Gold Crown Hazardous Fuels Reduction Project

Fire/Fuels/Air Report

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Fire and Fuels

Regulatory Framework

There are four guiding documents that provide the framework for fire management and provide specific goals, standards, and objectives for implementing a fire management program. Additional guidance and purpose for the Gold Crown project is recommended by the Bonner County Community Wildfire Protection Plan (discussed further in this section).

Guiding Documents	Direction
The IPNF Forest Plan	Provides standards and goals that Management Plans need to address on the Forest-wide and Management Area guidelines that define land uses.
The Forest Service Manual	Mandates all National Forests and lists objectives for fuels management.
Federal Wildland Fire Policy	Establishes standardized procedures and policies for Federal wildland fire management agencies.
National Fire Plan	Directs a comprehensive approach to the management of wildland fire, hazardous fuels, and ecosystem restoration on Federal and adjacent State, tribal, and private forest and range lands.

Idaho Panhandle Forest Plan

The primary Forest Plan Management Areas (MA1, MA4, and MA9) within the Gold Hill area include goals to manage suitable lands for timber production for the long-term growth and production of commercially valuable wood products, provide wildlife habitat, and to manage National Forest lands to maintain and protect existing improvements and resource productive potential. The fire protection standard to satisfy that goal uses the most appropriate management response (confine, contain, and control) to achieve the best benefit based on commercial timber values and where appropriate, big game winter range values. Prescribed fire is to be used as needed to meet silvicultural objectives of the management area. (USDA 1987, III-2, III-17, III-20, III-39).

National Fire Plan

The National Fire Plan (*www.forestsandrangelands.gov/*) was developed after the record-breaking wildfire season of 2000, President Bush requested a national strategy for preventing the loss of life, natural resources, private property, and livelihoods in the wildland/urban interface. Working with Congress, the Secretaries of Agriculture and Interior jointly developed the National Fire Plan (*www.forestsandrangelands.gov/*) to respond to severe wildland fires, reduce their impacts on communities, and assure sufficient firefighting capabilities for the future. The National Fire Plan (2000) addresses five key points:

- Firefighting/ preparedness
- Rehabilitation and restoration of burned areas
- Reduction of hazardous fuels
- Community assistance
- Accountability

The threat of severe high intensity wildfires is often blamed on drought or the expansion of the Wildland Urban Interface; the underlying cause is the build up of forest fuels and the changing of vegetation composition over the last 100 years. The severity of this problem has been recognized by many and in response the National Fire Plan (2000) was funded to reduce hazardous fuels and restore forests and rangeland. The 10-Year Comprehensive Strategy Plan (USDA and USDI 2001a) was developed and coupled with the Federal Wildland Fire Management Policy (2001) formed the framework to reduce the threat of fire, improve the condition of the land, restore forest and rangeland health, and reduce risk to communities (*www.forestsandrangelands.gov/*).

Table 1 describes the four principle goals and implementation outcomes of the 10-year comprehensive strategy pertaining to the National Fire Plan.

Table 1. Principle National Fire Plan goals and outcomes

Goals	Implementation Outcomes
1. Improve Fire Prevention and Suppression	Losses of life are eliminated, and firefighter injuries and damage to communities and the environment from severe, unplanned and unwanted wildland fire are reduced.
2. Reduce Hazardous Fuels	Hazardous fuels are treated, using appropriate tools, to reduce the risk of unplanned and unwanted wildland fire to communities and to the environment
3. Restore Fire -Adapted Ecosystems	Fire-adapted ecosystems are restored, rehabilitated and maintained, using appropriate tools, in a manner that will provide sustainable environmental, social, and economical benefits.
4. Promote Community Assistance	Communities at risk have increased capacity to prevent losses from wildfire and the potential to seek economic opportunities resulting from treatments and services.

Homes and structures continue to be constructed near lands managed by the Forest Service, which are vulnerable to damage or destruction from fire. As fuels continue to accumulate this situation becomes more volatile, requiring attention. The Gold Crown project is designed to reduce hazardous fuels, thus lowering fire intensities adjacent to private lands and rural residences. The Gold Crown Project conforms to the principles from guiding documents including the National Fire Plan strategies to reduce fire intensities in the Wildland Urban Interface and restore fire-adapted ecosystems.

Healthy Forests Restoration Act

The Healthy Forests Restoration Act of 2003 defines the term Wildland Urban Interface (WUI) as an area within or adjacent to an at-risk community that is identified in recommendations to the Secretary in a Community Wildfire Protection Plan (USDA and USDI. 2003). The wildland Urban Interface is defined by the Bonner County Community Wildfire Protection plan as being any wildland area within two miles of dwellings used for human habitation and / or infrastructure that serves these points of habitation (Nielson 2004).

In response a goal of the 10-Year Comprehensive Strategy to promote community assistance, Bonner County initiated a contract to develop a Fire Mitigation Plan (Community Wildfire Protection Plan) to aid in the protection of the communities within the county (Nielson 2004). The goal of the Bonner County Community Wildfire Protection Plan is to:

> *Reduce the risk to life and property, increase firefighter and public safety, and reduce suppression costs through forest fuels modification (Nielson 2004).*

The Gold Crown project area is classified as wildland-urban interface (WUI) defined by Bonner County in the Community Wildfire Protection Plan and is designated as a "Community at Risk" from wildfire as defined in the Federal Register August 17, 2001 (USDA and USDI 2001b).

The Bonner County Community Wildfire Protection Plan states:

> *The creation of defensible space around homes is only a part of a strategy necessary to ensure adequate protection from wildfire. It is necessary to do hazardous fuels treatment (HFT) beyond defensible space within the wildland urban interface in order to more completely address the threat from wildfire (Nielson 2004).*

Methodology for Analysis

Given that a wildfire could threaten or destroy adjacent homes, the primary concern to fuels management in the project area is the potential for high fire intensities and rapid spread rates, which make suppression efforts difficult or ineffective. Fire history information was used to determine impacts from past events for the cumulative effects analysis. Historic fire occurrence and the existing fuel conditions were obtained through fire archives, research, and modeling.

Sources of information for this analysis include: stand exam plot data; Hayden Lake, Hoodoo, Priest Lake, and the Bonners Ferry Remote Automated Weather Station data; 1935 and 2003 aerial photos, walk-through exams, and diagnosis conducted by Jennifer Costich-Thompson, project forester and reviewed by Silviculturist, Don Gunter, in the summer and fall of 2007. Detailed information from these sources is located in the project record.

A map of the recorded fire history for the Gold Hill area and aerial photos were used to make assumptions as to when effective fire suppression began (project file). Records of fire ignitions were obtained from a national database (Northern Region National Fire Plan Cohesive Strategy, Geospatial Dataset) and Idaho Panhandle fire records; the national database records contain information submitted by the Forest Service, other federal agencies, state libraries, or universities.

The typical fire season for northern Idaho is the months of July, August, and September. Analysis used available weather data from Hayden Lake, Hoodoo, Priest Lake, and Bonners Ferry weather station observations from July 1 through September 30 (Project File).

