Community Wildfire Protection Plan

Fire Response Zone 4

Upper Burgess Creek

Steamboat Springs, Routt County, Colorado

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LSA

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FIRE RESPNSE ZONE 4 - Upper Burgess Creek

COMMUNITY WILDFIRE PROTECTION PLAN

FIRE RESPONSE ZONE 4 – UPPER BURGESS CREEK **(72 + home sites and three condominium units that include another 52 residences)**

1. General Description

Legal Description: T5N, R84W, Sections 22

The Burgess Creek community covers approximately 600 acres. It is located just east of US Highway 40 approximately 2 1/2 miles south east of Steamboat Springs, Colorado. It is adjacent to the northwest boundary of the Steamboat Ski Area. The community's primary access road is Mount Werner Road and Burgess Creek Road. See the attached maps.

The elevation ranges from 7,100 to over 7,500 feet above sea level.

Access within the majority of the community is facilitated by Burgess Creek Road. It is a paved road that enters the community from the southwest side and passes up through the community making an "S" turn within the east side of the community ending at the Steamboat ski area maintenance yard. Spurring off of Burgess Creek Road near the ski area on the east end of the community are Burgess Pines Trail, Kinnikinnick, Trails Edge and Temple Knoll. All are short dead end roads. Trails Edge road is narrow with a short steep drop off from its intersection with Burgess Creek Road. On the north side of the community Ridge Road stems off of Burgess Creek Road and climbs up hill and to the north in an "S" turn pattern ending near the ridge top at the northeast end of the community. The grade for Ridge Road varies from 8 to 13% in steepness. Fox Ridge Lane and Liftline Lane are spur roads off of Ridge Road that dead end less than 400 yards from their point of origin. Liftline Lane is steep (10-15%) and narrow with a small turn around at the end.

2. COMMUNITY ASSESSMENT

Generally, the fire hazard and vulnerability to wildfire within this area is high to extreme depending on the time of year and the fire weather conditions. Because of the fuel type and continuity, steepness of slopes a wildfire in this area, under conditions of very high and extreme fire danger, would have a high resistance to control. A major factor and a modifier to the fire hazard is the condition of the herbaceous material such as grasses, forbs, and deciduous plants like aspen. The Gambel oak can be a major contributor to fire hazard, if frost damaged or during drought, because it can carry a fire at a high rate of spread into nearby structures or into the crowns of coniferous forests. A major contributor to the fire hazard is forest debris build-ups caused by natural tree mortality such as wind throw, insect and disease. In all fire danger conditions the fire hazard in Burgess Creek is exacerbated by the funnel affect on local winds up and down the drainage. During an average year the fire hazard is lowest in the spring and early summer and highest in the late summer and fall.

A. Fuel Hazards

- **Natural Fire Hazards -** Fuels in the area vary greatly between the south and north facing slopes. On most of the south and southeast aspects vertical stringers of large Gambel oak intermingled with patches of aspen dominate the vegetative type. Both vegetative types are associated with chokecherry, serviceberry, and snowberry along with a wide variety of forbs and tall bunch grasses. The most applicable fire behavior fuel models for this vegetative type varies between fuel models 2, 8 and 6 depending on the plant density, leaf moisture content, and season of year. See Appendix B *Primary Fuel and Fuel Hazards*. In other words the Gambel Oak can vary from a moderate to extreme fire hazard depending on the season of the year and whether or not it has received frost damage or been dried by drought conditions. Aspen fuel hazard will vary by the season of the year with the fall season, after the aspen have shed their leaves and the grasses have dried, being the most vulnerable time. The grass cover will serve as a fire behavior modifier when it is green and it will add to the hazard after it has dried. Fuel types on the south facing slopes will undergo the most extreme variations of fire hazard depending on the season of the year and whether or not there is a drought.

  In the drainage bottoms and on the lower elevation north facing (cooler) slopes the vegetative type is predominately large sized lodgepole pine trees (70 to 120 feet tall) with short-needled litter. Pockets of sub-alpine fir and aspen are included. There are patches of debris build up due to insect and disease mortality and wind throw. The amount of debris accumulation and fir understory affect the potential for wildfire to ladder into the crowns of the larger trees. The fuel models best representing this type are 8 and 10 depending on the amount and size of debris distributed on the ground. Small patches of aspen are occasionally present and, except in the fall, this vegetation tends to moderate the fire hazard. Aspen is fuel model 8 in the summer and 9 in the fall after leaf fall. This variety makes a complex patchwork of hazardous fuel loading in the vicinity of the structures. Left untreated this area would pose a high resistance to fire suppression efforts when fire danger is very high or extreme. The fuel hazard on the north facing slopes continues to grow as vertical and horizontal fuel continuity increases and forest debris accumulates. For more information see Appendix A *Fire Effects for Vegetative Types*.

- **Slope -** Slopes range from ten to sixty percent within the Burgess Creek community area. Road grades are range from 5% to 15%. The steep slopes (over 40%) add significantly to burning intensity, rate of spread and spotting potential of a wildfire. Several of the home sites are at the middle or top of steep slopes exacerbating the high hazard and vulnerability of the structures. The “slope factor” on fire hazard is greatly exacerbated by the funnel affect the Burgess Creek drainage has on the local flows of air and wind.

Burgess Creek Condominiums with tall lodgepole pine, fuel models 10 and 8.

View from lower Ridge Road showing Gambel Oak and associated shrubs on steep hillside. This is depicting fuel models 6 and 9.

B. Risk of Ignition and Wildfire Occurrence

- **History -** Up until approximately 80 to 100 years ago fire reoccurrence within this area varied from approximately 100 to 300 years. Over the past 80 to 100 years most of the wildfires have been suppressed causing the landscape to have a greater proportion of older and denser vegetation with fewer interruptions in fuel continuity.

