Broadaxe Fire and Fuels Specialist Report

Analysis Area

This analysis area for fuels contains approximately of Forest Service administered lands that are in the Broadaxe Creek drainage in the upper Gold Creek watershed on the St. Joe Ranger District of the Idaho Panhandle National Forests. Activities are proposed on 509 acres affected by mountain pine beetles to salvage dead, dying, and high risk lodgepole pine and to plant western larch and blister rust resistant white pine (Broadaxe EA Map). The 509 acres of proposed activities are referred to as the project area in this document and are the area in which cumulative effects to fuels and potential fire effects are considered.

Regulatory Framework

Forest Plan Direction

The IPNF Forest Plan provides a basis to implement efficient fire protection and use programs based on management objectives, site-specific conditions, and expected fire occurrence and behavior. Fire Management Plans are guided by the following standards:

- *Management area standards and goals provide direction for appropriate response.*
- *Human life and property are to be protected. Firefighter and public safety are first priority.*
- *Hazardous fire risk activity fuels will be treated to reduce the potential rate of spread and fire intensity so the planned initial attack organization can meet initial attack objectives.*

Management area (MA) standards define requirements for fire protection and fire use. The project area includes Management Areas 1, 9, and 6 with the majority of the project area acres in MA-1 and the least in MA-6 (Gold Creek Management Areas Map). The fire protection standards are to use initial attack strategies (confine, contain and control) as appropriate to achieve the best benefit based on commercial timber values and, where appropriate, big-game winter range values in these management areas. Fire use objectives are to utilize prescribed fire to achieve silvicultural and ecological objectives for the management areas as appropriate.

Forest Service Manual 5100

Forest Service Manual (FSM) 5105 defines fuel as combustible wildland vegetative materials, living or dead. The objective of fuel management as stated by FSM 5150.2 is to identify, develop, and maintain fuel profiles that contribute to the most cost-efficient fire protection and use program in support of land and resource management direction in the Forest Plan. Methods used for controlling flammability and reducing the resistance to control of a fire may include mechanical, chemical, biological, or manual means, including the use of prescribed fire and wildland fire use (FSM 5150).

Federal Fire Policy

Federal fire suppression policy from the early 1900s until the late 1970s has been that of total suppression. Only recently has fire policy been modified to recognize the importance of fire in balancing vegetation cycles within the temperate forest. The Federal Wildland Fire Management Policy and Program Review was chartered by the Secretaries of the Interior and Agriculture to examine the need for modification of and addition to Federal fire policy. The review

recommended a set of consistent policies for all Federal wildland fire management agencies. In adopting the policy, the Federal Agencies recognized the role of wildland fire as an essential ecological process and natural change agent that will be incorporated into the planning process (USDI and USDA 2001a). The severe wildfire seasons in recent years throughout the country have made it clear that fire cannot be excluded from fire-dependent ecosystems. On the other hand, because of developed areas, commercial forests, sensitive watersheds, and existing vegetative conditions, fire cannot be fully restored to its historic character without potentially severe consequences to humans, except perhaps in a few of the largest wilderness areas (Brown et al. 1994, Arno et al. 2000).

Analysis Methods

The information used in this analysis is a combination of the available data, research material, literature, field reviews and assessments. Diagnosis and analysis of stands within the Broadaxe Project Area were accomplished using stand summary data, basic stand data, stand component data and stand activity data (Vegetation Specialist Report). As a result of recent (2002 to present) observed losses to mountain pine beetle in this area, stand examinations were conducted during fall of 2004 to obtain current data to better assess the Broadaxe project area. Proposal of stands for treatment resulted from review of all the stand data for this area, with particular emphasis to the new stand exam data and area field reviews conducted by the silvicultural forester during 2003 and 2004. The proposed units were developed by sale preparation staff, with consideration for the proposed treatments coupled with existing access and terrain characteristics related to logging systems.

Habitat types were used for the project planning and site-specific considerations in this environmental assessment. *Forest Habitat Types of Northern Idaho: A Second Approximation* (Cooper et al, 1991) outlines the classification and characteristics of the habitat types. *Fire Ecology of the Forest Habitat Types of Northern Idaho* (Kapler Smith and Fischer, 1997) and *Fire History on the Idaho Panhandle National Forest* (Zack and Morgan 1994) were also used to assess the current and historic fire regime of the project area.

