. Time lag is a measure of the rate at which a given dead fuel gains or loses moisture. Hence grasses tend to be influenced by the weather conditions on an hourly basis. Wood fuels that are three inches in diameter or larger are considered 1,000-hour time lag fuels. This type of fuel requires a long period of time of dry or wet weather to affect its combustibility.

Winds can influence the direction and rate of spread of a wildfire. Of greater concern is the short spotting of the fire by embers transported by winds ahead of the main fire.

The effects of wind on a fire were on display most dramatically this past winter (December - 2021) during the Marshall Fire in Boulder County. This fire grew to over 6,200 acres and destroyed 1,084 homes. The wind gusts up to 115 miles per hour where reported. The wildfire reached the town of Superior, three miles away, in just one hour.

It should be noted that this level of high wind activity is not uncommon along the foothills where the proposed residential development is located. Finally, it should not be

assumed that the main periods of fire danger would be in the summer months. As history has shown, out of season fire events are much more common than might be expected by the public.

While the weather may contribute greatly to a wildfire event, it is immune to outside influences.

Photo 3. While this drainage could draw a wildfire uphill, it will burn on the western edge of the property and not directly impact the location of the proposed residence.

Predicted Fire Behavior

Using the USDA – Forest Service BehavePlus fuel modeling system 5.05 , the following predictions can be made based upon an 80-degree temperature day with a relative humidity of 18% with little cloud cover at 1:00 p.m. in the month of July.

Using the inputs of the 1-hour dead moisture being 7%, the 10-hour and 100-hour dead fuels are both set at 10%; live herbaceous (grasses) and live woody stems are set at 200%. This would be an expectation of mid-summer growth. It could be a windy day, or the site is experiencing strong downdrafts from thunderstorms, so the windspeed is set at 20 mph. Slope steepness is set at 1%.

Based on these inputs, a wildfire would spread at a rate of 39.6 feet per hour with a flame length of three-tenths of a foot or about four (4) inches.

If the inputs are changes to reflect a growing season plagued by long term drought, the outcome is decidedly different. The 1-hour dead fuel moisture is lowered to 3%. The 10-hour and 100-hour dead fuels have dried to 5%. The live fuel moisture is 50%, reflecting early dry growing season conditions. The live woody fuel moisture is composed of leaves and fine stems that have matured and is set at 100%, which would normally be a late growing season condition.

The wind speed of 20 mph and a slope of 1% remain the same as in the previous example. With the drier conditions, flame lengths could exceed 27 feet. The rare of spread blows up to over 49,800 feet per hour or 830 feet per minute. Assuming a fire ignited at Haycreek Road, a wildfire could reach the proposed residence in approximately six (6) minutes.

It is predicted that local suppression forces will not be able to contain the initial fire outbreak with mobile engines and hand constructed control lines.

It should be noted that these predictions are based upon normal weather conditions prevailing over the course of a year. Weather conditions that were exhibited during the winter of 2022 have been outside of normal conditions resulting in the catastrophic losses experienced throughout the western United States this past fire season. Again, the Marshall Fire provides an insight into what fire behavior might occur even in the winter season.

If such conditions are present on or in the vicinity of the proposed development site, any wildfire event can be predicted to be more severe and resistant to initial control efforts.

Wildfire Mitigation

It should be noted here that the occurrence of a wildland fire on this property and any subsequent spread of a wildfire to adjacent land could never be eliminated. In the Spaatz Fire, suppression forces were able to arrive on scene in approximately four minutes after the fire was reported. Even with this rapid response, the wildfire reached a size of 67 acres before it was controlled.

The potential for loss can be reduced and the odds can be improved that initial response forces can be successful in keeping a wildfire to the smallest size possible and structure loss to a minimum. But even with the best efforts of suppression forces, there will always exist a level of risk of loss to wildfire.

The only way to reduce the risk of loss from a wildfire is to modify the factors that influence fire behavior. Of the three factors discussed previously, the only factor that could be modified prior to a wildland fire is the fuels. The efforts in modifying fuels can be targeted to their arrangement, continuity and availability.