- **Causes** -The primary cause of fires in this community area is lightning. However, as human activities increase the likelihood of accidental ignition by people is increasing.

- **Risk -** Since fire suppression has been a longtime policy within this community area there are fewer places on the landscape where fuel density, fuel continuity, and fuel load have not increased. Therefore, the risk for large wildfire momentum has gradually increased over the years creating dramatic increase in hazard and fire danger during drought years or when the weather is hot and the fuels are dry.

  Risk within Burgess Creek is high to very high due to the fuel continuity coupled with an abundance of flammable debris scattered throughout the community area. When fire danger is very high to extreme and there is wind, a crown fire is highly likely and would be difficult to control.

C. Community Values at Risk

- **Values** - There are over 130 residences in Burgess Creek. Most have heavy fuels nearby and around them. About 20% of structures have recognizable defensible space. Many have flammable material near by, on the porch or under the decks increasing their vulnerability. A few of the structures have wooden shingle or shake roofs. The composition and wooden roofs tend to hold pine needles and forest debris allowing accumulations that also increase vulnerability to fire brands. Most of the structures are vulnerable to wildfire damage occurring from firebrand ignition and/or radiation ignition due to the heavy forest fuels within the area. Many homes are also vulnerable to ignition from the potential radiant heat because of the close proximity of hazardous fuels. ***Home site specifics are provided to each homeowner and available on the Internet through the Steamboat Springs Wildfire Hazard Mapping project (Community Viz and FireWise FPA 1144).***

- **Access -** The primary access road, Burgess Creek Road, is currently the only way into and out of the community. This road is paved and has numerous home site access driveways that intersect with Burgess Creek Road with very sharp turns too narrow for an average size or large vehicle to negotiate without backing up at least once. In fact the intersection of Ridge Road with Burgess Creek has a very sharp turn requiring most large vehicles to back and turn once. Most of the driveway access roads off of Ridge Road require very sharp turns involving at least one back and turn by most vehicles. The abundance of sharp turn requirements makes access to the area difficult for emergency vehicles and creates a situation very likely to interrupt traffic flow and cause traffic flow problems during an emergency.

Most road signs and addresses are in place. However, some of the driveways are narrow and turnarounds are marginal to non-existent at the end of the driveways.

- **Risk** - Because of the natural fuel continuity, steep slopes, the lack of defensible space and limited access the community would be very difficult to protect in the event of a wildfire under very high or extreme fire danger conditions.

- **Evacuation-** Evacuation planning is needed to minimize fire emergency confusion and risk to residents who might be asked to evacuate in the event of an emergency. With a small amount of road improvement work there appears to be at least one additional primary access and egress road available for emergency purposes through the Steamboat ski area along one of the ski trails. This would benefit the residents on the south end nearest the ski area. On the Ridge Trail side of the community an evacuation alternative could be developed with a small loop road added to the end of Ridge Road through the national forest down to the upper end of the Burgess Creek road.

- **Home Site Particulars** - For more information specific to "FireWise" at each home site see ***Steamboat Springs Wildfire Hazard Mapping project*** *(Community Viz and FireWise FPA 1144) available on the Internet.*

D. Local Preparedness and Protection Capability

Routt County has developed a Fire Management Plan, which incorporates federal, state, county and city policies and procedures and facilitates interagency coordination throughout the county. The plan includes, among other things, plans for coordinating fire prevention, training and preparedness, hazard mitigation, suppression within critical wildland urban interface (WUI) areas throughout the county and gives emphasis to the importance of safety. The plan also includes an Annual Fire Operating plan for the county, an annual Tactical Operations Plan and several other plans and policy documents pertaining to specific agencies with fire protection responsibilities.

- **Initial Attack** - The Steamboat Springs Fire Rescue is under contract with Routt County to be the primary responder to wildfire within this area. Steamboat Springs Fire Rescue is trained, equipped and experienced in wildland fire suppression as well as structural fire protection. However, the Steamboat Springs fire department has responsibilities for a Fire District that is approximately 378 square miles in size and includes over 9000 structures within numerous sub divisions as well as several hundred acres of wildland fire hazards involving well over 1500 structures. The primary fire station (Mountain Station) is 2-3 miles downhill from Burgess Creek community.

  The Colorado State Forest Service and the US Forest Service are also primary responders to a wildland interface wildfire. Mutual aid agreements provide a formal structure that encourages a cooperative approach between the county and the state and federal agencies. Through the mutual aid agreement reinforcements will be dispatched to a wildfire depending on the need.

- **Water Availability** - There is a fire protection water hydrant system throughout the entire community. The water supplies vary from 500 and 600 gallons per minute along the Ridge Road area up to 1000 and 2000 gallons per minute along the bottom of Burgess Creek road. Water is also available from the Burgess Creek (which runs from east to west) but its reliability for fire protection during a dry year or late in the fall is questionable.

3. COMMUNITY MITIGATION PLAN

Under each of the following categories the recommendations are listed by priority. Overall the priorities are to 1) Create defensible space where it is not present, 2) Reduce fuel hazard within the community by cleaning up natural forest debris, breaking up horizontal and vertical fuel continuity, 3) Insure alternate emergency evacuation routes.

A. Wildfire Prevention and Fire Loss Mitigation

The purpose of most of these actions is to reduce fuel continuity to the structures, reduce the potential radiant heat and production of fire brands near each structure, and to reduce the vulnerability of each structure.

1. Emphasize landowner’s responsibilities to create a fire resistant community and the urgent need for each of them to **create defensible space** for their individual home sites.

2. Assist residents to be more informed and to implement “FireWise” recommendations utilizing the ***Steamboat Springs Wildfire Hazard Mapping project*** developed for each home site structure group within the community and available on the internet. Insure homeowners are informed about cost sharing opportunities.