Use of Fire Family Plus

FireFamily Plus is a Windows program that combines the fire climatology and occurrence analysis capabilities of the PCFIRDAT, PCSEASON, FIRES, and CLIMATOLOGY programs into a single package with a graphical user interface (USDA 2002a). This program allows the user to summarize and analyze available weather observations using data from the nearest RAWS (Remote Automated Weather Station) pulled using KCFAST (Kansas City Access SofTware).

Trends were identified through use of Fire Family Plus, depicting a reasonable worse case scenario based on the information used for modeling. Weather data used from the four weather stations were combined to identify the 97th percentile weather conditions (Project File).

> A percentile is a value on a scale that indicates the percentage of a distribution that is equal to it or below it. For example, a temperature at the 97th percentile is equal to or higher than 97 percent of the observed temperatures.

Use of BEHAVE Model

Fire spread rates and intensities were predicted using the BehavePlus 3.0.1 model (USDA 2005). BEHAVE is an interactive computer system developed over several years that is designed to predict fire behavior characteristics for various fuel types. It simulates fire, associated fuel, and

environmental parameters. Fire behavior depends on stand structure, composition, amount of surface fuel, its arrangement, moisture content, prevailing weather, and physical setting on the landscape. Surface fire behavior is characterized by 13 fuel models that describe the fuel complex, loading, depth, and moisture of extinction (upper limits of fuel moisture beyond which a fire would no longer spread with a uniform burning front) for all sizes of fuels and slash (Anderson 1982). These models, along with dead and live fuel moisture content, slope, and wind speed, predict fire spread rate and fireline intensity (Anderson 1982).

The BehavePlus 3.0.1 model assumes that fire is no longer affected by the source of ignition and the fire is not being affected by suppression action. Fire behavior is heavily weighted toward fine fuels, due to fuels larger than one inch having little effect on rate of spread and fuels larger than three inch having no effect. The model assumes that fuels are continuous and uniform, the more uniform the fuel bed, the better the model will predict the fire behavior that occurs. The model predicts fire behavior quite accurately in grass fuel types (Fuel Model 2) and under predicts fire behavior in timber fuel types (Fuel Model 10) that are mixed with scattered down and dead. Uniform weather and topography are also assumed, changes in slope and weather parameters require new calculations.

There are several ways of expressing fire intensity. Fireline intensity is widely used as a means to relate visible fire characteristics and interpret general suppression strategies. A visual indicator of fireline intensity is flame length (Debano et al. 1998, p.56, 57). Table 2 compares fireline intensity, flame length, and fire suppression difficulty.

Table 2. Fireline intensity interpretations*

Intensity	Flame Length	BTU/Ft/Sec	Interpretation
Low	<4 feet	< 100	Direct attack at head and flanks with hand crews, hand lines should stop spread of fire
Low-Moderate	4-8 feet	100-500	Employment of engines, dozers, and aircraft needed for direct attack, too intense for people with hand tools
Moderate	8-11 feet	500-1000	Control problems, torching, crowning, spotting; control efforts at the head are likely to be ineffective
High	> 11 feet	> 1000	Control problems, torching, crowning, spotting; control efforts at the head are ineffective

*Based on Rothermel (1983) page 161 and National Wildfire Coordination Group (1993).

Affected Environment

Existing Condition

The types of fires that occur in forested ecosystems (Zack and Morgan 1994; p.19-22) include:

- Nonlethal fires – fires that kill 10% or less of the dominant tree canopy. A much larger percentage of small understory trees, shrubs and forbs may be burned back to the ground line. These are commonly low severity surface and understory fires, often with short return intervals (a few decades).

- Mixed Severity fires – fires that kill more than 10% but less than 90% of the dominant tree canopy. These fires are commonly patchy, irregular burns, producing a mosaic of different burn severities. Return intervals on mixed severity fires may be quite variable.

- Lethal fires – fires that kill 90% or more of the dominant tree canopy. These are often called "stand-replacing" fires and they often burn with high severity. They are commonly crown fires. In general lethal fires have long return intervals (140 to 250 years or more apart), but affect large areas when they do occur. Local examples of these types of fires would be the Sundance and Trapper Peak fires of 1967 that burned over 80,000 acres in a relatively short time period during late summer drought conditions.

In 1994 Zack and Morgan completed a fire history study on two forested landscapes in northern Idaho, one in the Coeur d' Alene River basin and the other north of Bonners Ferry. Due to the proximity to the project and similar habitat types this study was used to make assumptions on historic fire frequency and severity within the Gold Crown project. The number of lightning fires regularly experienced in northern Idaho accounts for a disturbance regime that includes regular major wildfires (Zack and Morgan 1994). Fire suppression has effectively excluded most wildland fires since the 1930s. This has eliminated the underburns and mixed-severity fires, which served as the thinning agents that favored dry habitat type legacy trees (larch and ponderosa pine). The changes to western warm dry forests have been well documented. Keane et al. (1990, p.190)states:

Figure 1. Evidence of past fire within stand # 65402003

> *"Before 1900 most of these forests, experienced frequent surface fires that maintained open, park-like stands of ponderosa pine, and western larch on moist sites, along with lesser amounts of Douglas-fir, grand fir and lodgepole pine (Arno 1980, Gruell et al. 1982, Martin 1982, Gruell 1985, Steele et al 1986). Most areas have had few if any fires during the past 70 years and, as a result, the more shade tolerant Douglas-fir and Grand fir have increased in numbers, often forming dense understories of dense immature stands arising after past logging activities (Weaver 1967, West 1969, Arno 1976, Steele et al. 1986)."*

Harvey (1994, p.87) states:

> "With effective exclusion of natural underburning in this century, dry forests quickly became over-stocked, often exceeding carrying capacity. In the absence of fire, native insects and pathogens regulate stocking by killing susceptible individuals and species. Frequent underburning also prevented excess accumulation of carbon and nutrients in woody biomass (Harvey 1994, Mutch 1994). The balance between fire and biological decomposition in regulating carbon accumulations in these forests has been disrupted (Olsen 1981). A current danger is stand-replacing wildfire with fuel accumulations so high that burns are extremely hot, resulting in critical reductions of stored nutrients, with accompanying losses in potential productivity (Harvey et al. 1994a). The effectiveness of fire prevention and suppression has permitted increased ground-fuel accumulations and stratified fuels (both living and dead) to the point where

many fires cannot be easily contained or confined. They now burn hotter and more extensively than 10 years ago (Auclair and Bedford 1994, Baker 1992, Brown 1983). This effect has been especially evident in dry forests that historically experienced fire every 5 to 25 years (Mutch 1994)."