Habitat types were grouped to facilitate landscape level analysis and planning because of similar environments and vegetation characteristics such as productivity, disturbance regimes, stand dynamics, susceptibility to insect and disease, forest cover types, structural stages and successional pathways. *A Biophysical Classification, Habitat Groups and Descriptions* (USDA, 1996) was used for this analysis.

Prescribed fire and fuels treatments were identified by a fuels specialist based on existing and desired stand conditions, the proposed harvest and regeneration activities, and the historic fire history of the analysis area. Proposed treatments were developed to facilitate the achievement of the desired condition over time. Considerations included stand composition, stand size class, stand structure, estimates of existing fuel loads, calculated predictions of potential fuel loads, and qualitative estimation of future fire effects based on the calculated potential fuel loading and literature review.

The measurement criteria used in analyzing the alternatives is qualitative change in future surface fire severity in acres.

Affected Environment

The analysis area has a limited history of fire occurrence, primarily due to the historically long intervals (100 years +) between stand-replacing fire events and to fire suppression. Two fires,

one in 1889 and the other in 1910, affected approximately two-thirds of the Broadaxe Drainage (Gold Creek Fire History Map). Current records, derived from old hand drawn maps that were later digitized for use in a GIS, indicate a distinct edge between the two fires with the more recent 1910 fire lying down drainage and down slope of the earlier 1889 fire. In the 21 years between the two fire events enough fuel accumulation, both live and dead, would have occurred within the bounds of the 1889 fire to permit at least limited surface fire spread. Under the conditions in which the 1910 fire burned, it is reasonable to expect that logs and snags within the 1889 fire area would have provided adequate receptacles in which embers could cause spot fires. It is also reasonable to expect that due to the down drainage, down slope position of the 1910 fire to the 1889 fire, surface fire would have spread into and embers would have been lofted into the lower portions of the 1889 fire. Therefore, it is likely that there is some amount of overlap between the two fires that could be considered a "re-burn" to the east and west of the boundary between the two fires. The extent and severity of this likely re-burn is unknown but would have contributed to the existing vegetation and fuels conditions where it occurred, particularly if it were of mixed or high severity. In addition, small spot fires resulting from embers of the 1910 fire could have occurred far up slope and up drainage into the 1889 fire, consuming course woody fuels and little else. Low existing down woody fuel loads found within much of the project area may be evidence of this.

No other large fires are recorded within the analysis area other than the 1889 and 1910 fires. Units 3 thru 11 are completely or partially within the mapped boundary of the 1889 fire. Therefore it is assumed that the ongoing fire-free period within these stands is 116 years. Areas within the analysis area that have no recorded fire history are presumed to have an ongoing fire-free interval of 116+ years (Units 1 and 2) and areas within the mapped boundary of the 1910 fire have an ongoing fire-free interval of 95 years. Mixed severity fire events, which probably occurred historically, have been precluded by fire suppression for approximately the last 70 years.

Existing surface fuel loads are generally light and are estimated to range from 5-10 tons per acre. Low shrubs, herbs, and late seral conifer regeneration are found in the live aerial fuel bed between the soil organic layer and the primary forest canopy. Duff depths were not measured or estimated but are presumed to be generally less than 3 inches due to the low productivity and early seral stage of most of the stands within the project area. Lodgepole pine is a primary to dominant species in the overstory of the stands in the proposed action and are currently or recently were heavily infested with mountain pine beetles.

Most of the lodgepole would fall to the ground within 20 years from now, dramatically elevating potential for severe surface fire and the resistance to control of a potential fire. This is within the historic range of variability for these habitat types. It is unlikely, due to the dry exposed aspects and terrain on which the project area exists, that these stands would develop into mature mid or late seral stages before they would be affected by a stand-replacement fire. Such a fire would most probably be of moderate to high severity in terms of below and above ground effects and would reset the development of affected stands back to stand initiation of early seral species which is also not unusual in the historic context. Lodgepole pine overwhelmingly dominates the early seral overstory seed source and, as such, is expected to dominate species composition of the overstory within the project area following disturbance by fire. Historically, lodgepole has been a primary component of the early seral forest in the project area but was accompanied by western larch, Douglas-fir, and western white pine which contributed to species and structural diversity within the overstory. Today, seed sources for early seral species other than lodgepole are limited within most of the project area and may be more limited following a fire, as described above, due to mortality.

Environmental Consequences

Table 1 summarizes the effects of the alternatives on fuel loading and potential fire severity in the Broadaxe Project Area. This table shows the differences in fuel loading and potential future fire severity between alternatives for the Broadaxe Project Area.