3. Expand defensible space and do fuel hazard reduction including thinning and pruning within 150 to 200 feet of buildings. Thin the areas adjacent to the home sites to achieve spacing of 12 to 20 feet between trees or large brush stems and remove all slash and natural forest debris The extent and size of the area to be treated varies with height of vegetation, steepness of slope and distance from structures. The purpose for this is to interrupt large fire momentum and reduce potential for fire to spread at a rapid rate or propagate into tree canopies and Gambel oak brush tops.

4. Establish a central slash disposal or pickup system for the community: as an example dig one or two slash disposal pits for piling and burning and eventually cover and rehabilitate the site.

B. Fuel Hazard Reduction

The treatment of fuel hazards for this community should be a high priority. For it to be effective it must be a coordinated effort between the community, the County, the State and the Forest Service. The fuel treatment projects should be designed at a community scale through interagency, community and property owner coordination. The distance and extent of hazard reduction for each project depends on steepness of slope, height and density of vegetation, and distance from structures. The purpose for most of these proposals is to interrupt the potential for large fire momentum and reduce potential for fire to spread at a rapid rate or propagate into tree canopies and Gambel oak brush tops. The following are the actions that should be taken by priority. ***The first item should be coordinated with the defensible space work being conducted throughout the community.***

1. Implement an intra-community fuel hazard reduction program to reduce the potential wildfire intensity and momentum with the following actions:

    - Thin and reduce, with the creation of small clearings, the presence of Gambel Oak 200 feet below structures and below Lift Line and Ridge roads and within 100 feet along contour or above structures and roads. Herbicide may be needed to control Gambel oak sprouts. Encourage moderate regeneration of aspen in these areas. The small clearings should resemble the Forest Service clearings and thinning in upper Burgess Creek just beyond the east end of Ridge Road.

    - Continue to maintain “cleanup” of lodgepole pine debris accumulated from annual windthrow in the Burgess Creek drainage area between the drainage bottom and the Burgess Pines Trail.

    - Within 100 to150 feet of the travel ways treat fuels along forested segments of roads and driveways by thinning to achieve a 40 percent tree canopy cover, pruning up to 15 feet above the ground and removing slash, forest debris, and anything flammable. The roads are strategic facilities needed for evacuation and suppression operations.

2. Develop a fuelbreak 100 to 150 feet or more wide, with crown closures less than forty percent, between the conifers on the north slope and the oak, aspen, and the associated shrub clumps on the south slope along the top of the primary ridge, between Burgess Creek and Fish Creek, the north boundary line of the Burgess Creek community. Hand cutting, mowing and use of a hydro ax can accomplish this. This fuelbreak will not only help protect Burgess Creek it will provide protection benefits to the other associated communities nearby.

3. In Fish Creek, south of the Sanctuary residences at the base of the steep conifer covered steep ridge separating Burgess Creek and Fish Creek, thin to achieve a 40 percent tree canopy cover, prune up to 15 feet above the ground and removing slash, forest debris, and anything flammable to reduce potential wildfire momentum and rate of spread at the bottom of the ridge leading up to the north side of Burgess Creek drainage.

C. Infrastructure improvement

1. For access roads and driveways over 100 feet long widen to at least 10 surface feet for single lane and 16 surface feet for double lane. Where over 150 feet long provide terminus turn around with radius of 45 feet or hammerhead turnaround with pullouts at least 34 feet long.

2. Mark driveways and other internal travel routes with a sign indicating house address and limitations such as no turnaround, steep slopes, narrow width or other deficiencies.

3. Create wider driveway and primary access road intersections and turning radiuses (45 feet minimum) to reduce the amount of traffic flow interference in the event of emergency.

4. Expand turnaround radius at the end of the Ridge Road, Fox Ridge Lane and Lift Line Road to a radius of at least 45 feet or install a hammer head turn around facility with pullouts at least 34 feet long.

D. Improved Protection Capability

1. Home Owners Association should appoint or designate a board, a committee, or an individual representative to help coordinate with the County and City as well as within the community for actions agreed on for implementation.

2. Steamboat Springs fire department should seek funds for a full time district wildland fire coordinator to do the following: provide public information and guidance, provide training, design projects, prepare grant project proposals, develop county or fire district standards for urban interface fire issues, coordinate and collaborate with federal and state agencies to update fire and fuels plans, equipment acquisition, designing joint projects, monitoring and follow up work.

3. Develop an evacuation plan that accommodates initial attack vehicles while safely evacuating the residents.
    - Designate an emergency evacuation egress route through the ski area.
    - Develop an emergency evacuation road from the east end of Ridge Road down to the paved Burgess Creek road.
    - Designate the ski area maintenance lot as a safety zone in the event that evacuation from the upper area is blocked.
    - Install a central warning siren within the south side and another one for the north side.

    See Appendix F *Evacuation Planning* for more information pertaining to evacuation planning.

E. Monitoring

1. The Steamboat Springs Fire Rescue and the Home Owners Association should set goals and monitor implementation progress made to reduce the community vulnerability.

2. All fuel hazard reduction improvements and the evacuation routes should be inspected annually for repair and clean up work.

APPENDICES

APPENDICES

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APPENDIX A: FIRE EFFECTS FOR VEGETATION TYPES

Following are the characteristic vegetation types in northern Routt County. Fire reoccurrence intervals were assumed to be 100 to150 years in the lodgepole pine type and sub-alpine fir types.

Lodgepole pine: Lodgepole pine is more vulnerable to ground fires than thicker barked species such as ponderosa pine or Douglas fir. Because its thin bark has poor insulating properties, many trees are killed from ground fires as a result of cambial heating. However, some trees survive, and in general, low-intensity ground fires thin lodgepole pine stands.

Seeds are well protected from heat inside sealed cones. In the Rocky Mountain area lodgepole pines exhibit considerable variability in the percentage of seed cones that are serotinos (cone requires heat to open and disburse seed). However, intense crown fires that ignite the cones can destroy the seeds.