The Gold Crown area includes the following habitat type groups for this analysis:

- **Dry habitat types** (266 acres) consist primarily of ponderosa pine, western larch, Douglas-fir, and grand fir. Prior to effective fire suppression, many stands in these forest types were burned frequently by low- or mixed-severity fire; occasional stand-replacing fires also occurred. Where fires occurred at relatively short intervals (less than 25 year), they were mainly non-lethal. Stands comprising all age structures were the result of non-lethal fire regimes, even-aged structures were the result of fire regimes with a combination of both non-lethal and severe fire patches (Smith and Fischer 1997, pp. 56-57).
- Moist habitat types (306 acres) are dominated by a mixture of conifer species (western red cedar, western hemlock, western larch, Douglas-fir, grand fir, western white pine, lodgepole pine, etc). These are the most common forest types on mid-elevation sites in the mountains of the northern Idaho Panhandle. Prior to the introduction of blister rust, when white pine was a dominant species, this was known as the "white pine type." These forests are very productive and prior to European settlement tended to accumulate large amounts of biomass (the collection of all living plants in a forest) in the relatively long intervals (average 200+ years) between stand-replacing fires. Sometimes, low severity fire occurred two to three times as often as either moderate- or high-severity fire (Smith and Fischer 1997, pp. 99, 102-104). Because pre-settlement intervals between severe fires were generally long in these forests types, the effects of fire exclusion are subtle. However, exclusion of low- and mixed- severity fires over the past 90 years has reduced ecological diversity and increased homogeneity (stands of similar size, age, species composition, structure, etc.) across the landscape (Smith and Fischer, 1997, p 108).

Historic fire regimes in moist habitat types were variable and consisted of long-interval, large, lethal fires mixed with shorter return interval, nonlethal, and mixed-severity fires. The dry forest types within the project area are scattered among larger areas of moist types. These types historically burned more frequently with nonlethal and mixed-severity fire (Smith and Fischer 1997 p. 56-57, 91-92).

Gold Crown Area Fire History and Occurrence

Lightning and humans are the source of fire starts in the Sandpoint Ranger District. The location of fires in the Sandpoint Ranger District have been recorded and mapped for approximately 130 years. The last major fire to burn within the Gold Crown project area occurred in the 1920's. Forest Service records show that at least eight fires have been suppressed within the last fifteen years in the Gold Crown project area (Figure 2). Several other fires have been suppressed adjacent to the project area.

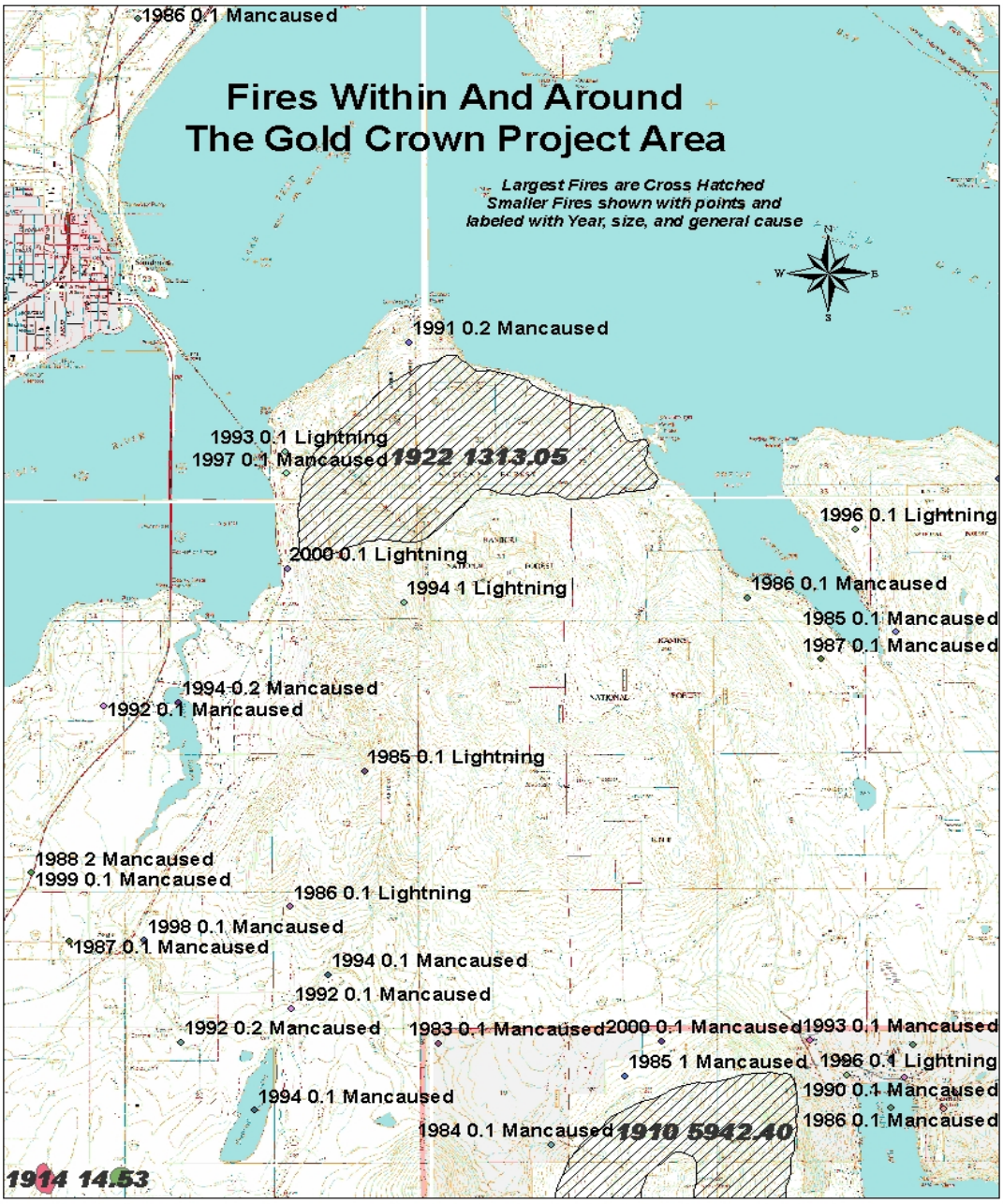

Figure 2. Fire History map of Gold Crown project area.

Today the risk of lethal stand-replacement fire in the Gold Crown project area is increasing due to accumulated fuel loads. At the same time, adjacent development has increased, and with it the risk of human-caused ignitions also increases. In the absence of nonlethal fires, both ground and ladder fuels are increasing due to tree growth, normal tree mortality, excessive root disease, and beetle-caused mortality. These factors are affecting moist and dry forest habitat types.

Existing Fire Hazard and Fire Behavior

Fire regimes are identified by the interaction of fire with the environment, the number of fire occurrences and the frequency at which these occurrences take place. The fire regime indicates

the frequency or fire return interval and the type of fire severity that is considered *typical*. Each fire regime has three condition classes that have been developed to categorize the current ecological condition as defined in terms of departure from the historic fire regime. Condition classes are a function of the degree of departure from historical fire regimes resulting in alterations of key ecosystem components such as species composition, structural stage, stand age, and canopy closure. One or more of the following activities may have caused this departure: fire exclusion, timber harvesting, grazing, introduction and establishment of exotic plant species, insects and disease (introduced or native), or other past management activities. As the condition class number increases a greater deviation is indicated with the associated greater risk of the loss of key biological elements found within the system.