- **Arrangement**

The arrangement of fuel considers the size, shape and compactness of the fuel itself. Smaller fuel sizes have a greater surface area exposure for preheating. If these smaller sized fuels are only lightly compacted in spacing this results in easier ignition and increased combustion.

Fuels that are tightly compacted and larger in size have lower surface areas. This reduces the ease of ignition and combustion.

One technique in reducing the readily ignitable fuel level would be to remove fuels, such as dead leaves, fallen limbs and other small organic debris, from the proposed development. However, it is not practical to remove these types of fuels from the entire property.

During the construction phase of any residential structure, the most likely source of ignition will come from personnel and activities. These sources of ignition may come from flammable chemicals, improperly discarded cigarettes, shorts in electrical equipment, and other means.

It is suggested here that the reduction of the most ignitable fuel be done in areas that are within fifty feet of the pad of the proposed residence. This will reduce the amount of small, flashy fuel in proximity to the structure. It will also retard the spread of a fire towards adjacent property and provide suppression forces additional time to contain a fire quickly.

Once a residential structure is built, a wildfire safety zone should be established. Wildfire safety zones are intended to slow a fire down so that it may be controlled and extinguished. There are three zones that comprise a wildfire safety zone.

The first zone is the one that contains the most opportunity for modification. The minimum width recommended is thirty feet and is divided into three segments.

As these zones may be unique for each lot that is developed, it is difficult to make specific recommendations here. However, it is recommended that each lot be treated prior to completion of the structure and the issuance of the occupancy certificate.

Specific information on the development of wildfire safety zones is available through the Colorado State Forest Service in the Quick Guide Series Fire 2012-1, *Creating Wildfire-Defensible Zones* at the following link:
https://static.colostate.edu/client-files/csfs/pdfs/FIRE2012_1_DspaceQuickGuide.pdf

It is suggested here that the simplest modification would be periodically mow the grass around the structure out to a minimum distance of one hundred (100) feet (see Photo 4). This will reduce the overall height of the grass and will mimic a compressed fuel bed which does not burn readily.

Photo 4. The grasses could be mowed to a reduced height which will retard a wildfire's rate of spread and intensity. The photo is taken from the end of the easement/property boundary to the east.

- **Continuity**

The second factor affecting fuels that can be modified is their continuity. Is the fuel continuous or patchy in nature? Is the fuel layered in such a manner that it can leave the ground and spread into a vegetative canopy?

In this instance, the fuels in the grass fuel model are continuous. They extend west to east and north to south. Again, mowing the grass out from the residence will create a break in this continuity.

The north facing slope fuels are also continuous in nature. It is a mix of knapweed, grasses, Gambel oak and scattered ponderosa pine (see Photo 5). The bulk of this location is not contained within the property boundary.

Photo 5. Cross view of the north facing slope that borders the property.

- **Availability**

The final consideration is the availability of fuel to physically burn. This factor is influenced by the weather on a daily or yearly basis and cannot be readily influenced.

The current weather patterns have contributed to a long-term drought situation that has influenced the availability of fuels to burn. This year has proven to be an exception with a very wet season with precipitation reaching over 70% of normal. The long-term trend of above average day time temperatures and below normal precipitation levels have allowed fuels to reach a higher state of availability than might normally be the case, particularly during winter months. This may result in wildfire acting in a manner that might be more characteristic of mid to late summer burning conditions.

Other Considerations

Firebrands & Secondary Ignitions

It is becoming more apparent that structure loss is not occurring during the passage of a burning wildfire front but from ignition of the structure by firebrands and secondary ignitions. Firebrands are burning materials or embers that are lifted into the air by convective wind currents. Firebrands can be cast hundreds of feet in advance of the fire front. This was very evident during the Marshall Fire and most recently in the devastation experienced in Lahaina, Hawaii.

