FUELS REPORT FOR THE WHITETAIL HAZARDOUS FUELS PROJECT

Ashland Ranger District
Custer National Forest
Northern Region

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A. PURPOSE AND OBJECTIVES

In 2004 Powder River County adopted the "Powder River County Wildfire Protection Plan". Within this plan several areas were identified and assigned a hazard rating. In this cooperatively produced document between local landowners, Powder River County Staff, and Ashland Ranger District personal, the Whitetail Hazardous Fuels (WHF) Project Area was identified as the highest priority for fuel reduction within the 2,102,400 acres of Powder River County. The project is located adjacent to or within close proximity of private landholdings and Forest Service infrastructure including the historic Whitetail Cabin and Holiday Campground. Please refer to the map in Appendix D- Project Maps for a representation of the project area.

The purpose of the Whitetail Hazardous Fuels Project is to reduce hazardous fuel conditions by changing forest condition classes 2 and 3 (described as having high, unnatural fuel loads) towards condition class 1 (described as a more natural, balanced fuel load and setting). This goal is to be achieved through the use of prescribed fire, thinning, commercial and pre-commercial forest vegetation management treatments.

The objectives specific to fuels management are to:

- Reduce the likelihood of a stand replacing wild-land fire by removing down woody and ladder fuels
- Create a distribution of forest age classes and structure that is more resistant to high-severity stand replacing wild-land fires.

B. Analysis Area

The geographic area used to analyze the effects to the fuels environment is the project area. This boundary can also be seen in Appendix D- Project Maps. The bounds of analysis would be that point in the affected environment where direct, indirect, and cumulative effects would no longer be detectable.

C. Affected Environment

The current condition of the factors that affect fire behavior, specifically the fuels; as well as the fire regime condition class and current fire suppression capabilities for the Whitetail Hazardous Fuels analysis area are described below.

D. Fuel Characteristics: Fuel loading, canopy characteristics, species composition, structure, continuity, etc.

1. Species Composition

The project area contains 3 types of ecosystems; ponderosa pine forests, hardwood bottoms, and plains grasslands with trees. For more detail on species composition in the project area see the Forest Vegetation Report (page 14-21). Because hardwood bottoms

represent such a small percentage (less than 10%) they were clumped into the ponderosa pine forest type for analysis purposes. Using TSMRS photo interpreted data and stratum data, the 9767 acre project area was broken into two distinct types: grassland and forested stands. Of the total project area, 3053 acres or 31% of the area was classified as grassland while the remaining 6708 acres or 69% was classified as forested stands.

2. Fuel Models

Due to slope, aspect, and associated terrain and vegetation, several different fuel models were present historically in the project area – representing three of the main fuel model groups where grass, shrubs and brush, or timber litter would have been the main carriers of a surface fire. Predominantly, these are Fuel Model 1 (short grass), Fuel Model 2-Timber (grass and under story) and Fuel Model 9- Hardwood Litter. (Anderson, 1982) See Table 1.1 Fuel Model Distribution for the percentage of the project area in each fuel model.

Table 1.1 Fuel Model Distributions

Fuel Model	% of Project Area
FM 1-short grass	31%
FM 2-Timber (grass and under story)	15%
FM 9-Hardwood Litter	54%

3. Stand Structure

As previously mentioned 69% of the project area is classified as forested stands. Within these forested stands, various stand structural classes exist. For a complete description of these development classes refer to Appendix A- Structural Development Class Descriptions. Using stratum data from TSMRS (Timber Stand Management Record System), each stand's structural class was classified into one of these classes. Table 1.2 displays the existing distribution of these structure classes.

Table 1.2 Whitetail Fuels Reduction Structural Development Class Distribution table.

Structural Class	Existing Percent	Reference Percent
Post Replacement	1%	10%
Mid Development Closed	3%	15%
Mid Development Open	2%	25%
Late Development Open	19%	40%
Late Development Closed	75%	10%

4. Fuel Loading

Coarse-woody debris (dead standing and downed pieces greater than 3" in diameter) is an important component of a healthy ecosystem. Animal life processes, site productivity and protection, as well as fire, are important components most commonly discussed by forest managers (Brown, Reinhardt, Kramer 2003). Observations of past fire behavior shows that small woody material, less than 3" in diameter, has the most substantial influence on fire behavior (such as spread rates and fire intensity), and can be estimated using broadly accepted fire behavior models (Brown, Reinhardt, Kramer 2003). However, large woody fuels can contribute to large fire development and high fire severity. The greater the fuel loading of this large material, coupled with the size and decay rate, can greatly influence fire severity (effects to soil, water, other forest resources) – this is generally due to smoldering and persistent burn periods (Brown, Reinhardt, Kramer 2003). The sizes amounts and continuity should be balanced with other needs such as reducing the threat of wildfire burning off NFS lands and onto private lands. Strategic locations of fuel loads on the landscape to aid in fire suppression operations and fire fighter safety should also be a consideration.

For the dry sites decay rates for dead, down woody material are generally lower than they would be on moister sites, especially in the absence of fire (Brown, Reinhardt, Kramer 2003). Although the amount of CWD throughout the project area varies, surface fuels average 5 to 8 tons per acre across the landscape with small scattered areas having 15 to 20 tons per acre. Crowning out, spotting, and torching are greater where heavy CWD has built-up in a forested environment (Brown, Reinhardt, Kramer 2003).

Fine fuels are continuous throughout, in the form of twigs, small branches, live and dead brush and grasses, and pine needles. As mentioned, these fine materials would contribute

to the overall fire spread, especially on the drier sites where the forest floor is littered with ponderosa pine needles.

Small fuel loads can be summarized by fuel model – the majority of the current untreated portions of the project area can be classified as Fuel Model 9- Hardwood Litter (Anderson 1982).

Currently surface fuels average 5 to 8 tons per acre across the landscape with small scattered areas having 15 to 20 tons per acre.

5. Canopy Characteristics

Canopy Base Height (CBH) is the lowest height above the ground at which there is sufficient amount of canopy fuel to propagate fire vertically into the canopy (Scott and Reinhardt, 2001). When reducing crown fire initiation is priority, fuels treatments should include removing some or all of the ladder fuels and other vegetation that contributes to a low canopy base height. Canopy base heights were determined across the project area from on-site observations during the field season of 2007. In the Whitetail Hazardous Fuels project area values vary from a low of 1 foot to over 20 feet. Drier sites**,** such as south slopes, have slightly higher CBH than do the more moist sites (generally north slopes). On dry sites the CBH is 5-7 foot while on the moist sites the CBH is 3-6 feet.

Figures 1.1 and 1.2 show typical examples of the current conditions in the WHF project area.

Figure 1. Note the ladder fuels in the understory

Figure 2. Note the continuous canopy stand

Canopy Bulk Density (CBD) is the mass of available fuel per unit crown volume (Scott and Reinhardt, 2001). This measure is the bulk property of an entire stand, not an individual tree. Canopy bulk densities were assumed from the canopy cover estimates in Scott and Reinhart (2005) photo guide. Although variations in CBD may be a result between the differences in site productivity, this guide provides the best information available to estimate CBD levels. For the values used refer to Appendix B- Model Assumptions.

Scott and Reinhardt (2001) describe the criteria necessary for active crown fire: Mass-flow rate is defined by Van Wagner (1977) as the rate of fuel consumption through a

vertical plane within the fuel bed and it is a product of CBD and spread rate. CBD affects the critical spread rate needed to sustain active crown fire. If the mass-flow rate falls below a certain threshold, active crowning is not possible. Therefore, the lower the canopy bulk density, the lower the potential for active crown fire. This increases the **crowning index – or wind speed at which active crown fire is possible** – so it would take greater winds to sustain active crown fire once the canopy bulk density is decreased in a stand. It is assumed that treatments that remove over story trees would also effectively lower the CBD – for example, if 50% of the canopy is removed, then it is assumed the canopy bulk density is decreased by 50% on average. However, this relationship can vary quite a bit depending on species removal, as some species obviously have much more mass in the canopy than others.

E. Fire Characteristics

1. Fire History

Active fire suppression has been ongoing for quite some time on the Ashland Ranger District. Levi S. Howes was one of the first ranchers in the Otter creek area, near what is Ft Howes today. In his memoirs Levi wrote about fire suppression tactics of the early 1880's. In these memoirs he writes:

> "One of the drawbacks to the cattle business then was the prairie fires, which were sometimes set by lightning and sometimes by outlaws or Indians, and we had to drop everything to fight the fires in order protect the grass. We usually fought fire at night as it burns much less readily then. Where it was in the timber we "back fired" around the timber, but where it was in the grass, we had to whip it out."

At that time the Custer National Forest had not yet been established. Yet by 1911 (four years after the establishment of the Custer National Forest) evidence of the accumulation of ladder fuels from the effects of 20+ years worth of wildfire suppression can be seen in Levi's memoirs:

> "The estimated timber on the Custer National Forest is now about 300,000,000 board feet, but since the fires are kept down, the reproduction of young trees are many times the timber now standing."

Historically, frequent low-intensity fires cleared dry type ponderosa pine forest types of brush and grass but left trees alive and healthy (Graham, et. al, USDA, 2004). Extreme fires were uncommon. By excluding fire from the natural cycle through decades of fire suppression, extended drought and other changes, the result is greater tree densities and a buildup of flammable vegetation across large areas of the forest landscape resulting in large stand replacement fire. The 2000 Stag-Tobin Fire Complex on the Ashland Ranger district that burned 69,872 acres is an example of this.

Many estimates exist to quantify how often fires would occur. The estimated return interval used for fire group 2 and 3 (the most common fire groups to the project area) have a high frequency low intensity fire regime, with an interval between 5 and 25 years (Forest Vegetation Report). For the purpose of an FRCC analysis, the Black Hills

ponderosa pine PNVG assumes a 23 year reference fire frequency. Although the extent of these fires was large, the severity was often low.