Table 3. Description of Fire Regime Condition Classes

Fire Regime Condition Class	Description	Potential Risks
Condition Class 1	Within the natural (historical) range of variability of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances	Fire behavior, effects, and other associated disturbances are similar to those that occurred prior to fire exclusion (suppression) and other types of management that do not mimic the natural fire regime and associated vegetation and fuel characteristics. Composition and structure of vegetation and fuels are similar to the natural (historical) regime. Risk of loss of key ecosystem components (e.g. native species, large trees, and soil) is low.
Condition Class 2	Moderate departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are moderately departed (more or less severe). Composition and structure of vegetation and fuel are moderately altered. Uncharacteristic conditions range from low to moderate; Risk of loss of key ecosystem components is moderate.
Condition Class 3	High departure from the natural (historical) regime of vegetation characteristics; fuel composition; fire frequency, severity and pattern; and other associated disturbances.	Fire behavior, effects, and other associated disturbances are highly departed (more or less severe). Composition and structure of vegetation and fuel are highly altered. Uncharacteristic conditions range from moderate to high. Risk of loss of key ecosystem components is high.

Fire regimes within the Gold Crown Project area were determined using two habitat types, dry and moist. Dry habitats are primarily south aspects or exposed points and ridges where ponderosa pine or Douglas fir is the climax species. Dry habitats fall into Fire Regime I. Moist habitats are generally more northerly aspects or draws, and host a variety of species such as western larch, white pine, grand fir, Douglas fir, and western red cedar. The most dominant climax species on moist sites in the Gold Crown Project area is western red cedar. The moist habitats fall into Fire Regime III.

Fire Regime Definitions:

I – 0-35 year frequency and low surface fire most common to mixed severity (less than 75% of the dominant overstory vegetation replaced).
II – 0-35 year frequency and high severity (greater than 75% of the dominant overstory vegetation replaced).
III – 35-100+ year frequency and mixed severity (less than 75% of the dominant overstory vegetation replaced).
IV – 35-100+ year frequency and high stand replacement severity (greater than 75% or overstory vegetation replaced).
V – 200+ year frequency and high stand replacement severity.

Habitat	Fire	FRCC	Acres	%
Dry	I	2	266	47
Moist	III	3	306	53

The Fire Regime Condition Class Analysis for the Gold Crown Project area showed that the landscape as a whole is in Condition Class 2, and is in need of restoration of fire effects, vegetation composition/structure and

fuel characteristics. The departure from natural fire frequency and severity and the departure from natural vegetation composition/structure, and fuel characteristics influenced the dry and moist habitat types. Fire exclusion, white pine blister rust, and timber harvest not mimicking the natural fire regime are primary factors pushing the Condition Class rating into Condition Class 3 in localized moist habitats.

The BehavePlus 3.0 surface fire model was used to estimate the potential fire intensity of the Gold Crown project area, given the existing stand structure. Although the part of the project area is classified currently as Fuel Model 8, many stands within these areas are moving into the fuel model 10 with localized portions currently being rated as fuel model 10. Due to the increase of insect and disease, fire exclusion, increased competition for nutrients and water from overcrowded stands, and the loss of key ecosystem components, such as Western White Pine, further departure from fuel model 8 is expected. In fuel model 10, fires burn in the surface and ground fuels with greater intensity than the other timber litter models. Crowning, spotting, and torching of individual trees is more frequent in this fuel model leading to potential fire control difficulties. (Anderson 1982). This is due to the amount of 1, 10, and 100-hour fuels present, which under the right conditions (high temps, low relative humidity, etc.) are receptive and will carry a fire.

Table 4. Existing potential fire behavior.

Fuel Model	Surface Fire Flame Length (feet)	Rate of Spread*	Fireline Intensity Surface**
8	5.5	1.9	23
10	21	8.3	563

* Chains per hour, (66 feet equals a chain).
**BTUs/ft/sec. See Table 8 for further clarification.

Under the existing condition, fire behavior modeling suggests that, should a wildfire occur during extreme fire danger conditions (97th percentile weather), high-intensity fires would take place in fuel models 10 (Table 4). Control problems would exceed the capability of hand crews resulting in the need for indirect suppression strategies to be employed, resulting in a greater area burned (see figure 3).

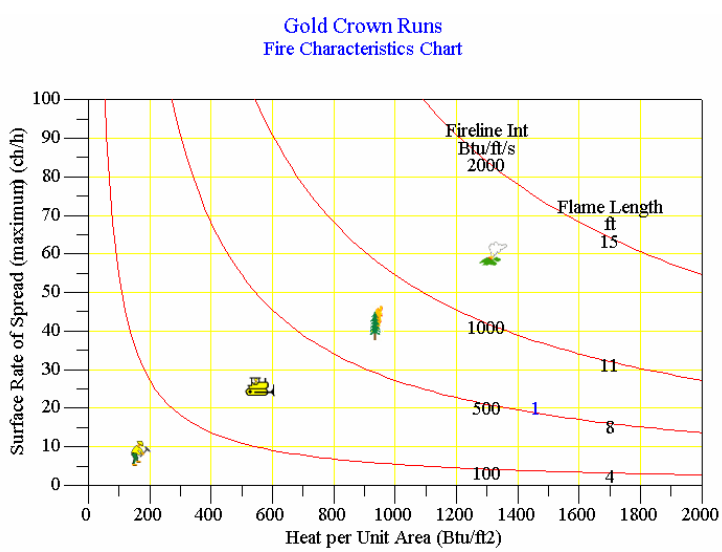

Figure 3. Fire Characteristics chart.

Compared to surface fires, crown fires exhibit higher spread rates and flame lengths. A crown fire increases the threat to firefighters, public safety, and increases the threat of property loss (Scott and Reinhardt. 2001, p. 1). BehavePlus 3.0.1 was also used to model crown fire initiation. Flame lengths are indicators of potential fire intensities, but cannot be used alone to determine the effectiveness of the proposed treatment. The less distance between the base of the tree canopy and the ground surface, the less surface flame length is required to initiate and sustain a crown fire (Figure 4). This is referred to as Canopy Base Height. Canopy Base Height is used along with flame lengths to determine the potential for a surface fire to spread into the tree crowns. As the potential for a crown fire increases suppression efforts become more difficult or ineffective.