Research and case studies in Australia have found that there is a 50% probability of loss of structures that are 100 – 200 feet from the fire front. This would seem to indicate that firebrands are a major contributing factor of structure loss.

In the U.S., studies indicate there is 90% probability that a structure with a non-flammable roof and that is at least 100 feet from the fuel bed will not be lost during a wildfire. However, this statistic may be misleading as the Cedar Fire (CA) in 2003 indicated that 60% -70% of the structures lost were ignited by firebrands. This would also infer that solely relying on 'defensible space' for structure protection may not be adequate.

In a professional paper by Scott (2005), the exposure of a structure to embers and firebrands is discussed. In an inference to fuel mitigation in the 'defensible space' zones, Scott states that "In no case is complete removal of the forest canopy required to mitigate crown fire potential near a structure." This infers that 'defensible space', while a good starting point, may not be the whole solution in preventing structure loss.

Currently, fire-safe construction is the recommended protocol for fire brand risk reduction by the professional wildfire community.

Roads and Driveways

Roads and driveways to the residence should be constructed in accordance with NFPA 1141, *Fire Protection for Planned Building Groups*. Specifically, road widths should not be less than twenty-four feet to allow for simultaneous access of emergency equipment and evacuation.

Driveways should provide a minimum width of twelve feet and a minimum vertical clearance of fifteen feet. The grade of any driveway should not exceed 12%. The entrance to the driveway from the road should not exceed a ninety-degree angle. A turnaround should be provided as access to the residence is over three hundred feet in length. These turnarounds should be within fifty feet of the structure.

The easement road has a length of over one mile from Haycreek Road. It is assumed here that the access will not be paved but will may have either a gravel base or remain an improved dirt track. In either event, it is recommended here that the grass be mowed for sixty (60) feet on either side where possible.

As the road easement could be considered a dead=end roadway, there should be a turnaround at its terminus. The turnaround should have a minimum of one hundred-twenty (120) foot outside diameter. Another option would be to provide turnouts to allow exiting evacuees to yield the road to incoming emergency vehicles. The authority having jurisdiction, Tri-Lakes Monument FPD in this instance, should make the final determination as to what should be required.

The rationale is that individuals attempting to flee a wildfire may very well panic with flames right up against the road. This maintenance may help to enable safe evacuation and provide initial responders with a safe passage as well.

From a detailed wildfire hazard assessment performed in a local subdivision, a common discrepancy found was inadequate or poor visibility of individual residential address numbers. Letters and numbers indicating the residential address should be a minimum of 4 inches in height with a ½" stroke. The numbers or letters should be strongly contrasting with the background color to readily visible from Haycreek Road to delineate the entrance for the property.

Landscaping

The vegetation that is used in the landscaping of the structure should be fire resistant. For example, ornamental junipers can be very flammable and easily ignited by aerial firebrands. Planting these shrubs near the exterior walls of any residential structure provides a readily available fuel source that could threaten the structure and divert suppression forces to protect the building instead of controlling a wildfire.

From the historical fire record of the region, the ignition of ornamental junipers around structures is a major contributor of damage and subsequent loss. **It is strongly recommended that the use of junipers and any other lowing growing ornamental conifer in the landscape be prohibited within thirty feet of a structure's foundation.**

If a native landscape is retained, the use of periodic irrigation helps keep landscapes lush and green, thereby lowering their ability to ignite. There are many irrigation techniques available that can keep plants less susceptible to burning while still adhering to water conservation principles.

Another alternative to irrigated green space would be to line the footprint of the foundation of the structure with rock. If rock is used, it should be placed at a minimum

width of five feet from the foundation. This will prevent flame lengths from reaching the building.

There are many different sizes and types of rock available. It should be noted here that it would be necessary to remove leaves and other litter from within this rock fuel break on an annual basis.