Post-fire recovery tends to be rapid as new stands quickly establish from seed released by serotinous cones. Stocking rates influences seedling growth in fire-generated stands. In overstocked stands, trees may not grow more than 4 feet tall in several decades, but in under-stocked stands lodgepole pine grows fast. Lodgepole pine seedling establishment following fire is influenced by many factors, including pre-fire over-story density, competing vegetation, and probably most important, fire intensity, which in turn affects seedbed condition, opening of serotinous cones, and seed survival.

High-intensity fires generally expose much mineral soil and open serotinous cones. Occasionally, crown fires may be intense enough to ignite cones in the crown. This destroys much of the seed supply resulting in low stocking. Following low-intensity fires, lodgepole pine stocking depends on the amount of mineral soil exposed. Generally if the duff is dry, ground fires will expose mineral soils, but if the duff is moist, less mineral soil is exposed resulting in lowered stocking. Surface fires will not open serotinous cones in the tree crowns, but most lodgepole stands in the Rockies have sufficient open-coned trees to provide seed for restocking.

Lodgepole pine girdled by ground fires, but with no crown scorching, may appear healthy for a couple of years after fire even though they are essentially dead. This is because it often takes more than 2 years for these trees to lose their needles. Trees injured by fire are susceptible to attack by insects. Most commonly, trees infested are those with greater than 80 percent basal girdling. Lodgepole pines that survive ground fires are susceptible to attack in later years by decay fungi that enter through basal wounds. Fire-killed lodgepole pine trees begin to fall 2 to 5 years after dying and most trees will be down in about 15 years.

Sub-alpine fir: Subalpine fir is easily killed by fire. It is very susceptible to fire because it has thin bark that provides little insulation for the cambium layer. As subalpine fir matures the bark thickens and some self-pruning of lower branches occurs but both spruce and fir tends to retain lower branches that provide ladder fuels. Roots are shallow and susceptible to heat damage during a fire. Fir tends to grow in dense stands that are susceptible to crown fires. Some larger trees may survive light, surface fires but these often die later due to infection by wood-rotting fungi that enter through fire scars. Mortality in mature trees results from crown scorch, girdled stems from cambial heating and damage to shallow root systems.

Wind blown seed from surviving trees in protected pockets is responsible for most stand reestablishment. Reestablishment is more successful following small fires where surviving trees or trees on the margin of the burn provide a seed source. On large, high intensity fires that kill seed trees regeneration of the sub-alpine fir forest is a slow process. Seedling establishment is best on moist surfaces where fire has consumed most or all of the duff leaving bare mineral soil. Seedlings require some shade and do best on sites with standing dead trees or logs on the ground.

Aspen: Small-diameter quaking aspen is usually top-killed by low-severity surface fire but as dbh increases beyond 6 inches quaking aspen becomes increasingly resistant to fire mortality. Large quaking aspen may survive low-severity surface fire, but usually shows fire damage. Moderate-severity surface fire top-kills most quaking aspen, although large-stemmed trees may survive. Severe fire top-kills quaking aspen of all size classes. Moderate-severity fire does not damage quaking aspen roots insulated by soil. Severe fire may kill roots near the soil surface or damage meristematic tissue on shallow roots so that they cannot sprout. Deeper roots are not damaged by severe fire and retain the ability to sucker.

Mortality does not always occur immediately after fire. Sometimes buds in the crown will survive and leaf out prior to the death of the tree. Even when quaking aspen is not killed outright by fire, the bole may be sufficiently damaged to permit the entrance of wood-rotting fungi. Basal fire scars may also permit entry of borers and other insects, which can further weaken the tree. Quaking aspen on slopes generally show greater damage than do trees on flatter areas. Flames moving uphill often curl up the lee side of trees when fanned by upslope wind, charring the stem further up its bole.

Quaking aspen generally sprouts vigorously after fire. Long-term growth and survival of quaking aspen sprouts depend on a variety of factors including pre-fire carbohydrate levels in roots, sprouting ability of the clone(s), fire severity, and season of fire. Moderate-severity fire generally results in dense sprouting. Fewer sprouts may be produced after severe fire. Since quaking aspen is self-thinning, however, sprouting densities are generally similar several years after moderate and severe fire. A low-severity surface fire may leave standing live trees that locally suppress sprouting, resulting in an uneven-aged stand.

Sagebrush: Most sagebrush species are easily killed by fire. Site productivity affects the ease with which sagebrush will burn. Highly productive sites have greater plant density and more biomass, which, in turn, provide more fuel to carry a fire.

Big sagebrush, which comprises a majority of the sagebrush association, has a shorter fire return interval than the low sagebrush types. Among the three major subspecies of big sagebrush, basin big sagebrush is considered intermediate in flammability. Mountain big sagebrush is most flammable, and Wyoming big sagebrush is least flammable. Fire return intervals for mountain big sagebrush are in the 15-40 year range, for basin big sagebrush in the 25-70 year range, and for Wyoming big sagebrush in the 50-100 year range.

All subspecies of big sagebrush re-invade a site by soil-stored or off-site seed. The rate of stand recovery depends on the season of fire, availability of seed, post fire precipitation patterns, and the amount of competition provided by other plant species regenerating after the fire. If a good moisture year occurs soon after the fire, reestablishment can be greatly accelerated. Pattern of burning also greatly influences the rate of post fire reestablishment. Small areas are more rapidly re-invaded from adjacent seed sources; individuals surviving within the fire perimeter may provide much of the seed for recolonization. Sagebrush seed is not disseminated for great distances; most is shed near the base of the parent plant.

Sagebrush seedlings re-establish readily and grow rapidly on light to moderate intensity burns; reproductive maturity may occur in 3 to 5 years when competition is removed and growth conditions are optimal. Desirable pre-burn density and cover may be achieved in 15 to 20 years under favorable conditions. It may take 30 years or more before desirable pre-burn densities and coverage of big sagebrush subspecies are regained on high intensity, large burns or where herbaceous competition impedes sagebrush reestablishment.