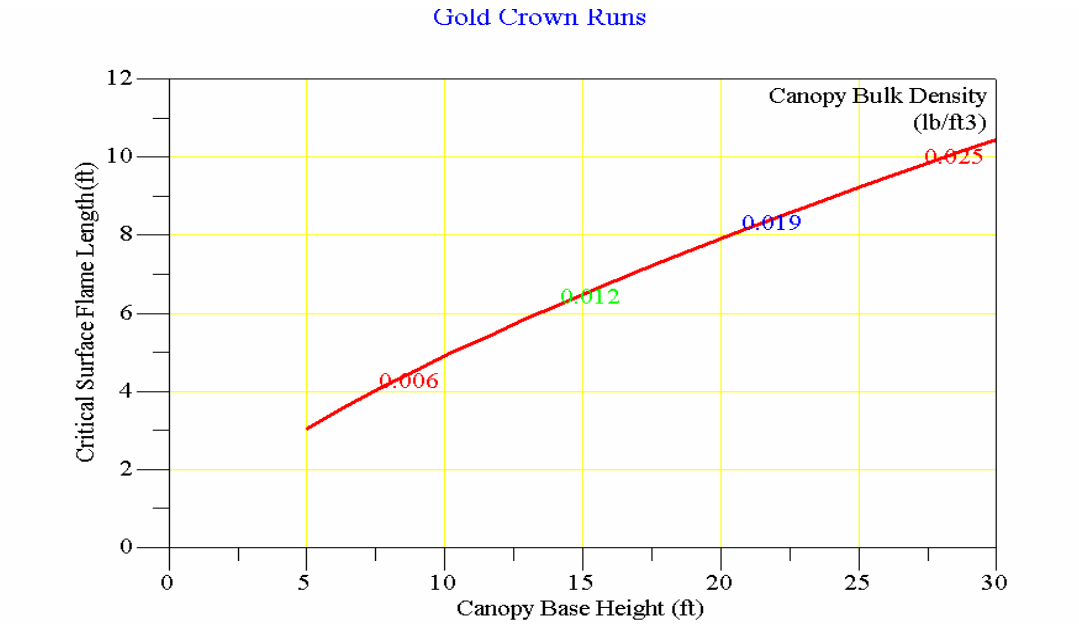

Figure 4. Canopy base height as compared to potential flame length needed to initiate a crown fire. The line depicts the potential point of transition from surface fire to crown fire given the right weather factors (97th percentile).

Fire exclusion in fire-adapted ecosystems can cause many changes in vegetation and potential fire behavior, which are well documented. Large, stand destroying, lethal wildfires, which were historically rare in the open dry habitat type ponderosa pine forests, have become common in the dense stands that have developed as a result of fire exclusion. These dense stands provide abundant fuel ladders that allow fires to increase in intensity and burn explosively through the tree crowns (Arno et al. 1996, p. 114). The increased potential for crown fire as a result of fire exclusion is of concern to fire managers, particularly when the conditions exist adjacent to communities. Crown fires are the most difficult to suppress and as a result are more likely to become large. The Gold Crown project area is surrounded by private land and homes, and a large, uncontrolled fire would be a threat.

To date, 19 defensible space projects have either been completed or are in process around private structures within the project area. Such projects do indeed increase the defensibility of those treated homes when faced with a wildfire threat; however, such treatments have been shown to even have a greater protection benefit if combined with landscape fuel reduction treatments. In addition, when considering that over 300 structures are currently within the project area and only 19 have been treated, much remains to be accomplished.

Desired Future Conditions

The desired vegetative structure would typically only support low fire intensity. After the proposed treatments, heavy concentrations of dead and down fuels would be removed through prescribed fire and piling. Modifying fuels would change potential fire behavior so effective, rapid, and safer fire suppression could occur, minimizing loss of key habitat and large trees. Direct fire suppression action could be used in treated areas, with the potential reduction in costs and the reduction of resource damage caused by a severe fire.

After treatments, fuel would ideally be maintained in a fuel model 8 condition (Table 4). The effectiveness of maintenance after treatments has been well documented in the USDA Forest Service publication "*Influence of Forest Structures on Wildfire Behavior and the Severity of Its Effects*" (USDA 2003, p.6).

Aerial fuels separated from surface fuels by large gaps are more difficult to ignite because of the distance above the surface fire, thus requiring higher intensity surface fires and a longer duration fire to dry out the canopy (USDA 2004, p.11). After treatments the canopy would be less dense and the potential for high intensity surface fire would be reduced, resulting in less likelihood of a sustained crown fire.

Environmental Consequences

Alternative A – No Action

Direct and Indirect Effects

Alternative A would not result in any direct effect or change to forest fuels. No fuels reduction treatments would be implemented.

In the absence of any kind of human-caused or natural disturbance, indirect effects would occur from the natural progression of forest growth and change. Vegetative conditions, fire behavior, and fireline intensity as described in the existing condition section would persist.

Over time more fuels would accumulate as trees continue to succumb to insects and disease, increasing the continuity of surface fuels, increasing ladder fuels, and thus lowering the gap between surface fuels and the canopy. The shade intolerant understory would continue to grow and replace the overstory as it falls to the forest floor, increasing the continuity of the canopy. The rate of spread and flame lengths in this situation would increase: combined with the ladder fuels, lowered canopies, and the continuity and densities of the canopy, the potential for sustained crown fire would be increased. High flame lengths and fireline intensities directly affect our ability and strategies to suppress wildfires.

Figure 5. Accumulating surface fuels due to competition, insect, and disease. Stand #65402002.

Cumulative Effects

The cumulative effects analysis area encompasses all of the federal, private, and other lands that could burn into or out of the project area in any single fire event. This area is not definable on a map, because determining how large or how far a fire would travel is dependent on a number of variables including fuel conditions, temperature, relative humidity, wind, topography, and many others that cannot be determined until an ignition occurs. An example of this is the Sundance Fire of 1967, which traveled more than 16 miles and engulfed more than 50,000 acres, mostly within a nine-hour time frame (USDA 1968).

Under the No Action Alternative, wildfires in the analysis area would continue to be suppressed. Therefore, fuels would continue to accumulate through forest succession processes and fire behavior would continue to trend away from historic conditions, creating an increasing challenge to fire suppression forces. Fires would tend to burn with more intensity over time, potentially becoming more dangerous and destructive. Forests where root disease is an increasing problem would also contain more snags, which are particularly dangerous for firefighters. Larger, more intense fires that threaten nearby homes and communities could have various unwanted effects (evacuations, threatened, and burned structures, adverse health effects from smoke). With the increasing developments within and adjacent to the project area, the cost of a large scale wildfire could potentially be devastating, whether it be the risk to human life or real property. Within the project area the majority of ignitions occur due human actions; with the increase of use of this area and increased development the likelihood of human ignitions is expected to increase.

Because of the private property values and public infrastructure like utility lines, wildfires would continue to be suppressed in the project area. By allowing fuels to continue accumulating, the No Action Alternative would contradict the goals of the National Fire Plan (*www.forestsandrangelands.gov/*) to reduce hazardous fuels and restore fire-adapted ecosystems.

Several timber harvests prior to 1940 are suspected to have occurred of fire killed snags; from the height of stumps, locations, and the lack of excavated trails or roads, trees may have been removed using horse logging systems and skidded down draws during the winter. While little is known about them, harvests likely removed standing, large, fire-killed species like ponderosa pine and western larch. Over a half-century later, the fuel reduction benefits that may have occurred have been long since overshadowed by natural vegetative growth, mortality, and subsequent fuels accumulation.

Forty-eight acres of shelterwood harvest and one hundred and seventeen acres of group selection were completed in 1995 during the Goldhill Timbersale. Within a few years, these young stands would likely be precommercially thinned. This combination of harvest, slash treatment, planting and subsequent thinning are taking these stands toward historic conditions when wildfires tended to have lower intensity fires.

Adjacent private forestland is a mixture of heavily harvested areas with follow-up fuel treatments, to houses surrounded by dense untreated forest. This spectrum of fuel conditions suggests some private property values are relatively safe from potential wildfire damage while others are very vulnerable.