Table 1 - Summarized comparison of estimated fuel loading and fire severity by alternative for the entire 509-acre Broadaxe Project Area.

Measurement Parameters	No Action	Proposed Action
Estimated Existing Surface Fuel Loading (tons/acre)	Min. 5-10 Max. Mean 8	Min. 5-10 Max. Mean 8
Estimated Future Surface Fuel Loading (ton/acre)	Min. 23-71 Max. Mean 47[1]	Min. 14-33 Max. Mean 24[2]
Future Surface Fire Severity	Moderate to High	Low to moderate

[1] Estimated future surface fuel loading for no action includes calculated fuel volumes of stem wood less than 8 inches in diameter and unmerchantable tops and whole trees less than 6 inches in diameter of lodgepole only. It does not include existing surface fuel loads.

[2] Estimated future surface fuel loading for the Proposed Action includes calculated fuel volumes of unmerchantable tops less than 3 inches in diameter for the minimum value and unmerchantable tops and whole trees less than 6 inches in diameter for the maximum value to coarsely depict the potential range of fuel loading under a spectrum of possible utilization scenarios. Fuel loads include lodgepole only do not include existing surface fuel loads.

Existing surface fuel loads were ocularly estimated during site visits but were not formally inventoried because there was no perceived hazard due to low existing values. Estimated fuel loading for the No-Action Alternative presumes, for the purpose of simplicity, that all lodgepole pine are dead, down and sound (as opposed to rotten). Volume estimates from stand exams conducted in the fall of 2004 were converted from board feet per acre to tons per acre and were used to estimate tons per acre of stem wood contribution in the No-Action Alternative. Unmerchantable top weights and wood density values of lodgepole pine were obtained from Brown et al. (1977). Volume estimates from the 2004 stand exams were calculated for a small end log diameter of 8 inches. Available tables of slash weights in Brown et al. (1977) only include slash weights (foliage, branch wood and bole wood) of unmerchantable tops less than 6 inches in diameter. Volume estimates for stem wood between 6 inches and 8 inches diameter in the affected stands was unavailable and as such is not included in the estimates of total potential fuel loading under no action. Therefore, whole tree weights (stem wood and unmerchantable tops) used to predict future surface fuel loading for the No-Action Alternative are conservative underestimates.

Fire Behavior Factors

Fire behavior is primarily affected by three elements: fuels, weather and topography. The topography of the Broadaxe Project Area is generally described as very steep slopes along a narrow creek drainage, with gentler slopes near and on the higher ridges. Surface fire behavior and crown fire potential are generally higher on steep slopes than on gentle slopes due to flame angle and convective influences which pre-heat fuels upslope and ahead of a flaming front. Typical surface fire rates of spread may be twice the rates on flat terrain under equivalent fuel and climatic conditions. When individual trees or groups of trees torch on steep slopes, fire travel can

continue uphill through the crowns with little wind influence. The majority of the project area has little live canopy cover and is on south to west aspects or ridge tops. The already existing lack of canopy cover combined with the alignment of slopes with the prevailing southwest winds results in little sheltering of surface fuels from the prevailing winds. The lack of sheltering and high insolation on these aspects would contribute to both fire intensity and severity on any given burn day. Drought periods act to regulate wildfire occurrence. Research indicates that common regional drought occurrence corresponds with many major fire episode years (Zack and Morgan, 1994).

No Action

Direct and Indirect Effects

Nearly all of the lodgepole trees that are dead and dying would fall to the ground within the next 20 years, becoming available surface fuel for fires. Severe surface fire is the major concern within the project area, rather than crown fire. Most of the lodgepole pine has already died and is currently losing its needles. This, coupled with the low levels of existing surface fuel loading result in generally low crown fire potential. Potential for severe surface fire would rapidly increase within the next 20 years as dead lodgepole trees fall and would persist for many decades beyond. As mid and late seral tree species become more prevalent within the stands, crown fire hazard would increase due to increasing ladder fuels and the existence of heavy surface fuel loads generated by the fallen lodgepole. Table 2 shows the estimated potential surface fuel loading in 20 years by unit (Broadaxe EA Map) presuming all lodgepole are dead and down in the project area.

Table 2. Estimated fuel loadings in 20 years for the Broadaxe No Action Alternative presuming all lodgepole pine are dead and down surface fuels. Fuel loadings presented are for lodgepole pine only and do not include existing surface fuel loads.

