Saint Mary and Upper Snake are the six designated recovery units that are home to the threatened population in the lower 48 states. That portion of the HLC NF west of the Continental Divide is in the Columbia Headwaters recovery unit. The Columbia Headwaters Recovery Unit Implementation Plan has identified threats and recovery actions. The habitat threats to bull trout identified on the Forest by the Recovery Unit Implementation Plan were upland/riparian land management and water quality (U.S. Department of Interior, 2015). The Recovery Unit Implementation Plan listed actions to address habitat threats that included these that are applicable to the HLC: 1) Prioritize Blackfoot River Tributaries for restoration, 2) Improve habitat through BMPs (BMPs) and conservation easements, 3) Protect and improve water quality, and 4) supply cold water. In addition, there are other actions identified under demographic threats and non-native species that the Forest would need to work cooperatively with our partners to address.

A conservation watershed network would conserve bull trout and genetically pure stocks of westslope cutthroat trout by identifying areas where cold water is expected to occur into the future. A conservation watershed network is a collection of watersheds where management emphasizes habitat conservation and restoration to support native fish and other aquatic species. The goal of the network is to sustain the integrity of key aquatic habitats to maintain long-term persistence of native aquatic species. Designation of conservation watershed networks, which include watersheds that are already in good condition or could be restored to good condition, are expected to protect native fish and help maintain healthy watersheds and river systems and benefit aquatic systems as part of the action alternatives.

Coarse filter plan components primarily related to watersheds, RMZs, Conservation watershed network, and road management would improve ecological conditions for bull trout, westslope cutthroat trout, and other aquatic species and maintain persistence of the species across the planning area. The conservation watershed network protects a network of connected aquatic species populations in cold water refugia by reducing effects associated with roads. The revised forest plan adds an active restoration component through desired conditions, objectives, guidelines, and standards that would supplement the retained passive components of INFISH and expands those protections forestwide. The revised forest plan would also help move projects and activities towards the desired conditions and improve aquatic habitats.

As part of the revision process, the forest will consult with the USFWS on the plan's effects. A biological assessment will disclose the effects of the revised HLC NF Plan on the threatened bull trout and designated bull trout critical habitat.

3.6 Air Quality

3.6.1 Introduction

There are two primary types of air quality effects concerning the Forest and forest operations. First is the effect of regional air pollution on forest natural resources and human health. Second is the effect of forest emissions on forest natural resources, human health, and regional air sheds.

Air quality on the HLC NF is dependent on the type and amount of pollutants emitted into the atmosphere, those that currently exist, or are in the "background" in the atmosphere, the size and topography of the airshed, and the prevailing meteorological and weather conditions. Sources of pollution within the Forest may include particulates and ozone precursor gases generated from timber and mining operations, prescribed and wildland fire, forest administrative operations, and recreational use.

The focus of this section is on smoke and how the various alternatives could affect smoke production through the use of prescribed fire, the management of naturally caused wildfires to meet resource objectives, and the management of damaging wildfires. Of all potential sources of air pollution from management activities that occur on the Forest, smoke is the most substantial contributor to air quality and visibility. Smoke can exacerbate human health conditions as well as reduce the ability to view the

scenery on the Forest. However, as discussed in the "Fire and Fuels Management" and forest "Terrestrial Ecosystems and Vegetation" sections, there is an established need to use fire to maintain and restore the fire-adapted ecosystems on the Forests and to reduce hazardous fuels in the wildland-urban interface.

3.6.2 Regulatory framework

Federal Law, Regulation and Policy

1999 Regional Haze Rule: The 1999 Regional Haze Rule mandates that states address control of man-made air pollution that impacts visibility in designated Class I airsheds (such as the Bob Marshall Wilderness area). The goal is to return visibility conditions in Class I areas to natural background conditions by the year 2064.

Prevention of Significant Deterioration: The Clean Air Act requires federal land managers,"…to preserve, protect, and enhance the air quality in national parks, national wilderness areas, national monuments, … and other areas of special national or regional natural, recreational, scenic, or historic value." Prevention of Significant Deterioration addresses resource protection through the establishment of ceilings on additional amounts of air pollution over base-line levels in "clean" air areas, the protection of the air quality-related values of certain special areas, and additional protection for the visibility values of certain special areas.

State law, regulation and policy

The Montana Ambient Air Quality Standards: The Administrative Rules of the State of Montana, Chapter 17.8, Subchapter 2, Ambient Air Quality, state air quality requirements. Montana's standards are as stringent as, or more stringent than, the national ambient air quality standards. Some of the state standards have different averaging periods or have been converted from concentration units (ppm) to mass units (μg/m3) using different standard conditions.

Montana State Implementation Plan: The collection of Environmental Protection Agency-approved programs, policies and rules that the State of Montana uses to attain and maintain the primary and secondary National Ambient Air Quality Standards.