Currently, many sagebrush communities are at or beyond the age (structure and composition) when fire would normally have intervened to move these communities back to an earlier serial stage. Lack of fire may be due in part to fire suppression efforts, lack of fine fuels related to grazing issues, or many other factors that influence the susceptibility of a vegetation community to fire. Continued exclusion of fire from these communities has and will continue to allow succession of sagebrush to advance to a point where native herbaceous plant species (fine fuels) may be limited where fuels are currently not limited. Many of these sagebrush communities in the lodgepole pine zone have seen an increased abundance of lodgepole pine trees, which replace sagebrush and more importantly, the herbaceous species needed to carry fire. These herbaceous species are critical to maintenance of the natural fire regime for these communities.

Decreased herbaceous species in the sagebrush community extends the fire return interval outside the norm until extreme conditions are necessary for a fire or other disturbance to occur. At that point, the site is susceptible to cheat grass or other non-native plant invasion and the fire return interval may become much shorter than normal. A non-desirable sagebrush community (lacking or devoid of native herbaceous vegetation) may increase the chance for cheat grass invasion following a disturbance, which in turn would be perpetuated by more frequent fire events.

Gambel oak: Gambel oak is a fire-adapted species. It responds to fire by vegetative sprouting. Fire in Gambel oak may promote a brief grass-forb stage depending upon fire intensity and frequency. In most situations, Gambel oak sprouts vigorously the first growing season following fire. If successive fires occur at this stage, Gambel oak may be reduced to a grass-forb stage. In the absence of fire, Gambel oak reaches maturity in 60- 80 years. On the Steamboat Pines, particularly the west side, Gambel oak density and fuel continuity has increased because of the absence of fire during the past 100 years.

Gambel oak appears to be a relatively benign fire type. Its appearance is deceptive. When live fuel moistures get below 130% Gambel oak becomes very volatile. Unexpectedly hot, fast spreading fires in Gambel oak have killed over nineteen firefighters in Colorado over the last two decades.

Grassland–Grasses/Forbs: Fire effects depend on the growth habit and phenology of affected plants, as well as season of burn, fire intensity, and burn severity. Fires usually top kill and consume vegetation to ground level. Rhizomatous grass and forb species are frequently favored by fire, as fire may stimulate the initiation of new shoots. Rhizomatous species usually have coarse stems and lesser amounts of leafy material, which results in rapid combustion, and little downward transfer of heat to below ground plant parts. Heat transferred downward may adversely impact meristematic growth tissues and injure the affected plant. Bunchgrass crowns characterized by coarse stems and leaves are generally considered to be less prone to prolonged burning than fine-leaved bunchgrasses.

Burns occurring in the spring, an unlikely scenario given the rare incidence of natural ignitions at that time of the year, after new growth is initiated can severely injure most grass and forb species. Likewise, burns when grasses and forbs are in the fruiting stage (generally in early to mid-summer) when root carbohydrate reserves are low can result in significant damage.

Grasses and forbs spread rapidly via surviving rhizomes following a burn. Non-rhizomatous plants establish relatively rapidly from seed banks in the soil or from off-site seed sources. Composition and production of most grass and forb species usually exceed (under optimal conditions) pre-burn levels within two growing seasons following a burn.

APPENDIX B: PRIMARY FUEL AND FIRE HAZARDS

The primary fuels within the Steamboat Pines community are shrub land and forested land. Using the best system for predicting fire behavior, Fire Behavior Officers (FBO), fuel models 8 and 10 probably best depict the lodgepole pine type as well as the sub- alpine fir types depending on the amount of dead and down material intermingled, the canopy closure and age (size) class of the timber. Using the National Fire Danger Rating System (NFDRS) fuel models these same types could be represented by H and G respectively. Fuel Model 8 depicts the aspen stands in the summer while Fuel Model 9 (NFDRS E) is more indicative of fall burning conditions in aspen. Fuel Model 1 and 2 (NFDRS L and T respectively) are the best depiction of grasslands and shrub lands respectively.

Fuel Model 1   (NFDRS L)
Fire spread us 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 and timber is present, generally less than one third of the area.

Fuel Model 2   (NFDRS T)
Fire spread is primarily through the fine herbaceous fuels, either curing or dead. These are surface fires where the herbaceous material, in addition to litter and open sagebrush contribute to the fire intensity. Open shrub lands that cover one-third to two thirds of the area may generally fit this model; such stands may include clumps of sagebrush that generate higher intensities and that may produce firebrands.

Fuel Model 6 (NFDRS F)
Fire spread is primarily through large Gambel Oak that ranges in height from 6 to 15 feet. There are occasional pockets of debris distributed throughout the unit. Fires require moderate winds, greater than 8 mph at mid flame height. Fire will drop to the ground at low wind speeds, if there is no ground debris, or at openings in the stand.

Fuel Model 8 (NFDRS H)
Slow-burning ground fires with low flame lengths are generally the case, although the fire may encounter an occasional “jackpot” or heavy fuel concentration that can flare up. Only under severe weather conditions involving high temperatures and low humidity’s, and high winds do the fuels pose high hazards. The thinned and cleaned up stands of lodgepole represent this model in Steamboat Pines.

Fuel Model 9 (NFDRS E)
Fires run through the surface litter faster than model 8 and have longer flame height. Concentrations of dead-down woody material will contribute to possible torching out of trees, spotting and crowning. The pure stands of aspen represent this model. In the fall, after the associated grass and forbs have cured, this fuel will burn more intensely and is temporarily more of a threat.