Unit Number		**1**	**2**	**3**	**4**	**5**	**6**		**7**	**8**	**9**	**10**	**11**
							Above Stateline Road	**Below Stateline Road**					
Unmerchantable Tops < 6 inches diameter	**<3in**	4	7	12	5	4	9	6	6	12	3	7	7
	>3in	6	11	17	7	5	13	8	8	17	5	9	10
Stem wood > 8 inches diameter		33	37	37	25	21	50	49	35	42	15	26	31
Total estimated fuel loading from LPP		44	55	67	37	30	71	63	49	71	23	42	47

Since it is impossible to predict actual fall rates of trees after they die, it is presumed in this analysis, that all lodgepole pine trees in the project area would be dead and down logs within 20 years. Dead and down logs are available to fires as surface fuel. Wood particles greater than 3 inches in diameter are known to contribute significantly to surface fire severity, particularly when loading of 3+ inch fuels exceeds 30 tons per acre. Severe surface fires can damage soils by removing or altering soil organic matter, volatizing nutrients, decreasing water absorbing capacity, and by killing living plant parts and microorganisms. These effects are due to a combination of factors including duration of undesirable heating, depth of undesirable heating, and area affected by undesirable heating (Brown et al. 2003). For this analysis, 30 tons per acre

of fuels greater than 3 inches diameter are considered a critical threshold beyond which undesirable below ground fire effects are likely to occur during peak fire season (August and early September) fuel and weather conditions on a substantial proportion of the Project Area.

Units 5 and 9 are the only two units that are not projected to develop fuel loads from mountain pine beetle-caused lodgepole mortality in excess 30 tons per acre of fuel particles greater than 3 inches in diameter. Stands within these units have mixed species composition and as such have low numbers of lodgepole pines relative to most of the surrounding units. The lower numbers of lodgepole in these units results in the lower estimated future fuel loading (Table 2). While Units 5 and 9 are not projected to accumulate large diameter fuels in excess of 30 tons per acre from lodgepole alone, they would continue to accumulate fine fuels from the surviving overstory. The surviving overstory would also contribute to fire intensity and, to a lesser extent severity, through torching and crowning, exacerbating the potential cumulative severity of a wildfire in these two units. Post-fire recovery in Units 5 and 9 would probably advance more quickly, however, due to the accumulation of course woody debris that would occur as fire-killed trees fall to the ground creating favorable microsites for plant establishment.

Cumulative Effects of the No Action Alternative

Under the current IPNF Forest Plan, fire suppression will continue, and as a result will allow fuels in the project area to accumulate as described above. Paving of the Little Joe Road on the Montana side of Gold Pass may increase the accessibility to and the subsequent volume of recreationists visiting the general area, effectively increasing the annual probability of human caused ignitions within and around the Broadaxe project area. Fuels within the analysis area will not be cumulatively effected by past, present, or future activities including the No-Action Alternative aside from the direct and indirect effects described above.

Proposed Action

Direct and Indirect Effects

The Proposed Action would directly result in the reduction of surface fuel loads by removing stems and portions of crowns of standing dead, dying, and at risk lodgepole pine trees. The reduction of surface fuel loads would result in the effective reduction of future surface fire severity within the project area with the exception of Unit 9. Unit 9 would have a substantial amount of residual overstory of predominantly fire intolerant mountain hemlock, subalpine fir, and grand fir that have a high probability of mortality from the proposed prescribed burning. These trees, if killed during prescribed burning, would contribute to future surface fuel loading. Unit 9 would be located on a moist east aspect on the upper third of the slope and should accumulate substantial snow over the winter and probably has higher rates of decay than the drier south and west aspects that most of the rest of the project area has. The tree species in question also have higher rates of decay than lodgepole pine. Because of the location of Unit 9, elevated future surface fuel loading resulting from mortality of fire-intolerant species would be acceptable.

Table 3. Estimated fuel loadings after salvage for the Broadaxe Proposed Action Alternative. Fuel loadings presented are for lodgepole pine only and do not include existing surface fuel loads or fuel loads resulting from mortality of other tree species following prescribed burning.

Unit Number		1	2	3	4*	5*	6		7*	8	9	10	11
							Above Stateline Road*	Below Stateline Road					
Unmerchantable Tops < 6 inches diameter	<3in	2	4	6	5	4	9	3	6	6	2	4	4
	>3in	6	11	17	0	0	0	8	0	17	5	9	10
Fuels > 3 inches from LPP reserve trees		10	10	10	10	10	10	10	10	10	10	10	10
Total estimated fuel loading from LPP		18	25	33	15	14	19	21	16	33	17	23	24

* Denotes treatment units or portions of treatment units proposed for whole-tree yarding rather than prescribed burning.