Construction Considerations

As the fuel in this development are grasses, oak leaves and other small woody debris, predictable sources of fuel that will burn and allow entry of a wildfire into the structure will be debris that is trapped under or next to the building or accumulation in the roof gutters. Porch, foundation, roof and attic openings should be screened off or enclosed to keep debris from accumulating and burning underneath. This is particularly important where wooden decks are planned at ground level. This was a factor in the loss of structures in the Waldo Canyon Fire. These location concerns were also expressed in a joint publication by Green Builder Media and the NFPA. This recently released e-book, 'Design with Fire in Mind', can be downloaded using the link. Go to the Resources tab and click on e-books.

It is strongly recommended that all decks that are planned at ground level be required to be sealed off and enclosed to prevent the accumulation of flammable debris underneath them.

In a wildfire risk assessment in a local development, a significant entry point for fire into a house was through the eaves, overhangs or sofits. These locations can trap embers and combustible gas or heat, that can ignite the structure.

Based upon recommendations from FEMA, overhangs, if used, should be enclosed with a flat, horizontal sofit with a one-hour fire resistance rating. The fascia should be constructed of non-combustible material.

The combustibility of a roof is one of the most important factors in determining the risk of a structure to damage or loss from a wildfire. The use of combustible materials such as wood shingles does not necessarily increase their susceptibility to fire. However, as a wood shingle roof ages and is influenced by the weather, individual shingles may start to warp, curl, and lose the tightness that was exhibited upon initial installation.

Siding materials, while not as critical as compared to roof, can help to lower the overall risk of a structure to damage by a wildfire. Where a high wildfire risk exists, the wildfire intensity may ignite combustible siding material.

It is recommended that due to the distance from Haycreek Road to the proposed residence, non-combustible siding materials should be used in construction of the structure.

Due to the increased loss of structures to wildfire events nationwide, there is growing emphasis on 'hardening the structure'. A recent report published by Headwaters Economics discusses the costs of added protection during construction of a residential structure. A copy of the full report can be downloaded at: Construction Costs for a Wildfire Resistant Home, California Edition (headwaterseconomics.org)

The report lists several construction improvements that are relatively inexpensive to install.

Water Supply

The property lies within unincorporated land of El Paso County. At the present time, there is no readily available water supply for ground suppression fire resources. The local fire department will need to rely on water hauled into the site during a fire.

It is assumed that the Tri-Lakes Monument FPD would be the primary resource for an initial attack on a wildfire. Station 4 is located approximatelyfive (5) miles and one-half miles away, at 15415 Gleneagle Drive.

The apparatus available at Station 4 is 1 – Type 1 Engine, 1 – Type 6 Brush Truck and a Water Tender. There would be a total of 4,800 gallons available for suppression during the first response.

Emergency Preparedness

Due to the distance required to evacuate from the property, it may be a option to "Shelter in Place" than risk getting trapped in a vehicle. In the event of a sudden ignition of a fire during high wildfire weather conditions, evacuation may not be possible. Specific information can be obtained at the following web site:
Guide To Staying Safe During Wildfires | SafeHome.org

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Appendix A

Fuel Model Descriptions

Fuel Model 1 Summary Page
Fuel Model 6 Summary Page

Source: Anderson, Hal E. Aids to Determining Fuel Models for Estimating Fire Behavior, National Wildfire Coordinating Group, General Technical Report INT-122, April 1982.

"This report presents photographic examples, tabulations, and a similarity chart to assist fire behavior officers, fuel management specialists, and other field personnel in selecting a fuel model appropriate for a specific field situation. Proper selection of a fuel model is a critical step in mathematical modeling of fire behavior and fire danger rating."

GR2 – Low Load Dry Climate Grass
GR4 – Moderate Load Dry Climate Grass
SH5 – High Load Dry Climate Shrub

Source: Scott, Joe H. & Burgan, Robert E. 2005. Standard fire behavior fuel models: a comprehensive set for use with Rothermel's (1972) surface fire spread model. Gen. Tech. Rep. RMRS-GTR-153, Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 72 p.