While it would not be uncommon to see blackened bark on the lower portion of the boles of most of the over story trees, the majority of the stand would not die from these historical fires. Some pockets of stand replacement existed, but that was usually less than 12% of the area (Black Hills Ponderosa Pine Potential Natural Vegetation Group). This high severity burning was limited to the closed canopy mid and late development stands.

As in the past, ignitions continue to occur today. Using GIS data from the Custer National Forests database, historical suppression records were pulled. From 1980-2006, 19 fires (less than 10 acres) were successfully suppressed in the analysis area, and an additional 4 fires were immediately adjacent. During this same time period large stand replacing wild fires including:

- Tobin Fire, 8,221 acres
- Wheatwell Fire, approximately 3,000 acres
- Schiller Fire, 15,250 acres
- Beaver Creek Fire, 620 acres
- Wild Fire, 1,800 acres

have been located to the west, north, east, and south of the analysis area. All of these large fires exhibited high severity and were very difficult to control.

2. Fire Regime Condition Class

Fire Regime Condition Class (FRCC) is a qualitative measure describing the degree of departure from historical fire regimes, possibly resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, canopy closure, and fuel loadings. Departure can be caused by any number of sources such as introduced exotic species, introduced insects or disease and management activities. Depending on forest type, it can be an indicator for fuel reduction needs and can help prioritize treatments to improve overall landscape condition class (Hahn and Strohm, 2005).

A fire regime condition class assessment was completed for the Whitetail Hazardous Fuels project area. The project area was used because it provided a scale large enough to assess effects and had sufficient data. While the project area has been classified as 31% grasslands and 69% forested stands, FRCC was utilized on forested stands alone. For this analysis, the Black Hills ponderosa pine PNVG (Potential Natural Vegetation Group) was used. For information on this PNVG see Appendix C- Fire Regime Condition Class. Within this PNVG there is a reference value for fire frequency, fire severity, and vegetative structure (early development, mid-development closed, mid-development open, late development open, and late development closed).

The forested areas in the project area are a **Condition Class 3** meaning there is a high departure from historic (reference) conditions. In Table 1.2, the different structure

classes are represented for both existing levels as well as historic (reference) levels. Table 1.3 displays the departure from historic (reference) levels in the early, mid, and late development canopy stands.

Table 1.3 Departure from Historic (reference) Levels

Structural Class	Existing Percent	Reference Percent	Departure
Post Replacement	1%	10%	-82%
Mid Development Closed	3%	15%	-67%
Mid Development Open	2%	25%	-85%
Late Development Open	19%	40%	-35%
Late Development Closed	75%	10%	76%

3. Fire Behavior

The following section summarizes the expected fire behavior based on the current condition of the fuels modeled under fire danger scenarios typical of hot and dry Ashland fire season. We model it this way because that is the time when fires pose the greatest threats to firefighters and the public and have the greatest potential for spread and extreme fire behavior – it allows the best opportunity to compare the effectiveness of fuels reduction activities. For model assumptions and input values refer to Appendix B-Model Assumptions.

Surface Fire Behavior

*Fuel Model 1 short grass and Fuel Model 2 timber (grass and under story***)-** Under the existing fuel conditions, surface fires would exhibit behavior that would limit direct attack to ground machinery and aerial resources only. Expected flame lengths would be 8-12 feet which is greater than the limit that can be safely attacked by hand crews using direct attack methods. While these are fast moving fires, their intensities are often less than fuel models with timber litter as the primary carrier. Although overall fuel loading is generally less in these stands, they are more open to the elements such as solar radiation and drying of fuels due to the generally west to south aspects.

Fuel Model 9 Hardwood litter- Under the existing fuel conditions, surface fires would exhibit behavior that would be expected to produce 4 foot flame lengths. This would

allow hand crews to attack a potential wildfire using direct attack. However, this **assumes that the potential fire would remain a surface fire**. Spotting and torching are more likely in this fuel type and would lead to incremental increases in intensity as a potential fire moves from the surface to the over story canopy.

Crown Fire Behavior

Crown fire potential is generally based on the amount of surface fuels, the amount of ladder fuels – which serve as the avenue to move surface fire into the tree crowns, and the density and spacing of the over story. Heavy surface fuels generally contribute to longer flame lengths. As mentioned above, if canopy base heights are low, those surface flames can then carry into the tree crowns. Once there, a crown fire may persist if the structure of the canopy is such to support crown fire. The more spaced the canopy, the greater the wind necessary to move fire from one crown to the next. Dense canopies would obviously require much less wind speed to support crown fire.

The condition of the project area is such that a crown fire could be supported due to the current surface, ladder, and crown fuels. The predicted flame lengths coupled with the low canopy base heights (less than 5 feet) equate to a **high probability of torching.** Using the NEXUS model, untreated stands with 69% canopy closure, 5 foot Canopy base height, and average surface fuel loading- a minimum 20-foot wind speed of 15.5 miles per hour would initiate torching and a 20-foot wind speed of only 11.9 miles an hour would be needed to sustain an active crown fire. This is not an uncommon 20-foot wind speed for the Ashland Ranger District. When the CBH is raised to 16 feet the 20-foot wind needed to initiate torching jumps to 47.5 miles an hour while the wind needed to sustain an active crown fire stays the same. This model assumes that canopy base heights are consistent over time and space. The flaw in this rational is that no consideration is given to regeneration coming in, damage to natural events (such as wind and snow damage), or lower CBH from adjacent stands may still allow surface fires to transition from a surface fire into a crown fire.

Table 1.4 Torching Index and Crowning Index for various canopy closure levels.

Canopy Cover	Canopy Base Height	Surface Fuels	20-Foot Wind speed to Initiate Torching	20-Foot Wind speed to Sustain an Active Crown Fire
69%	5	Average	15.5	11.9
69%	16	Average	47.5	11.9
52%	20	Average	58.1	13.2
47%	23	Average	65.8	17.6
35%	27	Average	75.8	21.2
23%	30	Average	19.6	26.4

F. Environmental Consequences

This section describes the environmental impacts of the proposal in relation to whether there may be significant environmental effects as described at 40 CFR 1508.27. The following are discussions that have relevance to determination of significance. A complete list of activities considered can be located in Appendix E- Activities Considered in Cumulative Effects.

Direct and Indirect effects on Fire Regime Condition Class and high severity wildfire potential are described below for the alternatives (No Action and Proposed Action). Those activities that had a measurable effect on the fuels environment were included at the end of this section.

The area used to evaluate effects has been previously been described in Section B- Analysis Area. Although the proposed action would most likely be implemented within the next five years, the effect of those treatments would likely have an effect for 20 years, so that time period time period would be used.

Three indicators of fire hazard were used to evaluate the changes in fire behavior by alternative: crown fire potential, structural diversity across the landscape, and changes in firefighter safety.

As mentioned previously**, crown fire potential** depends on three attributes at the stand level. These attributes are canopy bulk density, canopy base height, and surface fuel loading. By reducing the canopy closure to less than 40%, canopy bulk density would drop. By removing ladder fuels, canopy base height would increase to greater than 16 feet. And finally by keeping surface fuels 2-7 tons per acre, surface fire behavior would remain controllable.

Vegetative **structural diversity** is best measured through the FRCC analysis. FRCC is a departure model that takes into account the current vegetative structure classes, fire severity, and fire occurrence and compares those to a set of reference conditions. Not

only was the project area departed from natural fire frequency and severity, but vegetative characteristics differed as well. Initially, this analysis revealed that 75% of the project area was in the late development closed canopy class. By breaking up this continuity, wildfires do not have a continuous fuels environment to burn through allowing easier control, increased firefighter safety, and less devastating effects to the existing landscape vegetation.

Finally, improvements in **firefighter safety** can be measured by the ability to control a wildfire incident. This can be difficult to use one measure to assess. It is likely that wildfire suppression would continue through the life of this project. In this area, most of the local residents make a living farming and ranching, relying heavily on the land to feed their cows or growing their crops. So firefighters try very hard to keep wildfires that originate on federal land away from private lands. In order for those firefighters to continue doing this they must be able to work near those fires. Direct attack or suppressing a fire near the fire edge is possible for hand crews when the flame lengths are less than 4 feet (NFES#2165, 2006 page B-59). Flame length would seem like the likely way to assess whether the potential fire is then related to firefighter safety. Unfortunately, this is not the case. Resistance to control is a much more accurate measure of firefighter safety. Resistance to control, or difficulty of control, is the relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior. To illustrate this imagine the potential fire behavior in a Fuel Model 2 and 9. A Fuel Model 2 may have higher predicted surface fire flame lengths, however, because the fuel model 9 has more biomass in the larger fuel classes more heat is transferred to the firefighters, it is more difficult to inhibit spread rates (such as adding more water to slow the fire down), and more energy must be used to maintain control lines on the fire edge. In addition, fuel model 9 stands on the Ashland Ranger District are more susceptible to high intensity active crown fires.

1. Effects Common to Both Alternatives

a. Fuel Accumulation

Regardless of the alternative chosen, fluctuations in fuel loading would continue indefinitely in the Whitetail Hazardous Fuels project area as stands progress through succession. An action alternative would reduce fuels in the near-term and an assessment for future entries would be needed as fuel treatment benefits are known to lapse due to surface fuels accumulation and other stand changes (Agee 2002). Obviously forest type and other environmental and human factors would affect the rate at which that occurs. The no action alternative would not address the current fuel hazard and the affected area would be at an elevated potential of a large, uncontrollable (unwanted) wildfire due to increased fire intensity associated with higher fuel loads, which would hamper fire suppression efforts.

b. Probability of Ignition

Probability of ignition is strongly related to fine fuel moisture, air temperature, shading of surface fuels, and an ignition source (Graham et al 2004). Implementation of either

treatment alternative would not affect the likelihood of lightning strikes. Regardless of the alternative chosen, ignitions would still be expected across the proposed action area. Altered stand structure can affect stand temperature and humidity – there is generally a warmer and dryer microclimate in more open stands (Graham et al 2004). Dense stands, such as those with no record of past management or fire, generally have more shading of the surface fuels and higher relative humidity and air temperature (thus, higher surface fuel moistures) (Graham et al 2004). An open forest structure would have contributed to the maintenance of ponderosa pine and other fire-dependent forests – where fire starts may have been common due to an increased probability of ignition, but intensities and severities were generally lower due to maintained surface fuels. The proposed action would aim to mimic these surface fuel conditions. Even with a fire start in areas treated under the proposed action, fire spread would be expected to decrease due to projected slower rates of spread and lower flame lengths. In the case there is an ignition and resulting wildfire, spotting that accompanies crown fire would be reduced because of modified surface, ladder, and canopy fuels.

c. Suppression

Lightning is the main cause of fire occurrence on National Forest System lands on the Ashland Ranger District. According to the Ashland District Fire Summary, the Ashland district of the Custer has more fires per acre per year than any of the other Districts on the Custer (Clark, 1989). From 1951-1988, 1360 fires (or an average of more than 36 fires per year) were reported.