Fuel Model 10 (NFDRS G)

The fires burn in the surface and ground fuels with greater fire intensity than the models 8 and 9. Dead-down fuels include greater quantities of 3-inch or larger limb wood resulting from over maturity or natural events such as mountain pine beetle that create a large load of dead material on the forest floor. Crowning out, spotting, and torching of individual trees is more frequent in this fuel situation, leading to potential fire control difficulties. Most of the lodgepole pine and subalpine fir types within the Steamboat Pines represent this model. Within these types in most places there is dead material caused from blow down and insect mortality

Expected Fire Behavior with RH at 8%, Temperature 80 degrees, wind 10-15 mph.

Fuel Model	Flame Length (Feet)	Rate of Spread (Feet per Hour)	Spotting Distance (miles)	Size After 1 Hour	Size After 4 Hours (acres)
Fuel Model 1 (grassland)	12	37,400	0.3	7,500	120,600
Fuel Model 2 (sagebrush)	15	12,936	0.3	900	14,400
Fuel Model 6 (Gambel Oak)	4	970	0.3	12	189
Fuel Model 8 (clean LP)	2	264	0.3	1.0	16
Fuel Model 9 (aspen)	1	66	0.3	0.1	1.0
Fuel Model 10 (LP and S-F with debris and /or slash)	4	231	0.3	1	14

APPENDIX C: FUEL HAZARD REDUCTION GUIDELINES

TREE SPACING – RULE OF THUMB

Strive to reduce crown density to 40% or less.

Lodgepole and Subalpine Fir: Convert stem diameter from inches to feet and add 5 to 9 more feet depending on tree height and crown size.

> **Example:** A lodgepole pine 8" in diameter at dbh will have a spacing of 8 feet plus 5 to 9 feet for a total of 13 to 17 feet to the next tree.

The spacing does not need to be even. In fact the fuel treatment area will look more natural if the spacing varies and small clearings are intermingled with small stands of trees. The important focus should be on breaking up fuel continuity – horizontal and vertical.

Within the lodgepole pine stands in some areas too much thinning at one time can increase the risk of wind throw because lodgepole tends to be interdependent with regard to wind firmness. Staging the thinning work over a long enough time to allow the standing trees to develop their wind firmness can mitigate this. Thinning when trees are small helps prevent this blow down vulnerability. Thinning in patches and designing the thinning to minimize wind effect can be done depending on location. All of these can be used but can best be accomplished with the assistance of an experienced forester.

An important part of fuel hazard reduction is removal of the ladder fuels; particularly when adequate thinning cannot be accomplished in lodgepole due to the danger from wind throw. Therefore, the following is important to do within a lodgepole timber canopy.

Prune trees up to 6 or 8 feet depending on slope
Remove under story reproduction
Remove sagebrush, oak or any other flammable brush
Remove all dead forest debris
Remove trees recently killed by mountain pine beetle or any other disturbance

**Note: All slash disposal procedures should be implemented to avoid attracting Mountain Pine bark beetle to the project area.

APPENDIX D: EVACUATION PLANNING

Background

The growth of urban development in forested wildland areas in recent years has resulted in a potentially hazardous situation. People are attracted to forested areas seeking solitude and to escape the pressures of everyday life. Large land holdings have been subdivided into small affordable acreages for cabin sites or remote homes. At the same time wildfires have been aggressively suppressed allowing young trees to establish in high densities and dead fuels to accumulate to alarming levels. These ladder fuels provide a "leg up" for a wildfire to burn into the crowns and move rapidly under windy conditions. The new generation of small lot landowners value individual trees and have built their cabins under the cover of these overstocked forests. Cabins are constructed on prominent points or ridge tops for the view or they are tucked into the forest canopy seeking solitude. In order to minimize the impact of their presence on the land driveways are often narrow with inadequate opportunities to turn around at the building site. Little attention has been paid to the potential destructive capacity of an uncontrolled wildfire.

In an emergency wildfire situation that threatens the lives and property of residents in the area, the Steamboat Springs, Colorado fire department, in consultation with the fire suppression team and land managing agencies, has the responsibility and authority to evacuate residents to a safe area. Prior evacuation planning is essential to implement this action effectively.

By definition, evacuation is a protective action—moving people from a place of danger to a place of relative safety. As a phenomenon, it is a temporary mass movement of people that collectively emerges in coping with a threat to park visitors.

An Evacuation Plan will facilitate this orderly evacuation during an emergency wildfire situation that threatens residents and facilities. Step by step actions provide critical information and guidance for fire suppression, and law enforcement personnel during an emergency situation. Each subdivision, home site development area or land owner association should be strongly encouraged to develop an evacuation plan for their area that identifies potential evacuation routes and critical information (locked gates, inadequate bridges, etc) for a variety of wildfire threat scenarios.

Critical Contacts

Steamboat Springs Fire Emergency	xxx-xxx-xxxx
Steamboat Springs Fire Chief	
Routt County Sheriff	
Routt County Fire Warden	
Colorado State Patrol	
Colorado State Forest Service	
Colorado Division of Wildlife	
Medicine Bow Routt National Forest, Ranger District	
Bureau of Land Management Little Snake Field Office	
Interagency Fire Center/Fire Dispatch Center	
Federal Emergency Management Agency	
Routt County Emergency Preparedness Director	
Local News Media	
Red Cross	

Local Towing Service
Others_________________
____
____
____

Check List When Potential For Evacuation Exists

1) Close back country roads and trails at the trail heads

2) Post on bulletin boards information regarding fire danger.

3) Set up a local Information Center where residents and visitors can access up to date information and status regarding wildfire that pose a threat to the area.

4) Provide routine updates on wildfire conditions for local radio and television stations as the threat increases.

5) When the fire suppression team and land managing agencies (probably US Forest Service) believe evacuation may become necessary, notify the Routt County Sheriff and Routt County Fire Warden

6) Fire suppression team and land managing agency manager should meet with the Sheriff to decide if an evacuation is necessary. The decision to evacuate should be made and implemented well before the evacuation needs to be complete. Local conditions and the fire's rate of advance will dictate.