"This report describes a new set of standard fire behavior fuel models for use with Rothermel's surface fire spread model and the relationship of the new set to the original 13 fire behavior fuel models."

FUEL MODEL DESCRIPTIONS

Grass Group

Fire Behavior Fuel Model 1

Fire spread is governed by the fine, very porous, and continuous herbaceous fuels that have cured or are nearly cured. Fires are surface fires that move rapidly through the cured grass and associated material. Very little shrub or timber is present, generally less than one-third of the area.

Grasslands and savanna are represented along with stubble, grass-tundra, and grass-shrub combinations that met the above area constraint. Annual and perennial grasses are included in this fuel model. Refer to photographs 1, 2, and 3 for illustrations.

This fuel model correlates to 1978 NFDRS fuel models A, L, and S.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	0.74
Dead fuel load, ¼-inch, tons/acre	.74
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	1.0

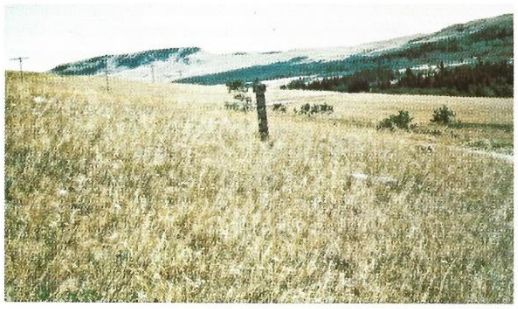


Photo 1. Western annual grasses such as cheatgrass, medusahead ryegrass, and fescues.

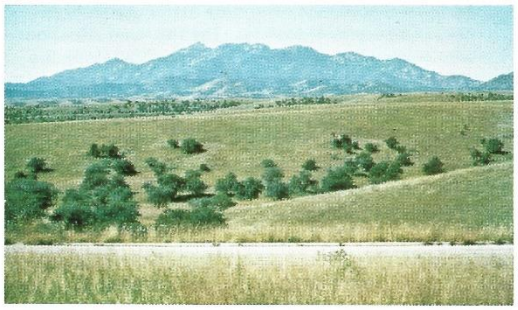


Photo 2. Live oak savanna of the Southwest on the Coronado National Forest.

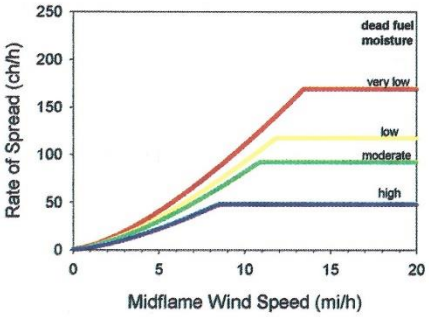
Photo 3: Open pine—grasslands on the Lewis and Clark National Forest

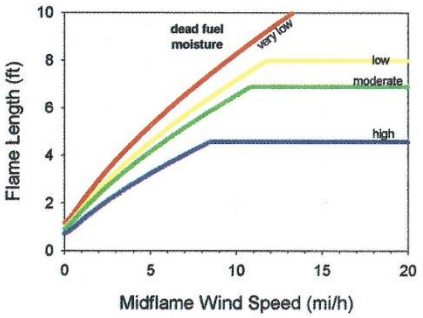
GR2 (102)

Low Load, Dry Climate Grass (Dynamic)

Description: The primary carrier of fire in GR2 is grass, though small amounts of fine dead fuel may be present. Load is greater than GR1, and fuelbed may be more continuous. Shrubs, if present, do not affect fire behavior.