As in the past, ignitions continue to occur today. Using GIS data from the Custer National Forests database, historical suppression records were pulled. From 1980-2006, 19 fires (less than 10 acres) were successfully suppressed in the Whitetail Hazardous Fuels analysis area, and an additional 4 fires were immediately adjacent. On average, 1.3 fire starts are reported in the Whitetail Hazardous Fuels project area every year.

Success in initial attack relies on efficient arrival time to a fire. Well maintained roads allow for safer travel and allow for a variety of resources to support a fire. Although road maintenance would be necessary to accomplish treatments, no new permanent roads are proposed for this project, thus access routes for suppression resources would not change. However, an open canopy and reduced surface and ladder fuels allow for quicker and safer foot travel to and from wildfires not accessible from an engine or other vehicle.

d. Topography and Weather

There are two contributing factors to wildfire behavior that cannot be controlled regardless of the action taken or alternative chosen for this project – the topography (elevation, aspect, parent material, etc.) of the project area and the daily and seasonal weather contributing to fire danger. However, modification of fuels and opening of a stand can affect microclimate, especially wind and solar radiation, influencing surface fuel moistures.

The Whitetail Hazardous Fuels project area is oriented with the prevailing wind direction - typical winds are moderate from the southwest. For the “worst case scenario” the average highest recorded observations are between 21-38.5 miles per hour (20-foot wind

speed). Wind orientation also plays a role in fire spread. Because the local topography is relatively flat the effects of wind on fire spread are increased. Therefore wind overrides slope effect on direction of spread. This then makes the direction of wind important. As previously mentioned the wind generally comes out of the southwest, causing fire spread and general fire movement to the northeast. Strong winds are generally associated with cold fronts, which can have an effect on fire behavior due to shifts in wind direction and downdrafts. More open stands created with fuels treatments would generally have greater surface winds than adjacent dense stands, affecting rates of spread and fire intensities based on that factor alone. However, properly executed fuel treatments that reduce fuels and reduce crown fire potential makes the increased wind a reasonable trade-off (Scott and Reinhardt 2001).
Slopes in the proposed treatment area are gentle to moderate, although a small portion is steep enough that it would require skyline harvesting.

2. No Action
Since the No Action alternative does not propose to change anything no direct effects would occur. Indirect effects for this alternative are discussed in Section **4. Cumulative Effects Related to Fire and Fuels.**

3. Direct and Indirect Effects

The Proposed Action is made up of both commercial and non-commercial treatments. Below is a discussion of the direct/indirect effect of each treatment.

a. Direct/Indirect Effects from Commercial Treatments:

1. *Commercial Thin (116 Acres)* - The design of the CT, harvest system is to thin from below to reduce fuel hazard, and promote healthy growing conditions. The expected effect of this treatment would reduce the risk of a catastrophic wildfire occurring in these stands. At the landscape level, this treatment would improve conditions by increasing the representation of mid and late open canopy stands.

2. *Commercial Thin 1(724 Acres)* - The design of the commercial thin 1 treatment is to thin from below to an average canopy cover range of 40-60% for wildlife habitat and vegetative diversity. While not all of the stand attributes that contribute to high severity wild land fire (Canopy spacing, ladder fuels, and surface fuel levels) would be treated, reductions in ladder fuels and surface fuel levels mimicking historic levels would be achieved. At a landscape level, this treatment would maintain late development closed canopy stands.

3. *Shelterwood and Seed Tree Treatments (753 Acres)* - The design of the shelterwood and seed tree harvest system is for stocking reduction to create pattern and structure diversity to alter landscape hazardous fuel conditions. The potential for high severity wildfire events would decrease in the immediate future in this treatment. As these stands develop this potential increases until the time when the over story trees are removed. In the absence of maintenance, in the form of prescribed burning or mechanical thinning the potential for greater than 75% over story mortality from wildfire would increase due to the continued

development of the forest canopy. At a landscape level, this treatment would improve conditions by increasing the representation of post replacement stands.

4. *Seed Tree Removal and Seed Tree Removal with Combinations Treatments (142 Acres)* - The seed tree removal treatment is designed to remove seed trees from past harvest activity or girdle. This treatment would maintain both closed canopy and create open canopy conditions. In the residual closed canopy stands, the risk of high mortality (greater than 75 % over story mortality) from wildfire would decrease slightly. In the residual open canopy stands, this risk would be reduced. At the landscape level, this treatment would improve conditions by increasing the representation in the post replacement, open and closed canopy mid development, and open canopy late development stands.

5. *Liberation Cut (22 Acres)* - The liberation cut treatment is designed to remove over story trees for structural diversity. The residual stand would have a slightly reduce potential for high mortality. At the landscape level, this treatment would improve conditions by increasing the representation in the mid development closed canopy stands.

6. *Special Cuts, Aspen and Woody Draw Treatments (56 Acres)* - The design of this treatment is to release the green ash (*Fraxinus pennsylvanica)* or aspen (*Populus tremuloides*) by removing the overtopping and competing ponderosa pine trees. By implementing this treatment the potential high severity wildfire behavior in the draw bottoms would be reduced. At a landscape level, this treatment would improve conditions by increasing the representation of the woody draw bottoms. Because this vegetation type makes up such a small percentage of the overall landscape, this is not expected to contribute to the overall goals of improving the FRCC.

Commercial activities would start soon after the decision is signed. Preparation and implementation of the initial phase of this would not be complete for at least 1-5 years. Generally, prescribed burning in the sale areas would not occur until the commercial operations are complete. The exception to this would be if the prescribed burn would not impact the commercial aspect of this treatment. Harvest alone only treats the ladder and canopy fuels and does little to address the surface fuels. Slashing, combined with biomass utilization or grapple-piling and pile burning are also effective methods of treating surface fuels, both natural and activity created – however it is not as effective in reducing the fine fuel loading (the smallest branch wood material) as is prescribed fire. This project proposes to use prescribed under burning on all acres except those identified as no treatment to address surface fuels.

After the harvests are complete, an appropriate prescribed burning specialist and/or forester would monitor the effectiveness of the harvest to determine the prescription for the prescribed fire. In some cases, increased or decreased over-story mortality may be desired, in which case timing of prescribed fire can be adjusted to meet these needs. The prescribed burning specialists would then monitor fuels attributes (such as moisture and arrangement) created by the harvest (commonly called activity fuels) to determine the most appropriate time to burn those areas. This could take up to a year to accomplish,

however, because the weather conditions are variable, timing of this burn would be adjusted to meet objectives.

Prescribed burns would be conducted in a way that would minimize the amount of over-story mortality. Table 1.5 describes the mortality limits for the various treatments. Surface fuels would be reduced to levels identified by the silvicultural prescriptions. If techniques, such as whole tree yarding, are utilized prescribed burning may not need to occur across some units. In this case disposal of the activity fuels would be accomplished through pile burning at landings or other appropriate areas.

b. Direct/Indirect Effects from Non-Commercial Treatments

1. *Prescribed Burn treatment (2332 Acres)*- Prescribed burning would be used to maintain and/or improve non-forest ecosystems and open grown ponderosa pine areas. These treatment units are primarily grassland types. Typical treatment in this type would allow fire management personnel to establish reliable control lines beyond the forested edges. The effect of this treatment is not expected to contribute singlely, in combination, or cumulatively to the project.

2. *Non-Commercial Broadcast burning treatments (1049 Acres)*- The non-commercial broadcast burning treatment is designed to thin from below in the 0 to 7" diameter class to reduce ladder fuels, and restore open grown large diameter ponderosa pine stands. These stands occur on southern, and/or dry aspects that naturally do not support high crown densities. After treatment, the risk of high severity (greater than 75% over story mortality) wildfires would be reduced. At the landscape level, this treatment would improve conditions by increasing the representation of late development open canopy stands.

3. *Non-Commercial Jackpot burning treatments (2219 Acres)*- The non-commercial jackpot burning treatment is designed to thin from below to a canopy cover range of 55-70% to eliminate ladder fuels while maintaining wildlife habitat and vegetative diversity. While not all of the stand attributes that contribute to high severity wild land fire (canopy spacing, ladder fuels, and surface fuel levels) would be treated, reductions in ladder fuels and surface fuel levels mimicking historic levels would be achieved. At a landscape level, increases would be seen in post replacement and late development closed canopy stands. However, the bulk of this treatment would maintain late development closed canopy stands.