7) Sheriff in consultation with the land managing agency makes the decision to evacuate the threatened area and implements the actual evacuation

8) Notify residents and visitors of the Order to Evacuate
    - Siren to alert visitors in the back country
    - Law enforcement patrol vehicles with public address systems announce evacuation order
    - House to house verification that threatened home site development is completely evacuated
    - Law enforcement vehicles and ATVs drive back country roads and trails to assure evacuation
    - Use one color flagging to mark secondary roads/trails at their junction with the primary road (evacuation route) when notification is in progress then change to another color when verification is complete on that road/trail.

9) Drive evacuation routes installing free standing traffic control signs at key road intersections and opening locked gates or cutting fences to allow exit.

10) Notify Federal Emergency Management Agency (FEMA)

11) Notify Colorado State Patrol

12) Assign law enforcement to direct traffic at critical road junctions

The officer in charge of the evacuation will make the decision regarding which evacuation route to use at the time. Depending on the situation the decision may be to use any or all of the routes to evacuate the threatened area.

Emergency Evacuation Routes

Primary emergency evacuation routes are suggested but should be validated with landowners and land managing agencies involved prior to the onset of an emergency need for evacuation. These primary evacuation routes should provide multiple opportunities for evacuating traffic to exit the area. Hazardous fuel concentrations should be treated along primary evacuation routes to reduce canopy cover to 40 percent or less and remove slash and combustible debris within 150 to 200 feet of the road. Tributary roads should be identified in local developments and treated similarly to facilitate a safe and orderly evacuation.

Estimated Time To Implement An Evacuation

The decision to evacuate a threatened area must be made well in advance of the time the fire is expected to threaten residents, visitors and facilities.

Fire Behavior and Evacuation Timing

Spread Component (SC) is the key fire danger component to monitor. The spread component is a numerical value derived from a mathematical model that integrates the effects of wind and slope with fuel bed and fuel particle properties to compute the forward rate of spread at the head of the fire. Output is in units of feet per minute. A spread Component of 31 indicates a worst-case, forward rate of spread of approximately 31 feet per minute.

The inputs required in to calculate the SC are wind, slope, fine fuel moisture (including the effects of green herbaceous plants), and the moisture content of the foliage and twigs of living, woody plants.

Since characteristics through which the fire is burning are so basic in determining the forward rate of spread of the fire front, a unique SC table is required for each fuel type.

<u>When considering spotting, the rich diversity of fuel types scattered throughout the Steamboat Springs area, and the likelihood of wind, it may be prudent, when fire danger is Very High, to start an evacuation process when wind brings a fire to within 2 miles of a subdivision or home site development area (urban interface area).</u> Knowing the SC for the most prevalent fuel type between where the fire is and where the home site developments are can best refine this judgment call. With a SC of 44 a fire will cover 2 miles or more within 4 hours. If the SC is 22

the fire will cover at least one mile within 4 hours and 2 miles within 8 hours. If the SC is 11 the fire will cover two miles within 16 hours. If the SC is 5 the fire can cover two miles within 32 hours.

For an example, the following table shows forward rate of spread in feet by five of the most common fuel types in the Steamboat Springs area during the conditions actually experienced in a 2003 Fire burning in similar fuels. The weather conditions were as follows: MAX temperature 80-83; MIN RH 17%; 20 foot winds at 10-18 mph by mid-morning. Mixing winds west 12 to 20 mph by late morning.
The Table does not include spotting which can dramatically increase fire spread on a windy day.

Fuel Type and Spread Component SC	1 hr	2 hrs	3 hrs	4 hrs	5 hrs	6hrs
Fuel Model 1 or 2 (grassland or sagebrush) SC 41	2,492	4,984	7,476	9,968	12,460	14,952
Fuel Model 6 (Gambel oak) SC 42	2,554	5,108	7,662	10,216	12,770	15,354
Fuel Model 8 (pine timber with good ground clean up) SC 2-3	152	304	456	608	760	912
Fuel Model 10 (timber with medium to heavy slash, fuel ladders or debris) SC 11	660	1,320	1,980	2,640	3,300	3,960

**In addition to the above circumstances this fire ignited 10 spot fires up to ½ mile north of the main fire. Spot fire occurrence and potential is an important factor in evacuation timing.

During this 2003 Fire the Fire Danger was very high.

Timing

Evacuation planning needs to take into account how long it will take to notify residents that an evacuation is necessary, how long it will take for them to get ready and start driving out of the area and then how long it takes to actually drive to a safe area. This determination should be made locally for each development area or subdivision and then validated before it is used during an emergency.

Every situation will be different but it is reasonable to estimate the minimum time required to be no less than 4 hours to complete the process. As much as three hours may be required to notify residents and visitors and get them started moving and another hour to get everyone out of the area. Residents and visitors closest to the advancing threat should be notified first. Once they are driving out of the area it will take them up to an hour in most cases to exit the area if traffic is flowing at a rate of 10 to 20 miles per hour.

Driving time should be measured on each of the potential evacuation routes by driving at a conservative speed depending on road conditions and how many people are expected to be evacuated to approximate how long it would take to drive the route during an evacuation providing traffic was moving at about that rate. The following table displays the type of information that needs to be incorporated in the Evacuation Plan.

Travel Time for Evacuation Routes

Beginning Point	Ending Point	Time Required	Miles Traveled	Average Speed

This table provides GPS coordinate locations for critical points referred to.

GPS Locations for Critical Features and Facilities

Feature	GPS Location

Recommendations

- Negotiate agreements with neighboring private land owners and land managing agencies to allow evacuation across their property on their roads and through their locked gates.
- Negotiate an agreement to thin fuels along the evacuation route between the subdivision or home development area and safe areas.
- Upgrade roads on evacuation routes by widening curves, providing water bars to prevent erosion and thinning fuels along these emergency exits.
- Construct and store freestanding “Fire Exit Directional Signs” or “Evacuation Route” for use in marking evacuation routes.
- Develop a specific evacuation procedure and assign responsibilities to proper authorities.