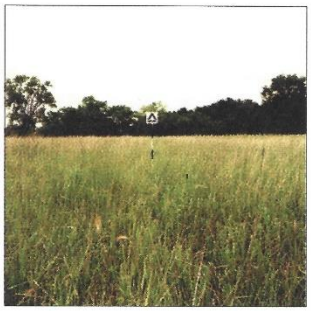
Fine fuel load (t/ac)	1.10
Characteristic SAV (ft-1)	1820
Packing ratio (dimensionless)	0.00158
Extinction moisture content (percent)	15





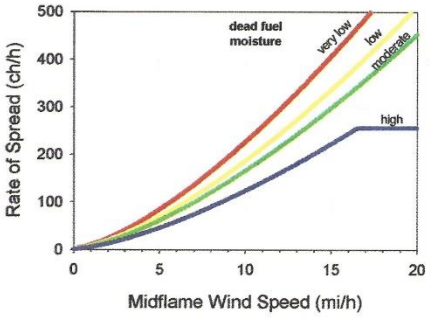
GR4 (104)

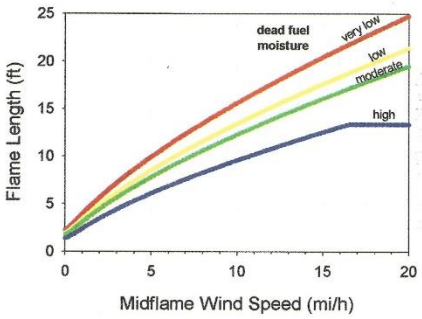
Moderate Load, Dry Climate Grass (Dynamic)



Description: The primary carrier of fire in GR4 is continuous, dry-climate grass. Load and depth are greater than GR2; fuelbed depth is about 2 feet.

Fine fuel load (t/ac)	2.15
Characteristic SAV (ft-1)	1826
Packing ratio (dimensionless)	0.00154
Extinction moisture content (percent)	15





Fire Behavior Fuel Model 6

Fires carry through the shrub layer where the foliage is more flammable than fuel model 5, but this requires moderate winds, greater than 8 mi/h (13 km/h) at mid-flame height. Fire will drop to the ground at low wind speeds or at openings in the stand. The shrubs are older, but not as tall as shrub types of model 4, nor do they contain as much fuel as model 4. A broad range of shrub conditions is covered by this model. Fuel situations to be considered include intermediate stands of chamise, chaparral, oak brush, low pocosin, Alaskan spruce taiga, and shrub tundra. Even hardwood slash that has cured can be considered. Pinyon-juniper shrublands may be represented but may overpredict rate of spread except at high winds, like 20 mi/h (32 km/h) at the 20-foot level.

The 1978 NFDRS fuel models F and Q are represented by this fuel model. It can be considered a second choice for models T and D and a third choice for model S. Photographs 15, 16, 17, and 18 show situations encompassed by this fuel model.

Fuel model values for estimating fire behavior

Total fuel load, < 3-inch dead and live, tons/acre	6.0
Dead fuel load, ¼-inch, tons/acre	1.5
Live fuel load, foliage, tons/acre	0
Fuel bed depth, feet	2.5

Photo 15. Pinyon-juniper with sagebrush near Ely, Nev.; understory mainly sage with some grass intermixed.

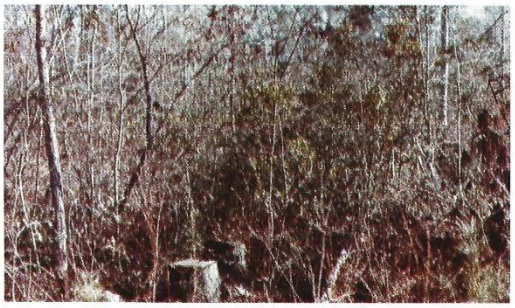


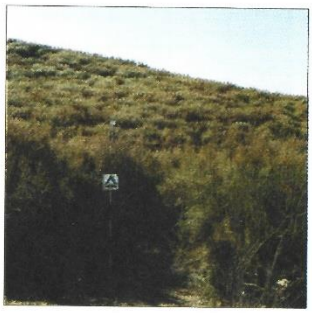
Photo 16. Southern hardwood shrub with pine slash residues.

Photo 17. Low pocosin shrub field in the south.

Photo 18. Frost-killed Gambel Oak foliage, less than 4 feet in height, in Colorado.