By pursuing Alternative A, no action:

- fuel accumulation would continue in the proposed project area
- nearby young plantations would be somewhat vulnerable to damage from wildfire spreading from the proposed project area into the plantations
- fire access in the proposed project area and along private property boundaries would remain unchanged

- nearby private property values would experience increasing susceptibility to damage from wildfires spreading onto private land from the proposed project area or from other private lands, depending on the location of the ignition, as fuels continue to accumulate

Alternative B – Proposed Action

Carrying out this alternative would effectively reduce flame lengths, lower existing fuel concentrations, decrease ladder fuels (brush and small trees), and increase the chance of successfully suppressing wildfires should they occur. Any fire starting in the project area or entering the project area would have a higher probability of being confined to the ground, affording a high probability of control using engines, hand crews, and air tactical resources. A wildfire would be substantially less severe and of lower intensity, as well as less expensive and safer to suppress than under current conditions.

Potential loss or damage of private property and resources from a fire burning in the project area, and then spreading into adjacent private lands would be reduced.

Direct and Indirect Effects

Modeling was conducted to determine potential fire behavior characteristics before and after treatment. Table 5 provides estimated potential wildfire behavior outputs for the fuels models represented in the project area, and the analyzed change in fire behavior characteristics related to the desired condition. After treatment, those areas represented by fuel models 10 would be better characterized by fuel model 8; a fuel model more conducive to fire suppression. Not all acres would be converted due to untreated riparian and sensitive areas within the stands.

Table 5. Post-treatment fire potential

Fuel Model	Surface Fire Flame Length (feet)	Rate of Spread*	Fireline Intensity Surface**
8	5.5	1.9	23
10	21	8.3	563

* Chains per hour, (66 feet equals a chain).
**BTUs/ft/sec.

Proposed treatments would change the quantity and continuity of fuels. Within the treated areas, fire behavior modeling indicates that fireline intensity and flame length would be reduced. Essentially, treatments would transition areas that would currently burn as Fuel Model 10 to burning as more like Fuel Model 8. Thinning from below would reduce stand density. Removal of dead and dying trees would reduce actual and potential surface fuels available to burn under high-intensity fires. Treatments would also increase stand vigor by making the soil, water, and nutrients available to fewer trees left in the residual stand (Graham 1999, p. 20). This would result in healthier trees and less future mortality from insects, disease, and wildfire, which contribute to future high fuel loadings.

Depending on the size, number, spacing, and species of reserve trees, stands that are treated with regeneration methods can have similar effects on wildfire as does the thinning of a stand. After harvest, the regeneration units will have fuels reduction activities to dispose of the slash, either prescribed fire or machine piling.

Several studies suggest that a combination of methods (ie logging, piling, and underburning) be used for the best results. However, there is also research that suggests mechanical treatment or

logging can have negative effects on fire behavior – essentially that flame lengths and rates of spread may actually increase from mechanical activities such as harvesting of the overstory in a forested stand. Research by Graham and others (1999) as well as Agee and Skinner (2005) support this – if the harvest operations leave slashed material in the stands and there is no follow up fuels treatment of the surface fuels. Because the proposed action *includes* post-harvest fuels reduction activities, surface fire would be the expected fire behavior (not crown fire), and fire intensities are expected to decrease where treatments have occurred.

In the short term (up to five years), logging slash created would increase the fire hazard until it was properly treated according to fuel mitigations listed above, or it naturally abated. The unmerchantable branches and other fuels that are left after harvest can substantially increase fuel load, increasing fire hazard until the fuel on site is treated with underburning or piling (USDA 2003, p 3). The increased hazard from slash is somewhat offset by stand density reduction. The removal of logs reduces fuels, and opening stands up would tend to force wildfires to burn on the ground and not in the tree crowns.

During harvesting operations, the potential of man-caused fire ignition increases. Common ignition sources include: equipment and vehicle operation, smoking, and arson. Standard timber sale contract provisions would require a timber purchaser to have fire suppression equipment on site and to take necessary fire precautions to prevent accidental wildfire ignitions. In the event of extreme fire conditions, harvest activities would be regulated or suspended until conditions improve. A timber sale administrator closely monitors the fire prevention requirements of the timber contract throughout the timber harvest operations.

The proposed action would increase the density of roads within the project area by approximately 2.2 miles. Although these roads would be put in storage after post harvest fuels treatments, they would be available for fire suppression activities, providing access for fire engines and other fire fighting equipment. Therefore, future suppression access would be improved in the area.

The proposed action alternative would remove part of the forest canopy, which would reduce the moderating effect of canopy (sheltering) on wind speed, so surface winds (winds beneath the canopy that effect surface fuels) would increase (Scott and Reinhardt 2001, pp. 31-32).

Agee has also stated that when activities are followed by sufficient treatment of surface fuels, the overall reduction of fire behavior and severity outweighs the increased winds and consequently the reduction in fuel moistures (Agee 2005, p4).

Lower flame lengths are indicators of reduced potential fire intensities, but cannot be used alone to determine the effectiveness of the proposed treatments. The spatial continuity and density of tree canopies in combination with wind and physical setting provide the conditions required for rapidly moving fires that typically consume the crowns (needles and small branches) of large forest areas (USDA 2004. p.15). Through thinning (reducing the canopy density) and other mixed treatments (breaking up of the canopy spatial continuity), causing a mosaic or patchiness, the spread of fire through a canopy will be reduced (Figure 3). Further treatments, both prescribed fire and mechanical, will reduce the surface fire intensities, thus further reducing potential sustained crown fire. As Canopy Base Height is raised and surface flame lengths are reduced the potential of fire moving into the canopy is lessened and the effectiveness of suppression efforts is increased.

Cumulative Effects

The cumulative effects analysis area, and the past, present and foreseeable future actions considered are described in the No Action Alternative cumulative effects section of this report.

Past timber harvest can affect fire activity, thus fire risk. The effects of past harvest on Forest Service-administered lands within the Gold Crown project area are varied, from the removal of selected individual trees to regeneration cuts. The effects on fire from timber harvest are also variable, depending on the amount of canopy removed, the subsequent fuel treatment, and the time since harvest. Timber harvest without subsequent fuel treatment may have the same effect as fire suppression, by causing an increase in surface fuels. The Gold Hill timber sale harvested timber and applied prescribed fire to reduce the surface fuels in the harvest units. In combination with the past timber harvests, the proposed action would effectively reduce fire intensity potential in the project area and reduce crown fire sustainability.

In the report "Influence of Forest Structure on Wildfire Behavior and the Severity of Its Effects" it is stated that:

> *"A combination of new treatments and maintenance treatments arrayed across a landscape can effectively disrupt fire growth and change fire behavior at the landscape scale, even though some stands within the landscape have not been treated recently."*(USDA 2003).

Most often, **timber harvests on private lands** tend to be partial cuts that remove trees of the highest economic value (usually the largest) and typically removes large, fire-resistant seral species. Natural regeneration is relied on to fill most created openings. This tends to favor shade-tolerant species such as Douglas-fir and grand fir, over early-seral species such as ponderosa pine and western larch. With increased values for private timber, and historic harvest practices on private lands, historic vegetation patterns may never be reestablished on private lands near the project area.