TABLE 1.5 - WHITETAIL HAZARDOUS FUELS PRESCRIBED FIRE PARAMETERS BY TREATMENT TYPE

Treatment Type Sub Category	Prescribed Fire Treatment	Approximate Ratio of Ground Area Burned:Unburned	Management Strategy to Achieve Prescribed fire Goals		
			Percent of Area in Fire Created Canopy Openings	Average Fire Created Canopy Opening Size in Acres	Percent Fire Created Over story Tree Mortality
4 – FUEL BREAK	Broadcast Burn	70:30	≤ 3	0.5 to 2.0	≤ 10
5 - SC	Jackpot Burn	30:70	≤ 3	0.5 to 2.0	≤ 10
7 - NCBJ	Jackpot Burn	70:30	5 to 10%	0.5 to 2.0	≤ 15
8 - NCBB	Broadcast Burn	70:30	≤ 5	0.5 to 2.0	≤ 20
9 - NCNS	Jackpot Burn	70:30	≤ 3	0.5 to 1.0	≤ 5
10 - PCT	Jackpot Burn		≤ 3	0.5 to 1.0	≤ 10
11 – STR/PCT	Jackpot Burn	60:40	≤ 3	0.5 to 1.0	≤ 10
12 – STR1	Jackpot Burn	60:40	≤ 3	0.5 to 1.0	≤ 10
13-LIB	Jackpot Burn	60:40	≤ 3	0.5 to 1.0	≤ 10
14 - RXB	Ecosystem Burn	70:30	N/A	N/A	N/A

4. *Pre-commercial thin treatments (96 Acres)*- The pre-commercial thin treatments are designed to thin sapling size class (1-5" diameter) to a density of 125 to 260 trees per acre and pole size class (5-8" diameter) to a density of 125-200 trees per acre, leaving the fastest growing, most disease free and damage-free trees. Through treatment, a slight reduction in potential over story mortality and surface fuels mimicking historic levels would be seen. At the landscape level, this treatment would have a small increase in mid development closed canopy acres.

5. *Special Cuts Non Commercial (49 Acres)*- The design of this treatment is to release the green ash (*Fraxinus pennsylvanica)* or aspen (*Populus tremuloides*) by

removing the overtopping and competing ponderosa pine trees. By implementing this treatment the potential wildfire behavior in the draw bottoms would be reduced. At a landscape level, this treatment would improve conditions by increasing the representation of the woody draw bottoms. Because this vegetation type makes up such a small percentage of the overall landscape, this is not expected to contribute to the overall goals of improving the FRCC.

6. *Non-Commercial Nest Stands (710 Acres)-* The design of this treatment is to reduce the ladder fuels inside the identified Goshawk Nest Stands. Due to differing stand structures, stands were split into the northern and southern stands. The northern two nest stands are located near roads 4422 and 44273 in the eastern portion of the project area while the southern two stands are located southeast of whitetail cabin. (Please see map in Appendix A for location)

   Northern two Nest Stands

   Thin from below without altering the over story canopy to maintain identified Goshawk nest stands and alternate nest stands. Purpose is to maintain mature high forest crown cover habitat for those wildlife dependent species. While not all of the stand attributes that contribute to high severity wild land fire (Canopy spacing, ladder fuels, and surface fuel levels) would be treated, reductions in ladder fuels and surface fuel levels mimicking historic levels would be achieved. At a landscape level, this treatment would maintain late development closed canopy stands.

   Because the design of this treatment is to maintain a mature over story care must be taken in the design of the application of a prescribed fire. In the northern most nest stand, canopy closures of greater than 40% over an area approximately 200 acres or more would not allow heat from a prescribed fire to dissipate well. In these nest stands, acceptable over story mortality rates of 5% have been specified. In order to meet that acceptable level, and still apply prescribed fire, fuels must be arranged in piles to minimize the primary fire effect to the surrounding over story trees.

   Currently, cost estimates to pile and burn those fuels averages $650-$1000 per acre depending on crew experience levels, fuel loading to be piled, and access. Due to unforeseen fluctuations in budgets, priorities, etc. this treatment may prove too costly to implement. In this case, logical fire control line boundaries would be identified on the boundary of these stands or beyond and no treatment would then occur within this boundary. Common logical fire control lines may be wet drainage bottoms, roads, water (lakes or streams), topographic features (such as ridge tops), or the like.

   Therefore, the proposed action would help maintain goshawk habitat over the long-term and reduce ladder and surface fuels, but not eliminate the risk of habitat loss to stand-consuming wildfire.

Southern Three Nest Stands (Whitetail Cabin Area)
Thin from below without altering the over story canopy to maintain identified Goshawk nest stands and alternate nest stands. Purpose is to maintain mature high forest crown cover habitat for those wildlife dependent species. While not all of the stand attributes that contribute to high severity wild land fire (Canopy spacing, ladder fuels, and surface fuel levels) would be treated, reductions in ladder fuels and surface fuel levels mimicking historic levels would be achieved. At a landscape level, this treatment would maintain late development closed canopy stands.

Through site specific visits, it is expected that jackpot burning could be implemented without effecting more than the specified 1-5% of the over story trees. This is primarily because the two southern nest stands have a lower canopy closure than the two northern stands. However, it is important to note that due to unforeseen fluctuations in budgets, priorities, etc. this treatment may prove too costly to implement. In this case, logical fire control line boundaries would be identified on the boundary of these stands or beyond and no treatment would then occur within this boundary. Common logical fire control lines may be wet drainage bottoms, roads, water (lakes or streams), topographic features (such as ridge tops), or the like.

Therefore, the proposed action would help maintain goshawk habitat over the long-term and reduce ladder and surface fuels, but not eliminate the risk of habitat loss to stand-consuming wildfire.

7. *No Treatment (1510 Acres)*- These are considered both open and closed canopy stands. Their characteristics would remain constant through this analysis. For a breakdown on distribution in development classes, refer to **Appendix B- Structural Class Improvements by Treatment Type**

Because this system has been allowed to develop without natural fire for so long, a multiple entry approach must be used on all treatments. This is especially true for the Non-commercial jackpot burning treatment. In this treatment, prescribed fire would be used to reduce both the ladder fuels and litter/duff layers while maintaining control of the burn. Through careful monitoring by the district fuels specialist, additional entries would be made until the desired residual stand characteristics have been accomplished. This would allow individual elements of the fuels environment to be treated with greater success and control.

In addition to the above treatments, a fuel break would be constructed in the middle of the project area. This approximately 300 feet average width fuel break (about 150 ft. each side) would occur along roads #4769 (Sartin – Stacey Cr.) #4427 (Beaver Crk/ Pumpkin Crk. Divide), #4777 (East Fork. Otter / Pumpkin Creek Divide), #4769, 4133

(Beaver Creek), and #4423 (Pumpkin Cr.). In order to use this as a barrier the following describes the residual stand minimums (adjacent stands with treatment prescriptions may exceed these minimums):

1. Canopy spacing of at least 10 feet between canopies of individual trees;
2. Ladder fuel canopy base height of greater than 10 feet (no branches between ground and canopy); and
3. Surface fuels less than 3 tons per acre on the average.

As table 1.6 shows, after implementing the proposed treatment there is still an under-representation in the mid development classes as compared to the reference conditions. Opportunities to utilize techniques such as over story removal were analyzed by the IDT, but concern surfaced concerning damage to the residual under story. These negative effects would exceed the benefits associated with contributing to this structural class. Therefore, it was decided the most appropriate technique to increase mid development classes was to take advantage of the areas where damage would be minimal and create young stands that would develop into mid development stands in the future. Hence, it is necessary to develop more acreage in the early development stage, so that stands may be developed into this class in the future.

Fuels treatments would remove the majority of the ladder fuels, thus raising the canopy base heights to at least 16 feet – a level where surface flame lengths would not be able to move into the tree crowns except for under rare scenarios of extremely high winds. In addition, harvest of the over story trees would effectively space tree crowns, reducing the likelihood of fire spread from one tree to the next as shown in the increased crowning index (wind necessary to sustain crowning) in the proposed action as compared to the current condition (no action).

Although an immediate decrease in the amount of ladder and aerial fuels would be realized post-harvest, a short-term increase of surface fuels from limbs, tops, and slashed material created from logging activities would increase the surface fire hazard before these fuels can be either grapple-piled or under burned. This short-term increase of fuels would not occur in units where the purchaser is required to or opts to remove these fuels at the same time harvest takes place. Over wintering of slash fuels is often a design feature to leach nutrients back into the soil. Harvest activities that take place in the late fall or early winter decrease the fire hazard because the activity fuels not only have a chance to over winter, they are on the ground during periods of very low fire danger and can then be either grapple-piled or under burned come the following spring. At any rate, although an increased short-term fire hazard for high intensity surface fire exists following timber harvest, the chance for crown fire is nearly eliminated, as the other ladder and crown fuels have been removed or at least reduced.

Table 1.6 Whitetail Fuels Reduction- Proposed Treatment FRCC Departure

Structural Class	Reference Percent	Existing Percent	Proposed Treatment Percent	Proposed Treatment Departure
Post Replacement	10%	1%	21%	35%
Mid Development Closed	15%	3%	5%	-48%
Mid Development Open	25%	2%	2%	-85%
Late Development Open	40%	19%	26%	-22%
Late Development Closed	10%	75%	46%	64%

4. Cumulative Effects Related to Fire and Fuels

a. No Action

Fire Suppression & Fuel Accumulation
Fire suppression would be a continued reality within the project area regardless of the alternative chosen. At the time of this document, there is no approved Wild land Fire Use (WFU) Plan for the Ashland Ranger District. Therefore, the appropriate response to wildfire in this area would be full-control suppression for the foreseeable future.

As mentioned before, without natural or prescribed fire in which these stands depend on a rather frequent basis, fuels would continue to accumulate in all layers adding to the fire hazard. This increases the potential for a crown fire similar to that of the 61,651 acre Stag Fire in 2000. In areas of this fire, more than 90% of the over story canopy was killed, leaving numerous dead trees standing. In 2008, the majority of those snags have fallen to the ground causing a dramatic increase in the surface fuel loading. As mentioned before this increase in surface fuel loading increases the potential fire behavior by increasing the potential intensity and flame length, making the probable wildfire more difficult to control and requiring more advanced methods of attack and equipment.

Departure from condition class
The No Action alternative would have no benefit on Fire Regime Condition Class in the present because it provides no method for moving the landscape towards a natural range

of departure. As each year passes from the current, the departure would become even greater, especially on dry sites that are departed from fire frequency.

A wildfire event could affect the fire regime condition class, but it is not possible to assume whether a wildfire in the project area would have a benefit or a negative affect on condition class – it would depend on the range of a fire, as well as the intensity and severity to forest resources. Furthermore, it is not possible to predict when and where a fire would occur on the landscape in the future.