Other documents that guide specific actions in the plan area

- Montana/Idaho Airshed Group Operations Guide (Montana/Idaho Airshed Group 2010)
- Helena NF Fire Management Plan (2014)
- Lewis and Clark NF Fire Management Plan (2014)

3.6.3 Best available scientific information used

The air quality analysis relies on existing and most current analysis, research, and planning documents. Information from several government, academic and private partnership consortiums that have conducted air quality emissions inventories, modeled pollution impacts and worked on air quality planning on a regional scale in and around the HLC NF area was used.

3.6.4 Affected environment

The HLC NF typically has good air quality across the entire plan area. Annual data from the air quality monitoring sites were evaluated for all available years. The major source of pollution is $PM_{2.5}$ emissions in the plan area include: 1) fires (including wildfires, prescribed fires, and agricultural field burning), 2) dust (road dust and construction dust), and 3) agriculture (crop and livestock dust). Fires tend to contribute a higher proportion of total particulate matter emissions in the western part of the plan area while agriculture contributes a higher proportion in the eastern part of the plan area.

Sources of air pollution and effects

In addition to the major non-point or area sources of particulate matter, emissions including fires, dust, and agriculture, there are also five point, or stationary sources of pollution contributing to particulate matter emissions in the plan area. They include electricity generated via combustion, industrial facilities, a petroleum refinery, a chemical plant, and a cement plant. The HLC NF is also subject to long-distance transport of emissions from sources to the west in Idaho, Oregon, Washington, and California, most notably wildfire smoke as it tends to be the most visible.

The Environmental Protection Agency classifies local air quality using the air quality index. The air quality index provides information on air quality to the general public as well as people with health concerns or target age groups.

The historical profile for Lewis and Clark County indicates periods in 2007 and 2010 when the air quality index was rated as unhealthy (red) for the general population. However, there are periods almost every year when the air quality index is rated as unhealthy for sensitive groups. The majority of days rated as unhealthy and unhealthy for sensitive groups occur in December and January with a small occurrence in September (EPA 2014a). For both Lewis and Clark and Cascade counties, prescribed fire or wildfire smoke could contribute to ratings of unhealthy or unhealthy for sensitive groups in August and September but would not contribute emissions in December or January.

The daily particulate matter air quality index for Cascade and Lewis and Clark counties for ten years from 2007 to 2016 shows relative improving air quality over time. However, wildfires and winter time conditions consistently increase particulate pollution and cause infrequent exceedances.

Wilderness air quality related values

Mandatory Class I federal areas have additional protection mandated by amendments to the Clean Air Act in 1977. There are three designated mandatory Class I federal areas, within the plan area wholly or partially managed by the HLC NF - the Bob Marshall, Scapegoat, and Gates of the Mountains Wilderness Areas. The FS has the responsibility to protect the air quality related values.

Snowpack chemistry

Snow chemistry is monitored at three sites within the planning area as part of the Rocky Mountain Regional Snowpack Chemistry Monitoring Project. This project aims to identify the sources of acid deposition that may affect mountain watersheds (USGS 2015/2017).

Regional haze and visibility

The 1977 amendments to the Clean Air Act recognized the importance of reducing haze and protecting visibility in national parks and wilderness areas.

In 2017, the MTDEQ reported overall, visibility on the clearest days in a given year has improved at all Class I areas in Montana. This is because clear days are primarily affected only by very low levels of haze caused by manmade air pollution and emissions of visibility-impairing pollutants have decreased over time.

On the other hand, the MTDEQ reports visibility on the haziest days in a given year has worsened at all but two of Montana's Class I areas. Analysis shows that the haziest days are primarily caused by wildfire activity both in and outside the state. At most Class I areas in Montana, these haziest days usually occur during wildfire season in the summer and fall when air monitors record high variability of organic and elemental carbon particles in the air. Wildfire activity is considered natural and is not something the state can control with regulatory measures or technology.

By contrast, the MTDEQ stated the measured contribution to haze that is associated with manmade pollutants, like sulfates and nitrates, has decreased at all but one Class I area on these same poor visibility days. In other words, although visibility on the haziest days has worsened over time, monitoring data suggests that this is due to increasing wildfire events and not increasing manmade air pollution. This conclusion reflects the same general downward trend in manmade emissions that has contributed to visibility improvement on the clearest days.

Visibility is measured by an air-monitoring network called Interagency Monitoring of Protected Visual Environments. The MTDEQ reports that at all of these monitors have shown improved visibility on the 20% best days. Every Montana Class I area is currently meeting its 2018 reasonable progress goal for the best days. This suggests that Montana's clean air strategies were sufficient to not only protect visibility on the best, clearest days, but also improve it.

The MTDEQ reports that despite seeing improvements in visibility on the best days, most Montana Interagency Monitoring of Protected Visual Environments sites did not see improvement on the worst days.