Slash treatments on private lands are controlled by the Idaho Department of Lands. Currently, there are fuel reduction efforts focused on private lands, primarily around structures within the resource area . These efforts are part of the Bonner County Urban Interface Fire Mitigation Committee (BONFIRE), an interagency partnership that works collaboratively to reduce hazardous fuels in the urban interface across all ownerships. These activities would complement the Gold Crown proposed project by progressing towards a landscape approach of reducing fire intensities in the wildland urban interface.

Within the project area Stimson is also proposing overstory removal and seed-tree regeneration harvests on approximately 200 acres.

In the summer/fall of 2008 Idaho Department of Lands is expected to start a thinning and regeneration harvest project on approximately 105 acres.

Future timber stand improvement (TSI) thinnings will break crown to crown fuel continuity as it develops in regenerated stands. Wherever these treatments occur, slash would create a fuel hazard until it was disposed of or naturally abated. The long-term benefit would be dispersed thinned stands characterized by low fuel loads and relatively low hazard risk. This positive fuel situation could endure for decades until an understory develops under these young stands. These low risk stands would be scattered throughout the larger project area.

Hunter access and firewood gathering would not be changed by the proposed project or by the combination of past, proposed and future projects. However, with fuel hazards reduced in the project area and adjacent past project areas, the likelihood of damage from human-caused fires would be effectively reduced.

Summary

Fire intensities and flame lengths would be reduced by the proposed fuels reduction activities of Alternative B. Canopy densities would be reduced and fuel continuity would be disrupted. With reduced fire behavior, the effectiveness of suppression efforts would increase and risk of large, fast moving landscape fires and smaller, local fires would decrease within the project area. However, the fuel treatments within the project area alone would not reduce the risk of a wildfire initiating on adjoining lands. Fire suppression has been effective in the analysis area on adjoining lands, which has contributed to a substantial change in the vegetation and fuel loading. It is reasonable to assume that fire suppression will continue considering the close proximity to private property, resource values at risk, and continued private land development and human activity.

Cumulatively, the recent past management including road construction and ongoing private land hazard reduction efforts, would act with Alternative B to reduce fire risk and intensity in the project area vicinity. This would effectively reduce the risks to life, property, and natural resources in the Gold Hill area.

Compliance with the Forest Plan and Other Regulatory Direction

The proposed action alternative (Alternative B) is consistent with direction in the Forest Service Manual (FSM 5100.) The proposed action alternative (Alternative B) is designed to help accomplish the goals of the 10-Year Comprehensive Strategy (Strategy) by reducing hazardous forest fuels and restoring fire-adapted landscapes. One of the guiding principles of the Strategy is to set priorities that emphasize the protection of communities and other high-priority watersheds at-risk. The long-term emphasis is to maintain and restore fire prone ecosystems at a landscape scale. The Gold Crown Fuels Reduction Project is entirely within wildland urban interface as defined by the Bonner County WUI Fire Mitigation Working Group (BONFIRE plan.) The project area is in close proximity to homes, infrastructure, and areas of proposed and expected increasing development, as well as being entirely within the WUI. These factors make the Gold Crown Fuels Reduction Project a high priority for hazardous fuel reduction treatments. The No Action Alternative (Alternative A) does not address the objectives of fire management (FSM 5140), the goals of the Strategy, or the goals of the Bonner County WUI Fire Mitigation Plan.

The Forest Plan (p. II-38) identifies two standards regarding fire management.

<u>Standard #1</u>

Fire protection and use standards are specified by management area. Cost effective fire protection programs will be developed to implement management direction based on on-site characteristics that effect fire occurrence, fire effects, fire management costs and fire caused changes in values.

<u>Standard #2</u>

The Fire Management Action Plan will be guided by the following Forest-wide standards:

a) Management area standards
b) Human life and property will be protected.
c) Fire will be used to achieve management goals according to direction in management areas. Implementation guides will be prepared for prescribed fire projects and programs identified in Table 10 (IPNF Forest Plan, Appendix F) using unplanned ignitions.
d) Management area standards will be used in Escaped Fire Situation Analyses as a basis for establishing resource priorities and values.

e) The appropriate suppression response for designated old-growth stands in all management areas except in wilderness will result in preventing the loss of old growth. Fire policy in relation to old-growth within wilderness will be provided in specific management direction developed for each wilderness area.
f) Activity fuels will be treated to reduce their potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.
g) Forest Fuel Management Fund expenditure priorities are:
    - Natural fuels that pose a threat to human life and property
    - Unfunded activity fuels
    - Areas where fuels/fire behavior is a threat to management area objectives.

Following is a description of how each alternative meets these Forest Plan standards. Forest Plan Standards 2d and 2e relate to wildfire suppression policy and requirements that are outside the scope of this project, and therefore compliance with these standards is not described. This project does not determine Forest Fuel Management expenditure priorities, so compliance with standard 2g is not addressed either.

No-Action Alternative (Alternative A)

The No-Action Alternative would not use prescribed fire to help meet the goals of the management areas within the project area. The alternative would not help develop cost-effective fire programs because it would allow far more intense potential fire behavior to exist in stands that, with treatment, would primarily exhibit low intensity, easily controlled fire behavior. Under the No-Action Alternative, severe fire effects, large wildfire management costs, and fire caused changes in values could reasonably be expected; these results could likely be prevented or lessened with action to treat forest fuels.

The No-Action Alternative would not take any preventative steps to protect human life and property within the project area from an uncontrolled wildfire. The continued succession of forest vegetation and fuels, mortality from insects and diseases, and the exclusion of fire would create areas where the trend in fire behavior characteristics would in time be inconsistent with the goals, objectives, and standards established in the Forest Plan. No activity fuels would be created under the No-Action Alternative, so there would be no need to treat activity fuels, which is consistent with the Forest Plan.

Proposed Action Alternative (Alternative B)

The proposed action alternative would use prescribed fire to help meet the goals of the management areas within the Resource Area, consistent with the Forest Plan. It would help develop cost-effective fire programs by making substantial progress toward reducing potential intensities of wildfire in areas affected by past fire suppression. By inference, the more area treated to restore, maintain, and trend stands toward historical species composition, the better the alternative meets the Forest Plan goals. The proposed action alternative (Alternative B) would best meet the goals, objectives, and standards of the Forest Plan because it would reduce the severity of fire effects, the costs of potential wildfire, and fire-caused changes in values on most acres (573 acres.) Treatments under the proposed action alternative would begin to trend stands away from potential fire behavior that could threaten human life and property in and near the resource area. The activity fuels created would be treated in a manner that is consistent with the standards of the Forest Plan.

Air Quality

Regulatory Framework

Current direction to protect and improve air quality on National Forests is provided by:

- Clean Air Act amendments of 1977, 1990, 1999 (42 U.S.C. 7401-7626); the Clean Air Act (Section 110) requires each State to develop a State Implementation Plan (SIP) to identify how the State will attain and maintain national air quality standards. The EPA has established National Ambient Air Quality Standards (NAAQS) for smoke and other particulate matter. Idaho Department of Environmental Quality (DEQ) ensures compliance with the NAAQS through regulations and air quality permits which are contained in the Idaho State Implementation Plan (SIP). Conditions of the air quality permits ensure that emissions from permitted industrial sources would not cause or contribute to a violation of the NAAQS.