Firefighter Safety
The No Action alternative does not propose to change anything, so conditions would be expected to remain similar to current conditions. Since 75% of the forested stands have been classified as a closed canopy, the potential for crown fire, firefighter safety would not be improved.

b. Proposed Action

Fire Suppression & Fuel Accumulation
Of all actions taken, fire suppression is the primary action to be considered when evaluating cumulative impacts to the fire and fuels resource. Much research has been done on the effects of fire exclusion, which has been summarized throughout this report. Crown fire potential is an important element of this assessment. By implementing the proposed action, conditions in the Whitetail analysis area would improve. While no one treatment can effectively reduce the crown fire potential for all of the possible scenarios, the proposed treatment would reduce the potential in the project area. As previously mentioned, weather and topography can contribute to crown fire potential; however, we do not have the ability to change these attributes. To lessen the potential for stand replacement wildfire the attributes we do have control over are surface fuel loading, ladder fuels, and canopy spacing. Specifically, those treatments that reduce the canopy to less than 40%, maintain surface fuels at 2-7 tons per acre, and increasing the canopy base height to at least 16 feet would reduce stand replacement potential. The effects of individual treatments have been discussed in the preceding Section 3 - Direct and Indirect Effects. Some treatments maintain a higher canopy cover than is desirable to reduce the risk of crown fire potential. These treatments have been designed to maintain goshawk habitat over the long-term but not eliminate the risk of habitat loss to stand-consuming wildfire.
The effectiveness of the fuels treatments selected was discussed previously an additional fuels treatments in the future would be necessary to keep hazardous fuels at a level where low-intensity fire can be controlled by suppression resources. These activities can include pre-commercial thinning, continued biomass utilization, piling & burning, and prescribed fire, along with many other activities not proposed for this project but could be considered in the future (mastication, chipping, etc.).

Departure from condition class
The Proposed Action alternative would have a positive benefit on Fire Regime Condition Class because it provides a method for moving the landscape towards a natural range of

departure from reference conditions. As seen in the table in Appendix C- Fire Regime Condition Class, the proposed action would change **1645 acres** into highly departed structure classes, as well re-introducing fire (in the form of prescribed burning) across the Whitetail landscape. Through the proposed action, the Condition Class would be **reduced to a Condition Class 2.**

Firefighter Safety

Private residences and buildings in and adjacent to the project area are quite often built near the creek bottoms and grasslands. The adjacent wild land fuels are predominated by grass and shrub types. Locally, this is a relatively safe condition in regards to home defensibility. However, the risk of escape from the adjacent federal grounds is still a concern. In those areas where the canopy has been reduce to less than 40% (reducing the canopy bulk density), the fuel loading is less than 7 tons per acre, and the ladder fuels have been reduced (thereby increasing the canopy base height) does not preclude the mere occurrence of a wild land fire, but it would reduce the risk of an escape on to private land by reducing the spotting potential and increasing the ability for local wildfire suppression resources to control a potential wildfire. The proposed treatments for this project are outside of the home ignition areas (generally 100-200' from structure) where Fire Safe work is focused, but the project would facilitate work that has been done because the potential for an area to burn takes into account fire moving from one area to another, the rate at which fire moves across a landscape, and the intensity at which a fire burns. Decreasing the likely fire intensity in one area would have a large effect on fire movement and fire intensity in another (Graham et al. 2004). Patches of vegetation that burn relatively slower or less severely than surrounding patches can reduce fire intensity, severity, or spread rate, or may force the fire to move around them by flanking (at a lower intensity), which locally delays the forward progress of a fire (Graham et al. 2004). This would be important where fires have the potential to move from the project area on to private land and into the home ignition zone.

By implementing the proposed action, firefighters would have more options available to achieve control. In areas where heavy fuel loads, abundant ladder fuels, and thick canopies hampered control efforts, new efforts including black-lining would be employed.

5. Forest Plan and Other Regulatory Direction Consistency by Alternative

Forest wide Goals:

The goal of air resource management is to meet or exceed state air quality standards and ensure protection of air quality values.

Management Standards:

5. Range

g) Conifer encroachment control may occur where:

(4) In rangelands where the invading trees are less than 3-feet high, prescribed fire may be the preferred treatment. Mechanical methods may be used in areas where trees are over 3-feet high, including removal for Christmas tree purposes.

7. Watershed (Soil and Water Resources), Air Quality

b. Air Quality

3) The objective is to maintain air quality at or above levels required by federal and state laws, regulations, and standards. Air that passes over the National System Forest lands would not be degraded below allowable increments by activities under Forest Service control. State and local governments and appropriate federal agencies would also be consulted and involved in monitoring and controlling air pollution originating on non-federal lands. Standards developed in the Cooperative Smoke Management Plan would be used for prescribed burning activities in the applicable states.

12. Law Enforcement and Fire Management

b. Fire Management

4) Fuels Management

a) A combination of treatments would be used that would most efficiently meet the fuels management direction of each management area. The Forest would consider the use of prescribed fire, using both planned and unplanned ignition as a management tool. Unplanned ignitions may be used throughout the forest to meet management area goals when fire prescriptions have been developed and approved by the Forest Supervisor. When prescribed fire-planned ignition is part of a treatment, it will be carried out at a time and within a prescription that will minimize impact on air quality and soil damage, achieve the desired results, and conform to the Northern Region Fuel Management and Treatment Guides.

b) Management activities that may increase fuel hazards will be analyzed to determine what level of treatment is appropriate. The cleanup or treatment of slash and debris resulting from any project will continue to be considered as a cost of the operation. Projects that cannot provide adequate debris treatment to meet management goals and objectives will not b e undertaken. Fire hazards will be reduced by cost-efficient means.

Management Area Standards and Goals:
9703 acres of the project area is within Management Area D. The goal for this management area is to maintain or improve the long-term diversity and quality of habitat for the selected species identified by the Ranger District as well as accommodating the other resource management activities such as timber harvest, livestock grazing, and oil and gas development. Some short term habitat impacts may be necessary to achieve long-term wildlife goals (Forest Plan p.53).

Management Area D Standards	
Standard	**Discussion**
Fire Management	**b. Prescribed fire, planned ignition may be used for range improvement and wildlife habitat, timber stand maintenance, fuels reduction, sanitation, maintaining vegetation, and associated wildlife habitat dependent on periodic fire. (Forest Plan p. 56)**

4 acres of the project area is within Management Area F, which is the Holiday Springs Campground. The goal for management area F is to provide a spectrum of recreation opportunities and settings in the and around developed sites and the access corridors to the sites in the categories of Semi primitive Non Motorized/Motorized, Roaded Natural Appearing and Rural. Resource management conflicts are resolved in favor of maintaining or enhancing the recreation opportunities including the visual setting (CNFMP pg 61.)

5. Summary of Forest Plan Consistency

No Action Alternative
This alternative would not take any action to protect human life and property within the analysis area from an uncontrolled and unwanted wildfire. The No-Action Alternative would not use prescribed fire to help meet the goals of the management areas within the analysis area. It would not help develop cost-effective fire programs because it is reasonable to expect more intense fire behavior than in treated stands, thus control would be more difficult and likely require a greater number and type of suppression resources. The continued lack of fuels management would be inconsistent with the Forest plan goals, objectives, and standards because of the continued trend in undesired fire behavior.

Proposed Action Alternative 2
This alternative would be consistent with the Forest Plan as it proposes to use prescribed fire to help meet the goals of the management areas within the analysis area. This alternative would take action to reduce potential flame lengths and rates of spread – preventative steps towards the protection of human life and property within and adjacent to the analysis area in the event of a wildfire. The reduction of fuels will also help the initial attack organization meet their suppression objectives, as activity fuels would be treated in order to reduce fire intensities that allow for safe direct attack. This alternative would help develop cost-effective fire programs by reducing potential intensities of wildfires and therefore the costs of controlling potential wildfires.

This alternative proposes to reduce fuels across the most acres in the wild land urban interface; therefore, it better meets the goals, standards and objectives of the Forest Plan, as well as meeting the intent of the Healthy Forests Restoration Act of 2003 and the National Fire Plan – as the proposed action specifically addresses fuels reduction through collaboration in the wild land urban interface of an at-risk community, addresses firefighter and public safety be modifying fuels to reduce fire intensities and the potential for crown fire, and promotes community assistance through utilization of the fuels (biomass) removed as a result of project activities.

Appendix A- Structural Development Class Descriptions

1. Early Development Stands- Average stand diameters are generally less than 5 inches Diameter Breast Height (DBH) with canopy covers less than 40 percent. Stands may be dominated by grasses and forbs, resembling a post replacement event such as a wildfire. Fuel loadings are relatively low with less than 3 tons per acre. Most often these are modeled as a Fuel Model 2-Timber (grass and under story).

2. Mid Development/Closed Canopy Stands- Average stand diameters would be between 5 and 9 inch DBH that are susceptible to stagnation. Canopy cover would be greater than 40 percent, but stand structures are most often single-storied. While ladder fuels are not identified in these stands, low canopy base heights (less than 5 feet) are usually present. Average surface fuel accumulations rarely exceed 7 tons per acre, with the majority of this material greater than 3 inches in diameter. Most often these are modeled as a Fuel Model 9- Hardwood litter.

3. Mid-Development/Open Canopy Stands- These are generally pole (5-9 inch DBH) sized trees with less than 40 percent canopy cover. Frequent fire would keep the under story clear of regeneration as well as limit the amount of accumulated surface fuels. Most often these are modeled as a Fuel Model 2- Timber (grass and under story).

4. Late Development/Open Canopy Stands- These stands typically would be thought of as open pine savannahs. Average stand diameters are greater than 9 inches with less than 40 percent canopy cover. Fuel loading generally would not exceed 4 tons per acre and ladder fuels would be scarce. The main fire carrier would be grass, making this a Fuel Model 2- Timber (grass and under story).