Table 3 shows the estimated surface fuel loading within the project area after salvage and prescribed burning. Fire modeling was not utilized in this analysis, so a general assumption was made that 50 percent of fuels less than 3 inches in diameter would be consumed during prescribed burning with the majority of the consumption occurring in fuels less than 1 inch in diameter and that very little consumption of fuels greater than 3 inches in diameter would occur. Fuel particles larger than 3 inches in diameter would be charred on the outside with negligible consumption actually occurring. This assumption presumes that prescribed burning would occur within a set of weather and fuels conditions that would limit consumption of duff and course woody debris to acceptable levels. This set of conditions would be developed for each burn unit using available fire models and would be defined in an approved prescribed fire burn plan. Prescribed burns would most likely occur in spring prior to green up or in autumn a few dry days following a substantial precipitation event but may occur any time throughout the year as long as the weather and fuel conditions are within the approved prescriptive parameters. Burning under these general conditions allows for consumption of small sticks, twigs and branch wood while minimizing consumption of larger woody material and duff.

Prescribed burns would top kill most shrubs, perennial herbs and forbs, and much of the smaller conifer regeneration and some proportion of the fire intolerant conifer species in areas where there is sufficient available fuel for fire to ignited and carry. Dormant season fire induced top killing of most endemic shrubs, forbs, and herbs found within the project area would stimulate new growth from belowground reproductive tissues, ultimately increasing productivity of many of these plants. High levels of duff consumption should be avoided as this could damage or destroy many of the belowground reproductive tissues, resulting in mortality and/or decreased productivity in most understory plants. Minimizing duff consumption would also maintain and protect ectomycorrhizae and microorganisms that are important components of ecosystem processes such as cycling of soil nutrients (Neary et al., 1999)

Units 4, 5, 7, and the portion of Unit 6 above the Stateline Road would be whole-tree yarded and no burning would occur. It is expected that most of the lodgepole pine branch and top wood less than 3 inches in diameter would break off during felling and yarding and stay on site, therefore no reduction was factored in. Retention of fire intolerant species is desired within these portions of the project area. Whole-tree yarding provides the ability to remove dead, dying, and high risk lodgepole pine from these portions of the project area while eliminating the need for prescribed burning, which would kill intolerant trees, or grapple piling and burning, which would cause high

severity soil heating where piles were burned and would necessitate mechanical activities within the units.

Lodgepole pines would be marked as reserve trees to ensure retention of at least 10 tons per acre of course woody debris greater than 3 inches in diameter. Minimum large diameter fuel loading from these trees is included in Table 3 as many of these trees are likely to fall due to wind, snow, or burning shortly after salvage occurs. This is important to note since course woody debris and large diameter fuel loading are synonymous. Retention of these trees and the addition of existing surface fuel loading and recruitment of course woody debris from trees killed during prescribed burning would cause loading of fuels greater than 3 inches in diameter to exceed 30 tons per acre in some areas within the project area. Surface fire severity is not expected to exceed moderate in most of the areas with higher fuel concentrations due to the fact that the fine fuel loading (< 3 inches diameter) would be substantially reduced at nearly the same time that large fuels are deposited. This would result in a net increase in surface fuel loading of large diameter fuels while maintaining the current potential for low to moderate surface fire severity indefinitely into the future. Fire spread is difficult without adequate fine fuels (<1 inch diameter). Therefore, wildfire occurring after successful prescribed burning is completed, as described above, would have little potential for spread beyond their ignition point and could be easily suppressed if necessary.

Cumulative Effects of the Proposed Action

Under the current IPNF Forest Plan, fire suppression will continue, and as a result will allow fuels in the project area to accumulate over time as described above. Paving of the Little Joe Road on the Montana side of Gold Pass may increase the accessibility to and the subsequent volume of recreationists visiting the general area, effectively increasing the annual probability of human-caused ignitions within and around the Broadaxe Project Area. The Proposed Action would reduce the potential for ignitions from any source to result in undesirable effects within the project area. The proposed action would result in an area of effectively low surface and crown fire hazard that may act as a barrier to fire spread for fires originating down slope and up wind of the project area within the analysis area or beyond. Fuels within the analysis area would not be cumulatively affected by past, present, or future activities including the Proposed Action Alternative aside from the direct and indirect effects described above.

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