APPENDIX E: DEFINITION OF TERMS

Appropriate Management Response (AMR) - Specific actions taken in response to a wildland fire to implement protection and fire use objectives identified by appropriate government agency. AMR allows for a full range of strategies to be applied, from an intense full suppression response to wildland fire use. The first response decision to be made is whether to have a suppression oriented response or to allow the fire to burn for predetermined benefits.

Confinement Response- The suppression-orientated strategy employed in appropriate management response where a fire perimeter is managed by a combination of direct and indirect actions and use of natural topographic features, fuels, and weather factors. These strategies and tactics could include perimeter control.

Disturbance- A discrete event, either natural or human induced, that causes a change in the existing condition of an ecological system.

Energy Release Component (ERC)- An index developed through the National Fire Danger Rating System. ERC then is an indicator of dryness in the fuel, is a fuel loading based rate that predicts how much energy f fire will produce both from its consumption of available fuel and through its residence time. ERC, and 1000hr. time lag fuel moisture has been used in dry climates to track seasonal drying trends.

Escape Fire Situation Analysis (EFSA)- If a wildfire has escaped initial attack EFSA is the process the agency administrator or acting uses to determine the best suppression strategy for achieving appropriate suppression that best meets resource objectives.

Fire Management Plan (FMP)- A strategic plan that defines a program to manage wildland and prescribed fires. The plan could be supplemented by operational plans, prescribed fire plans, hazardous fuels reduction, and prevention plans.

Fire Use- The combination of wildland fire use and prescribed fire application to meet specific resource and landowner objectives.

Fuel Treatment- Programmed and contracted to reduce or change fuel loading or type on a site. Can be accomplished by mechanical, chemical, or fire use.

Full Response- A suppression response action that can include: control lines surrounding the entire perimeter, (hot spot and cold trail may be considered completed line) including any spot fires, protection of interior islands, burn-out of fuels adjacent to control lines and mop-up to a standard adequate to hold under high fire intensity conditions. Full response objectives are based on safe yet aggressive approach to achieve containment of the fire by the beginning of the next burn period. Fire behavior may dictate, at least temporarily, the utilization of natural barriers or indirect strategies. These strategies and tactics would include direct control.

Haines Index- Lower atmosphere stability index (LASI) developed by Donald Haines. The index relies on two variables: dryness and stability/instability. On a scale of six, three points are given to dryness and three to the stability or instability of the atmosphere. Both these variables have a pronounced affect on extreme fire behavior. In the scaling, a 6 is extreme. 5 are high and, 4 are moderate, while 3 to 1 are low.

Initial Attack- An aggressive suppression action consistent with firefighter and public safety and values to be protected.

Initial Management Area (IMA)- The size of an IMA may be adjusted based on fire behavior predictions, weather forecasts, site analysis and risk assessment. The IMA becomes fixed as an MMA once a wildland fire is placed under a stage III implementation plan.

Maximum Management Area (MMA)- The firm limits of management capability to accommodate the social, political, and resource impacts of a wildland fire. Once an approved Wildland Fire Use plan is established the MMA is fixed and not subject to change. If MMA determination is exceeded, the fire will follow the Wildland Fire Situation Analysis (WFSA) process.

Mitigation Actions- Those on-the-ground activities that will serve to increase the defensibility of the Maximum Manageable Area (MMA); check, direct, or delay the spread of fire, and minimize threats to life, property, and resources. Mitigation actions may include mechanical and physical non-fire tasks, specific fire applications, and limited suppression actions. These actions will be used to construct fire lines, reduce excessive fuel concentrations, reduce vertical fuel, and create black lines.

POL – Stands for "Products Other than Logs" thinning to harvest poles and posts and firewood.

Polygon- A planning sub-unit within a fire planning area that represents similar resource values and landowners objectives, fuel conditions with associated fire behavior, Social/Political concerns and economic considerations. Polygons are categorized as A, B, C, and D areas.

Preparedness- Activities that lead to a safe, efficient, and cost-effective fire management program in support of land and owners management objectives through appropriate planning and coordination.

Prescribed Fire- Any fire ignited by management actions to meet specific objectives. A written, approved prescribed fire plan must exist prior to ignition.

Prescribed Fire Plan- A plan required for each fire application ignited by management. It must be prepared by qualified personnel and approved by the appropriate agency administrator prior to implementation. Each plan will follow specific direction and must include critical elements and how to mitigate each element.

Prescription Guidelines- guidelines used to show upper and lower reaches of a prescription.

Spread Component (SC)- An index developed through the National Fire Danger Rating System. The index provides predicted rate of spread of a fire (in chains per hour) from inputted information on the fuel complex and weather information collected from a local Remote Automated Weather System (RAWS) site.

Suppression Constraints- A limitation placed on suppression forces to minimize adverse affects to the environment due to fire suppression activities. An example would be restricting the use of heavy equipment in certain areas.

Suppression oriented response- A range of responses to a wildland fire, which range from full response to confinement of the fire. It may also include periodically checking fire status and fire behavior.

TSI – Stands for "Timber Stand Improvement" thinning to stimulate growth and improve residual tree health

Wildfire- An unwanted wildland fire.

Wildland Fire- Any nonstructural fire, other than prescribed fire, that occurs in the wildland. This term encompasses fires previously called both wildfires and prescribed natural fires.

Wildland Fire Implementation Plan (WFIP)- A progressively developed assessment and operational management plan that documents the analysis and selection of strategies and describes the appropriate management response for a wildland fire being managed for resource benefit.

Wildland Fire Situation Analysis (WFSA)- A decision-making process that evaluates alternative management strategies against selected safety, environmental, social, economic, political, and resource management objectives**.**