5. Late Development/Closed Canopy Stands- These stands would have higher canopy covers, in excess of 40 percent and sometimes in excess of 70 percent. Average stand diameters are greater than 9 inches, with some ladder fuels present. Surface fuel accumulations would be the highest of all stands, but would not exceed an average of 7 tons per acre. Because the main carrier in these stands is ponderosa needles, the most representative fuel model is 9- Hardwood litter.

Appendix B- Model Assumptions

Appendix B- Model Assumptions

							Units
surface fuel model		9	9	9	9	2	FM Number
dead moisture							
	1-hr	4	4	4	4	3	Percent
	10-hr	5	5	5	5	4	Percent
	100-hr	7	7	7	7	6	Percent
live fuel moisture	live	60	60	60	60	60	Percent
canopy fuels	bulk density	0.0104	0.0092	0.0065	0.0051	0.0036	lbs/ft^3
	foliar moisture content	90	90	90	90	90	Percent
	canopy base height	16	20	23	27	30	Feet
	canopy fuel load	4.14	3.56	2.38	1.79	1.21	Tons/acre
site	slope	25	25	25	25	25	Percent
	open(20-foot) wind speed	20	20	20	20	20	Mile per hour
	wind direction, from uphill	0	0	0	0	0	Degree
	wind reduction factor	0.3	0.3	0.3	0.3	0.4	No unit
multipliers	surface ROS	1.0	1.0	1.0	1.0	1.0	No unit
	crown fire ROS	1.0	1.0	1.0	1.0	1.0	No unit
	surface load &depth	1.0	1.0	1.0	1.0	1.0	No unit
	surface fire intensity	1.0	1.0	1.0	1.0	1.0	No unit
Canopy Closure		69.0	52.0	47.0	35.0	23.0	Percent

Fuel model			loading			fuel bed	extinction	Heat
DESCRIPTION	units	1-hr	10-hr	100-hr	live	depth	moisture	content
1 Short grass (1 ft.)	English	0.7	0.0	0.0	0.0	1.0	0.12	8000
2 Timber (grass and under story)	English	2.0	1.0	0.5	0.5	1.0	0.15	8000
9 Hardwood (long-needle pine) litter	English	2.9	0.4	0.2	0.0	0.2	0.25	8000

Appendix C- Fire Regime Condition Class Assessment

11/4/03 DRAFT

Fire Regime Condition Class (FRCC) Interagency Handbook
Reference Conditions

Modeler: Doug Havlina **Date:** 8/14/03 **PNVG Code:** PPIN9

Potential Natural Vegetation Group: Ponderosa Pine (Black Hills).

Geographic Area: Southern and eastern Montana, northern Wyoming, western North Dakota.

Description: PNVG occurs in landscape mosaic with plains grasslands, juniper, and sagebrush types on flat and gentle south-facing slopes. Historically, found with mixture of western bunchgrass and plains grassland communities.

Fire Regime Description: Fire Regime I, primarily short-interval (e.g., <25 yr) surface fires.

Vegetation Type and Structure

Class	Percent of Landscape	Description
A: post replacement	10	Grass and forb dominated community following fire and grazing effects
B: mid-development closed	15	Dense mid-development forest; pole to large pole size trees susceptible to stagnation. Marginal understory associated with limited site resources.
C: mid- open	25	Open mid-development forest with diverse herbaceous understory. Maintained by frequent burning.
D: late- open	40	Open late-development forest; widely spaced trees, diverse understory, and limited surface fuels due to frequent burning.
E: late- closed	10	Dense late-development forest with significant within-stand mortality. Poorly developed understory and substantial surface fuel accumulation.
Total	100	

Fire Frequency and Severity

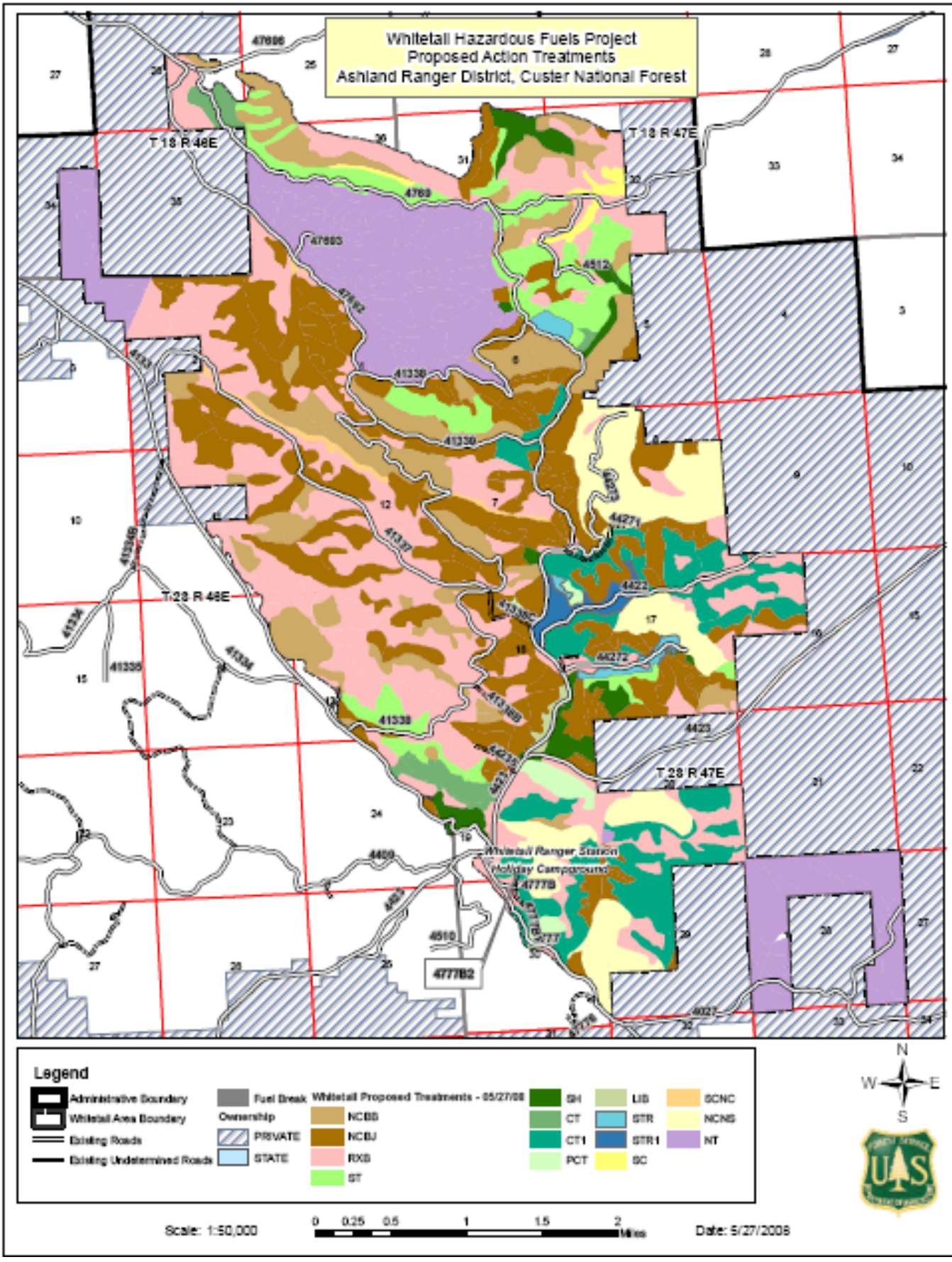
Fire Frequency-Severity	Modeled Probability	Pct, All Fires	Description
Replacement Fire	.005	12	Crown fire in B and E

Non-Replacement Fire	.038	88	Mostly surface fire; limited mosaic fire in B, C, and E
All Fire Frequency*	.043	100	

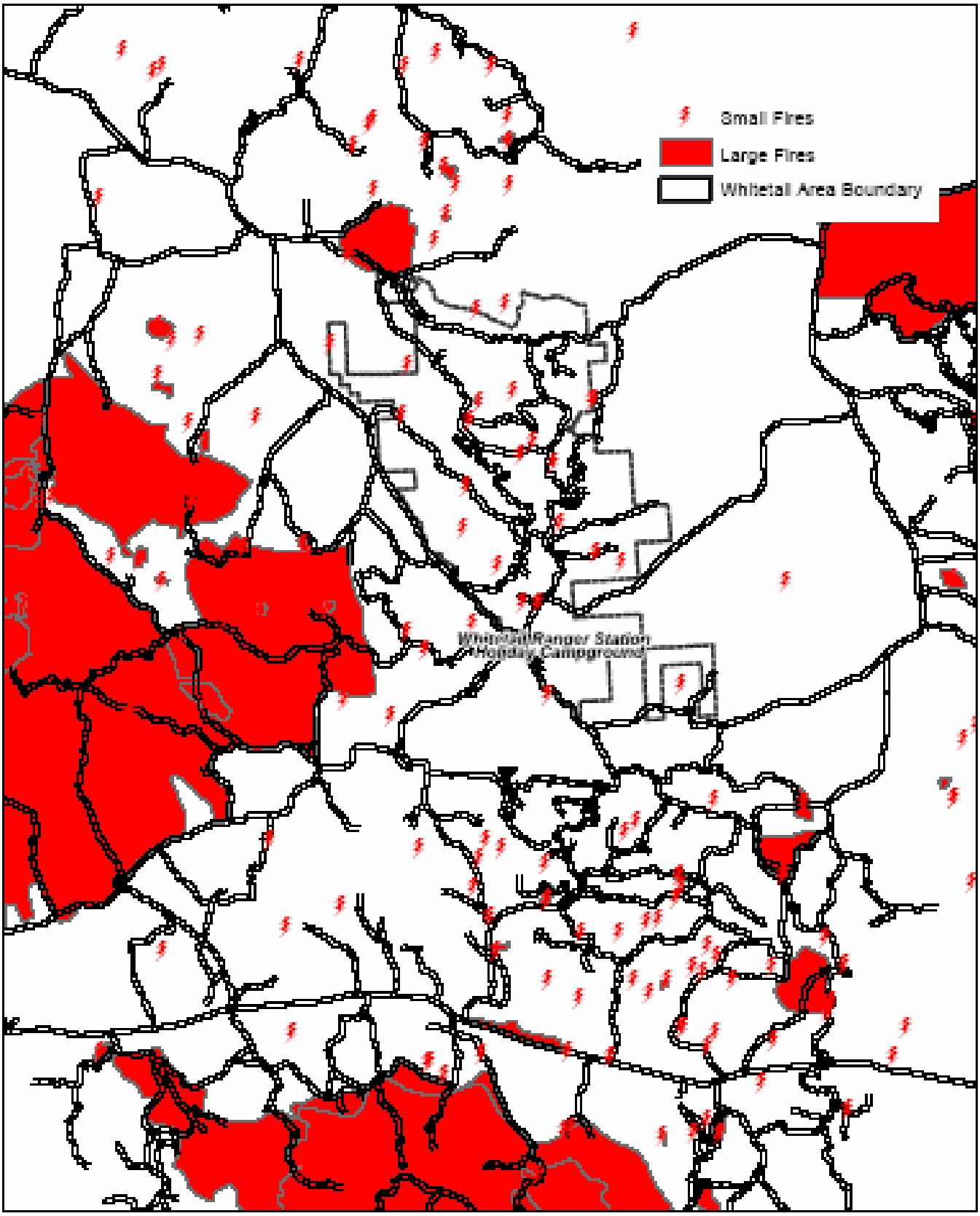
*Sum of replacement fire and non-replacement fire probabilities.