Page II-34 of the IPNF Forest Plan (Forest-wide standards) says:

- Participate with the State and others in the development and implementation of State Implementation Plans (SIP) that are compatible with management objectives for the IPNF
- All projects, contracts, and permits must comply with procedural and substantive requirements of the Clean Air Act, State Implementation Plans and State Smoke Management Plans
- Develop and use alternative slash (biomass) disposal methods that are practical and biologically sound
- Encourage utilization of forest products to reduce biomass, which must be disposed of otherwise

The Idaho Panhandle National Forests is a party to the North Idaho Smoke Management Memorandum of Agreement, whose intent is to minimize or prevent smoke impacts while using fire to accomplish land management objectives. The North Idaho group currently uses the services and procedures of the Montana/Idaho State Airshed Group (2006). A Missoula-based monitoring unit is responsible for coordinating prescribed burning in North Idaho during the months of March through November; they work in collaboration with the DEQ, assisting with any recommendations. During the winter months (December through February), the Idaho Panhandle National Forests voluntarily collaborate with the Airshed Group. The Airshed Group monitors meteorological data, air quality data, and planned prescribed burning and decides daily on whether to issue recommendations on burning for the following day (Montana/Idaho Airshed Group 2006).

The Goals of the Montana/Idaho Airshed Group Smoke Management Program are:

- Minimize or prevent the accumulation of smoke in Montana and Idaho from Prescribed fire as necessary to meet state and federal ambient air quality standards.
- Provide for the use of prescribed burning as necessary for purposes such as hazard reduction, forest/rangeland regeneration, and wildlife habitat improvement.
- Report and coordinate burning operations on forests and rangelands in Montana and Idaho.
- Evaluate the Smoke Management Program annually.

- Ensure burning activities are conducted during periods of optimal smoke dispersion and air quality conditions as advised by the Monitoring Unit.
- Meet the requirements of EPA's Interim Policy.

Historically, prescribed burning has occurred in the spring and fall seasons, within 45 to 60 days during each season. Each year, a list of all prescribed burning (understory and pile burning) planned for the Sandpoint Ranger District is entered into a database administered by the monitoring unit before March 1. Before 11:00 a.m., proposed burns for the next day are entered into the database. By 3:00 p.m. the same day, the monitoring unit posts, on a website, any recommendations concerning the next day's burns.

Environmental Consequences

Direct and Indirect Effects

Alternative A (no action) would not have any direct effects on air quality because no burning would occur. However, without abating fuels in the project area, indirect effects could result if a wildfire were to occur. Smoke from a wildfire could impact air quality in northeastern Idaho and northwestern Montana, posing a health risk during the fire. However, it is impossible to predict the extent and duration of smoke produced from a wildfire. Smoke would likely quickly dissipate when the fire was controlled.

Alternative B (proposed action) would have a direct, short-term effect on air quality in the project area. Although the project area is located within an Impact Zone, coordination with the Montana/Idaho Airshed Group will be utilized to minimize the impacts caused from prescribed burning. Under this proposed action, approximately 198 acres would be piled and burned, and 261 acres would be underburned. The implementation of this proposal would mean that some fuel would be harvested and taken off site for the purposes of lumber, pulp, and miscellaneous firewood cutting. By taking this fuel off-site, it reduces the amount of emissions going into the atmosphere through prescribed burning.

It is expected that residents near the actual burn area might see or smell smoke; however, it is expected that most impacts will be in the form of "nuisance" smoke and/or smell but would meet all the ambient air quality standards established by the Environmental Protection Agency. During the evening hours following a prescribed burn, some smoke would be expected to settle into the lower draws and drainages surrounding the Gold Crown project area. Smoke trapped in these low lying areas would be expected to dissipate once morning temperatures rise and the nighttime inversions lift. To limit the potential effects of inversions, the Montana/Idaho State Airshed Group would only allow burns to be conducted when good or excellent dispersion conditions are indicated. Compliance with burning regulations established by the North Idaho Smoke Management Group would assure that standards are met.

Air quality impacts from the proposed project would result primarily from burning. Logging equipment would produce temporary emissions of engine exhaust and dust emissions from vehicle traffic on and off roads.

An indirect effect of this proposal is a reduction in the emissions that would be released from potential wildfires in the area. By removing the small-diameter surface fuels with controlled low-intensity prescribed fire, the potential of a high-intensity fire developing within the stands would be reduced.

Cumulative Effects

The cumulative effects analysis area for smoke, road dust, and other related effects is difficult to tie to a specific geographic area. The distance that smoke and dust will travel is dependent on numerous factors, including the prevailing winds, local winds, inversions, the amount of smoke generated from a burn, the amount of fuel to consume, the stability of the atmosphere, and others. However, since the project area is located in northern Idaho, only a short distance from Montana, it is reasonable to consider the cumulative effects area to be northeastern Idaho and northwestern Montana.

Past, present and reasonably foreseeable activities and their impacts on air quality are difficult to address in terms of cumulative effects. Several large fires have occurred near the project area over the past century, as referenced in the Gold Crown Area Fire History and Occurrence; however, those effects on air quality are gone and cannot be viewed cumulatively.

Cumulative foreseeable activities that produce pollutants include, but are not limited to, burning on private lands and public lands, use of fireplaces, dust from unsurfaced roads, wildfires, and so on. Because of the coordination of prescribed burning in North Idaho and the collaboration with the DEQ, overlapping effects to air quality are minimized.

Alternative A (no action) –If a large wildfire were to occur, the Forest Service and the DEQ would probably restrict all regulated burning. However, effects of smoke from a large wildfire could become cumulative with unregulated pollutants in the area, such as smoke from fireplaces, dust from roads, etc. These types of cumulative effects are difficult to measure and predict.

Alternative B (proposed action) - Smoke from prescribed burning is transitory in nature. The effects of the proposed action from smoke are not likely to have cumulative effects with other activities in the airshed given the oversight by the DEQ. The district's burn-day determinations only allow burning when criteria are met that allow for good smoke dispersion. Daily regulation of amount of burning is managed to reduce impacts and negative effects of smoke. The number of days to accomplish prescribed burning in this project would compete with other burning in the airshed on any given day. It will be up to the Forest Service to establish burn priorities and the responsibility of the Air Quality Management District to manage those members of the Montana/Idaho Airshed Group that propose burning on that given day. If air quality is exceeding thresholds when proposed activities are scheduled to occur, Alternative B may result in some delays in burning as a result of this increased demand for "air space." Given these circumstances, there would likely be little to no cumulative effects from Alternative B.

Consistency with the Forest Plan and Other Regulatory Direction

Since Alternative A does not directly create any air quality impacts, it would be consistent with Forest Plan Standards and the Clean Air Act. If a large wildfire were to occur, air quality standards would likely be exceed until the fire were controlled.

Burning in Alternative B would be performed in accordance with smoke management practices, which are designed to prevent the smoke from causing a violation of the NAAQS. As stated above, there is little risk that a violation of any ambient air quality standard would occur as a result of the proposed action. Alternative B would be consistent with Forest Plan Standards and the Clean Air Act.

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