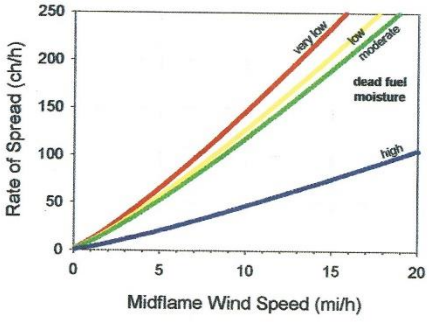
SH5 (145)

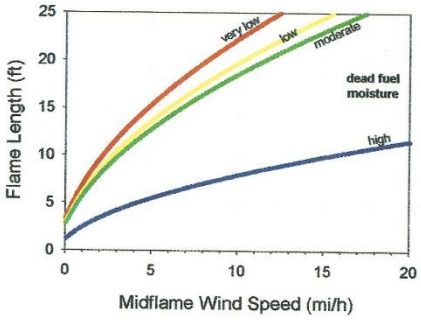
High Load, Dry Climate Shrub



Description: The primary carrier of fire in SH5 is woody shrubs and shrub litter. Heavy shrub load, depth 4-6 feet. Spread rate very high; flame length very high. Moisture of extinction is high.

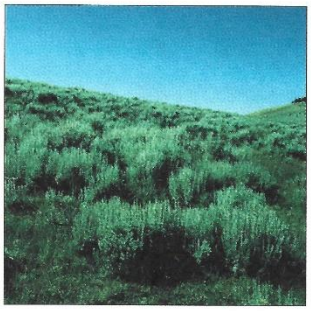
Fine fuel load (t/ac)	6.5
Characteristic SAV (ft-1)	1252
Packing ratio (dimensionless)	0.00206
Extinction moisture content (percent)	15





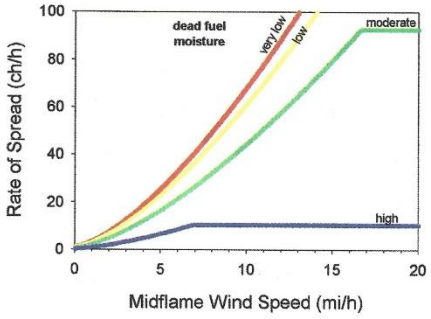
GS2 (122)

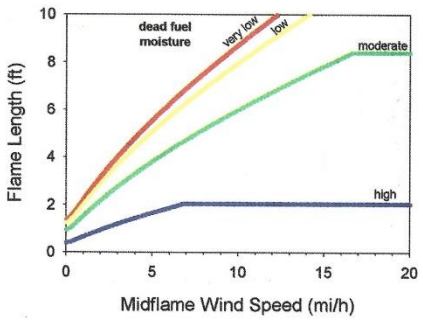
Moderate Load, Dry Climate Grass-Shrub (Dynamic)



Description: The primary carrier of fire in GS2 is grass and shrubs combined. Shrubs are 1 to 3 feet high, grass load is moderate. Spread rate is high; flame length moderate. Moisture of extinction is low.

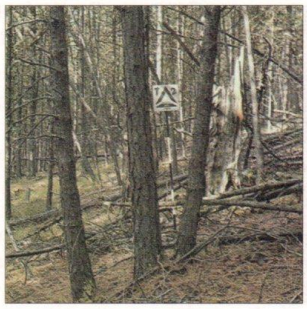
Fine fuel load (t/ac)	2.1
Characteristic SAV (ft-1)	1827
Packing ratio (dimensionless)	0.00249
Extinction moisture content (percent)	15





TL8 (188)

Long-Needle Litter



Description: The primary carrier of fire in TL8 is moderate load long-needle pine litter, may include small amount of herbaceous load. Spread rate is moderate; flame length low.

Fine fuel load (t/ac)	5.8
Characteristic SAV (ft-1)	1770
Packing ratio (dimensionless)	0.03969
Extinction moisture content (percent)	35