Activity	Total Acres	Post Replacement	Mid Development Closed	Mid Development Open	Late Development Open	Late Development Closed	Non-forested	Net Effect to P/N
Existing CT	116	0	108	8	0	0	0	Adds 108 acres to Mid Open
Treatment CT		0	0	116	0	0	0	
Acres Changed		0	(108)	108	0	0	0	
Existing CT1	724	0	0	0	0	724	0	No Effect
Treatment CT1		0	0	0	0	724	0	No Effect
Acres Changed		0	0	0	0	0	0	
Existing LIB	22	0	0	0	0	22	0	Adds 22 Acres to Mid Closed
Treatment LIB		0	22	0	0	0	0	
Acres Changed		0	22	0	0	(22)	0	
Existing NCBB	1049	0	0	125	858	63	3	Adds 188 Acres to Late Open
Treatment NCBB		0	0	0	1046	0	3	
Acres Changed		0	0	(125)	188	(63)	0	
Existing NCBJ	2219	0	109	0	158	1940	12	Adds 110 acres to Post Replacement
Treatment NCBJ		110	109	0	394	1594	12	Adds 236 acres to Late Open
Acres Changed		110	0	0	236	(346)	0	
Existing NCNS	710	0	0	0	0	710	0	No Effect
Treatment NCNS		0	0	0	0	710	0	No Effect
Acres Changed		0	0	0	0	0	0	
Existing NT	1510	0	0	0	159	687	664	No Effect
Treatment NT		0	0	0	159	687	664	No Effect
Acres Changed		0	0	0	0	0	0	
Existing PCT	86	56	0	0	0	30	0	Adds 86 acres to Mid Closed
Treatment PCT		0	86	0	0	0	0	
Acres Changed		(56)	86	0	0	(30)	0	
Existing RXB	2332	0	0	0	16	0	2316	No Effect
Treatment RXB		0	0	0	16	0	2316	No Effect
Acres Changed		0	0	0	0	0	0	
Existing SC	55	0	0	0	0	46	9	No Effect
Treatment SC		0	0	0	0	46	9	No Effect
Acres Changed		0	0	0	0	0	0	
Existing SCNC	49	0	0	0	0	0	49	No Effect
Treatment SCNC		0	0	0	0	0	49	No Effect
Acres Changed		0	0	0	0	0	0	
Existing SH	199	0	0	0	12	187	0	Adds 199 acres to Post Replacement
Treatment SH		199	0	0	0	0	0	
Acres Changed		199	0	0	(12)	(187)	0	
Existing ST	554	0	0	22	0	532	0	Adds 554 acres to Post Replacement
Treatment ST		554	0	0	0	0	0	
Acres Changed		554	0	(22)	0	(532)	0	
Existing STR	66	0	0	0	0	66	0	Adds 66 acres to Mid Closed
Treatment STR		0	66	0	0	0	0	
Acres Changed		0	66	0	0	(66)	0	
Existing STR1	76	0	0	0	0	76	0	Adds 30 acres to Post Replacement
Treatment STR1		30	0	16	30	0	0	Adds 16 acres to Mid Open
Acres Changed		30	0	16	30	(76)	0	Adds 30 acres to Late Open
								1645 Acres Moved to Underrepresented Structural Classes

Appendix D- Project Maps


Whitetail Hazardous Fuels Project
Proposed Action Treatments
Ashland Ranger District, Custer National Forest
T 18 R 46E
T 18 R 47E
T 28 R 46E
T 28 R 47E
Whitetail Ranger Station
Holiday Campground
47782
Legend
Administrative Boundary
Whitetail Area Boundary
Existing Roads
Existing Undetermined Roads
Fuel Break
Ownership
PRIVATE
STATE
Whitetail Proposed Treatments - 05/27/08
NCBB
NCBJ
RXB
ST
SH
CT
CT1
PCT
LIB
STR
STR1
SC
SCNC
NCNS
NT
N
W
E
S
Scale: 1:50,000
0 0.25 0.5 1 1.5 2 Miles
Date: 5/27/2008

Whitetail Hazardous Fuels Fire History



Appendix E- Activities Considered in Cumulative Effects

Appendix E- Activities considered in Cumulative Effects

Appendix E Projects Considered in Cumulative Effects Assessment Within Individual Issue Areas for NEPA document.

Activity	On NFS lands (Yes/No)	Estimated Period of Activity (Calendar Year)	Past, Present, or Reasonably Foreseeable Future Actions (RF)	Within Project Area	Considered in Fuel Effects?
Fly-Wilbur Timber Sale – Post-Sale Activities	Yes	2007-2010	Present, RF		No, outside the analysis area
Three mile Project	Yes	2003 - 2010	Past, Present, RF		No, outside the analysis area
East Fork of Otter Creek Road Reconstruction	Yes	2008 - 2010	Present, RF	X	Yes, however not a measurable effect for fuels
East Fork of Otter Creek Fuels Project	Yes	2008 – 2015	Present		Yes, however a high standard road separates the two project areas.
Travel Plan Management			Present, RF	X	No, Fire suppression and fuel treatments would not be limited by changes to this.
Livestock Grazing	Yes	Annually	Past, Present, RF	X	Yes, see Effects analysis
Taylor-Ten Fuels Reduction Project	Yes	Unknown	RF		No, outside the analysis area.
Noxious weed treatment	Yes	Annually	Past, Present, RF	X	Yes, noxious weed treatments are not likely to effect fire behavior, severity, or stand structures.
Dispersed Recreation (Camping, hiking, hunting, fishing,	Yes	Annually	Past, Present, RF	X	Yes, Dispersed Recreation is not likely to

Appendix E Projects Considered in Cumulative Effects Assessment Within Individual Issue Areas for NEPA document.

Activity	On NFS lands (Yes/No)	Estimated Period of Activity (Calendar Year)	Past, Present, or Reasonably Foreseeable Future Actions (RF)	Within Project Area	Considered in Fuel Effects?
hiking, bird watching, OHV, etc.)					affect fire behavior, severity, or stand structures.
Recreation in Developed sights (Red Shale, Cow Creek Holiday Springs campgrounds)	Yes	Annually	Past, Present, RF		Yes, see comment above.
Special Uses [Recreation (e.g. Outfitter and Guide) and Non-Recreation (e.g. Cultivation, communication sites livestock use, scoria pit)]	Yes	Annually	Past, Present, RF	X	Yes, same as previous comment.
Roundup Prescribed burning	Yes	2008 - 2012	Past, Present, RF		No, outside the analysis area.
Tenmile Prescribed burning	Yes	2008 - 2012	Past, Present, RF		No, outside the analysis area.
Timber Creek Prescribed burning	Yes	2006 - 2010	Past, Present, RF		No, outside the analysis area.
Administrative activities (permit administration, resource inventories, contract administration, road maintenance, wildfire suppression, etc.)	Yes	Annually	Past, Present, RF	X	Yes, see effects analysis for wildfire suppression.
Pre-commercial Thinning	Yes	Annually	Past, Present, RF		Yes, see effects analysis
Private land – Timber Harvest	No	1995	Past		Yes, see effects analysis
Private land – Livestock Grazing	No	Annually	Past, Present, RF		Yes, areas in the analysis

Appendix E Projects Considered in Cumulative Effects Assessment Within Individual Issue Areas for NEPA document.					
Activity	**On NFS lands (Yes/No)**	**Estimated Period of Activity (Calendar Year)**	**Past, Present, or Reasonably Foreseeable Future Actions (RF)**	**Within Project Area**	**Considered in Fuel Effects?**
					area were considered, however minimal effects are likely.
Private land – Farming	No	Annually	Past, Present, RF	X	Yes, areas in the analysis area were considered, however minimal effects are expected.

Appendix F- Glossary

Blowout: A hole made in the canopy by prescribed fire that results in nearly one hundred percent mortality of all conifers.

Canopy: More or less continuous cover of branches and foliage formed collectively by the crown of adjacent trees and other woody growth.

Canopy Base Height: The average height from the ground to the base of the tree canopies.

Commercial Thin: An intermediate (mid-rotation) stand tending treatment which harvests commercial sized lower crown classes with the objective of improving growth, vigor and/or value until at the end of the rotation. A commercial thin is not a regeneration treatment.

Cover: Vegetation used by wildlife for protection from predators, or to adverse weather conditions, or in which to reproduce. The different types are identified as hiding cover, thermal cover, and security areas.

Cumulative Effect: The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other actions. Cumulative impacts can also result from individually minor but collectively significant actions taking place over a period of time.

Diameter at Breast Height (dbh): A diameter measurement of a tree made at a point 4.5 feet above the ground surface.

Direct Effects: effects, which are caused by the action and occur at the same time and place.

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

Duff Layer: A layer of dead plant material that has fallen to the soil (ground) surface and has accumulated over several growing seasons. This fallen plant material is in the different stages of decay that ultimately results in the return of nutrients and minerals to the soil and living plants.

Ecosystem Burn: Treatment of fire dependent ecosystems to meet multi resource objectives identified in the Custer National Forest and National Grasslands Land and Resource Management Plan.

Ecosystem: Living organisms interacting with each other and with their physical environment, usually described as an area for which it is meaningful to address these interrelationships.

Effects (or impacts): Environmental consequences (the scientific and analytical basis for comparison of alternatives) as a result of a proposed action. Effects may be either direct, which are caused by the action and occur at the same time and place, indirect, which are caused by the action and are later in time or farther removed in distance, but are still reasonably foreseeable, or cumulative.

Even-aged: A stand of trees of essentially the same age, growing together.

Fire Line Intensity: The heat released per unit of time for each unit length of fire edge. The primary unit is Btu per second per foot of fire front.

Fire Severity: Degree to which a site has been altered or disrupted by fire; loosely, a product of fire intensity and residence time

Forage: Vegetation used for food by wildlife, particularly big game wildlife and domestic livestock.

Fuels: Combustible materials present in the forest, which potentially contribute a significant fire hazard.

Habitat Type: (Vegetative). An aggregation of all land areas potentially capable of producing similar plant communities at climax.

Indirect Effects: Secondary effects which occur in locations other than the initial action or significantly later in time.

Intensive Grazing Management: Grazing management that controls distribution of cattle and duration of use on the range, usually by fences, so parts of the range are rested during the growing season.

Ladder Fuels: Fuels that provide vertical continuity and enable surface fires to reach upper forest canopy levels.

Landscape: A heterogeneous land area composed of a cluster of interacting ecosystems that are repeated in similar form throughout. Landscapes vary in size from many thousands of acres to only a few acres.

Lopping: Methods of modifying fuels to allow for primary fuel treatment accomplishment and/or to speed natural abatement. Maybe a primary fuel treatment when no other treatments are planned.

Management Area (MA): Geographic areas, not necessarily contiguous, which have common management direction, consistent with the Forest Plan allocations.

Management Direction: A statement of multiple use and other goals and objectives, along with the associated management prescriptions and standards and guidelines to direct resource management.

Mature Timber: On lands allocated for timber harvest, and for the purpose of this project, mature is defined as trees or stands in which average annual stand growth has culminated, generally 80 to 100 years. In the context of wildlife - Mature forest habitat with characteristics needed to provide habitat for certain wildlife species such as the Goshawk.

Mineral Soil: Soil that is exposed; that there is no living or dead plant material covering the ground surface.

Mitigation: Actions to avoid, minimize, reduce, eliminate, replace, or rectify the impact of a management practice.

Monitoring and Evaluation: The evaluation, on a sample basis, of Forest Plan management practices to determine how well objectives are being met, as well as the effects of those management practices on the land and environment.

Mortality: Trees of commercial species, standing or down, that have died during a specific period, and were not cull trees at the time of death.

Natural Regeneration: Renewal of a tree crop by natural means using natural seed fall.

Natural Slash: Accumulations of material in a stand due to the lack of fire, natural dying, overstocking, etc.

No-Action Alternative: The No-Action Alternative is required by regulations implementing the National Environmental Policy Act (NEPA) (40 CFR 1502.14). The No-Action Alternative provides a baseline for estimating the effects of other alternatives. Where a project activity is being evaluated, the No-Action Alternative is defined as one where current management direction would continue unchanged.

Over mature Timber: For the purpose of this project, over mature stands are considered to be approximately 120 years of age or greater, average annual stand growth has culminated, or in which mortality often exceeds growth.

Over story: The portion of trees in a forest, which forms the uppermost layer of foliage.

Multistory: A stand of trees that has more than two canopy heights.

Pre-commercial Thin (PCT): The select felling, deadening or removal of trees in a sound stand primarily to accelerate height and diameter growth on the remaining stems, maintain specific species, stocking and/or stand density and improve vigor and quality of the trees that remain.

Prescribed Burning: The intentional application of fire to wild land fuels in either the natural or modified state under such conditions as to allow the fire to be confined to a predetermined area and at the same time to produce the intensity of heat and rate of spread required to further certain planned objectives (i.e., silviculture, wildlife management, reduction of fuel hazard, etc.).

Prescribed Fire: A wild land fire burning under preplanned specified conditions to accomplish specific planned objectives. It may result from either a planned or unplanned ignition.

Prescription: Management practices selected and scheduled for application on a designated area to attain specific goals and objectives.

Proposed Action: A proposal by the Forest Service to authorize, recommend, or implement an action.

Purpose and Need: A statement, which briefly specifies the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action. (40 CFR 1502.13)

Regeneration: The renewal of a tree crop, whether by natural or artificial means. This term may also refer to the crop (seedlings, saplings) itself.

Regeneration Harvest: Used in reference to clear-cut, seed tree and shelterwood harvest methods, which remove an existing, stand to prepare a site for regeneration.

Resistance to control: The relative difficulty of constructing and holding a control line as affected by resistance to line construction and by fire behavior. Also called difficulty of control.

Saw timber: Trees containing at least one 12-foot saw log or two noncontiguous 8-foot logs, and meeting regional specifications for freedom from defect. Ponderosa pine trees must be at least 7 inches in diameter at breast height.

Seedlings and Saplings: Non-commercial size young trees, generally occurring in plantations. Seedlings and saplings are from zero to five inches diameter at breast height. Seedlings are generally considered less than 1.0 inches diameter at breast height.

Seral Stage: A transitory or developmental stage of a biotic community in an ecological succession (does not include climax successional stage or pioneer stage).

Severe wild land fire (catastrophic wildfire): Fire that burns more intensely than the natural or historical range of variability, thereby fundamentally changing the ecosystem, destroying communities and/or rare of threatened species/habitat, or causing unacceptable erosion. (Society of American Foresters, 1998).

Site Preparation: A general term for a variety of activities that allow site establishment of regeneration such as removal or treatment of competing vegetation, slash, and other debris that may inhibit the establishment of regeneration.

Slash: The residue left on the ground after felling and other silvicultural operations and/or accumulating there as a result of storm, fire, girdling, or poisoning of trees.

Snag: A standing dead tree usually without merchantable value for timber products, but may have characteristics of benefit to some cavity nesting wildlife species.

Spot Fires: Fire ignited outside the perimeter of the main fire by a firebrand.

Stand: A community of trees or other vegetation uniform in composition, constitution, spatial arrangement, or condition to be distinguishable from adjacent communities.

Stocking: The degree to which trees occupy the land, measured by basal area and/or number of trees by size and spacing, compared with a stocking standard; that is, the basal area and/or number of trees required to fully utilize the land's growth potential.

Successional Stage: A stage or recognizable condition of a plant community which occurs during its development from bare ground to climax.

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

Thinning: Cutting to redistribute growth potential or benefit the quality of the residual stand.

Under story: Vegetation (trees or shrubs) growing under the canopy formed by taller trees.

Uneven-aged: Stands of trees of many age and sizes, growing together.

Uneven-age Management: The application of a combination of actions needed to simultaneously maintain continuous high-forest cover. Cutting methods that develop and maintain uneven-aged stands are individual-tree and group selection.

Wildfire: Any wildfire not designated and managed as a prescribed fire with an approved prescription.

Woody Draw: A classification of areas, particularly in grassland settings, where an over story of woody vegetation in small drainages creates habitat for many wildlife species and shade/wind protection and forage for livestock. The vegetation is a result of higher moisture conditions that in the surrounding area but surface water if any, running through the area is generally short term.

Appendix G- Bibliography

Agee, J. K., et al. 2002 Annual and Decadal Climate Forcing of Historical Fire Regimes in the Interior Pacific Northwest, USA. The Holocene 2002 pp 597-604

Anderson, H.E. 1982. Aids to Determining Fuel Models for Estimating Fire Behavior. USDA Forest Service General Technical Report INT-22.

Brown, James K, Reinhardt, Elizabeth D, and Kramer, Kylie A, 2003. Coarse Woody Debris: Managing Benefits and Fire Hazards in the Recovering Forest. USDA Forest Service Rocky Mountain Research Station General Technical Report RMRS-GTR-105

Clark, Wilson F. Custer National Forest, Ashland District Fire Summary: Covering calendar years 1951 through 1988. Custer National Forest Feb. 20 1989

Graham, R. T., Harvey, A. E., Jurgensen, H. E., Jain, T. B., Tonn, J. R., Page-Dumroese, D. S., 1994. Managing Coarse woody debris in Forests of the Rocky Mountains. USDA Forest Service Intermountain Research Station Research Paper INT-RP-477

Graham, R.T., McCaffrey,S., and Jain,T.B. 2004 Science basis for changing forest structure to modify wildfire behavior and severity. USDA Forest Service Rocky Mountain Research Station General Technical Report RMRS-GTR-120

Howes, L. 1927. Montana Territory. Suzanne Stevens Notti November, 2002

National Wildfire Coordinating Group, 2006. NWCG Fireline Handbook Appendix B Fire Behavior. National Wildfire Coordinating Group NFES #2165

Scott, J. H., Reinhardt, E. D. 2001. Assessing Crown Fire Potential by Linking Models of Surface and Crown Fire Behavior. USDA Forest Service Rocky Mountain Research Station Research Paper RMRS-RP-29

Scott, J.H., Reinhardt, E.D. 2005 Stereo Photo Guide for Estimating Canopy Fuel Characteristics in Conifer Stands. USDA Forest Service Rocky Mountain Research Station General Technical Report RMRS-GTR-145.

Scott, J.H., 2004 NEXUS 2.0 Release Notice. (www.fire.org)