The MTDEQ found that the conclusion that visibility did not improve at six of eight Interagency Monitoring of Protected Visual Environments sites does not necessarily mean that the Montana's clean air strategies were insufficient. As discussed above, many factors contribute to visibility impairment. In addition, the initial regional haze implementation period covers the years 2008-2018, with progress goals set for the end of the ten-year period. The Montana plan was not published until late 2012 and polluting stationary sources were given five years to install controls and comply with the prescribed emission limits.

Management of forest emissions

The potential effects of activities proposed on NFS lands must be assessed as directed by the NEPA, including effects to air quality. The MTDEQ often works collaboratively to measure air pollutants associated with activities such as prescribed burning using mobile air quality sensors. The NFMA directs agencies to protect and improve the quality of air resources, in addition to soil and water.

The HLC NF Forest Plan Revision is a programmatic level decision document and will not serve to authorize the implementation of individual air pollution emitting projects or forest operations. Subsequent site-specific environmental analysis would occur in order to implement future projects and general conformity would be addressed in the project level analysis.

3.6.5 Environmental consequences

Effects common to all alternatives

Smoke from wildfire is anticipated to be the primary source of pollutants and associated impacts to air quality on the forest, as it has been historically. There is limited ability to alter or control the location or extent of this effect, due to the unpredictable nature of wildfire. Wildfires have the greatest potential to influence short-term air quality and visibility in local areas.

The Forest will continue to adhere to the current state smoke management plan, and obtain required permits and approval from the MTDEQ to conduct prescribed burning operations and implementation of wildfires used for resource benefit. These controls provide for protection of public health and welfare by mitigating the impacts of air pollution, while still allowing fire to be used in maintaining healthy ecosystems.

Anthropogenic emissions

The MTDEQ reports that continued implementation of air pollution control measures make it likely that anthropogenic emissions of visibility-impairing pollutants would continue to decrease with time. On and off-road fuel standards as well as fleet turnover are likely to continue to reduce nitrogen oxide emissions from mobile sources. In addition, pollution control technology is constantly evolving as research, new emission standards, and litigation push for further reductions from point sources (MDEQ 2017).

Clean air would continue to be produced and filtered through the forests. The major impact to air quality in the plan area is fine particulate matter ($PM_{2.5}$), from agriculture, wildfires, and prescribed fires, dust, and residential wood smoke. Agricultural burning and prescribed burning are regulated throughout the plan area and residential wood smoke is regulated in certain areas including Lewis and Clark County (Lewis and Clark County 2011). Guidelines governing these sources may become even more stringent in the future.

Wildfire and prescribed fire emissions

The HLC NF and adjacent communities generally have very good air quality. December and January tend to register the highest $PM_{2.5}$ concentrations during the winter months. The months of July, August, and September are likely to register increases in $PM_{2.5}$. During these months, wildfires, prescribed fires, agricultural burning, and agriculture dust can adversely impact air quality, although pollutants do not generally reach unhealthy levels based on the air quality sensors. Much of the plan area is sparsely populated and subject to transport winds that serve to disperse pollutant emissions but high pressure systems common in the summer can stall dispersion and impact air quality. Smoke from agricultural, personal debris burning, prescribed burning, or wildfires can settle for days, producing unhealthy conditions in valley bottoms. Usually, these conditions only occur for a few days at a time. However, the fine particles associated with smoke from wildland fires can be especially problematic for those with ongoing health problems and for the elderly and children, increasing their risk of hospital and emergency room visits or even the risk of death (EPA 2003). The MTDEQ and counties regulate open burning throughout the year while working with the Montana/Idaho Airshed Group to coordinate projects and potential air quality impacts from each prescribed burn.

Air quality impacts from wildfires may intensify in the future if these fires occur with greater frequency or the amount of burned area increases. Many climate projection scenarios indicate warmer temperatures in the plan area (Wear et al. 2013) which could lengthen the wildfire season. If warmer temperatures indeed occur, the window for available burning by wildfires may broaden which would affect fire frequency in mid to upper elevation areas where fuel moisture and burning conditions during summer months currently inhibit fire spread in many years. Spracklen et al. (2009) indicate that increases in emissions from wildfires may increase organic carbon concentrations by 40 percent and elemental carbon concentrations by 20 percent over the western U.S. by 2050. Large fires will continue to occur on the the Forest, driven by climate, weather, and fuel conditions, including the influence of the Pacific Decadal Oscillation, El Niño Southern Oscillation, and the Atlantic Multidecadal Oscillation (Kitzberger et al. 2007).

National direction for FS management actions would continue to have a profound effect on how wildfires and fuels are managed across the HLC NF. Variable fire budgets would impact suppression efforts, prescribed fire implementation, hazardous fuels planning, and wildland fire implementation. National direction will also continue to provide forests with guidance in the management of wildland fires and fuels on the landscape. National direction would likely continue to focus on increasing the occurrence of fires managed for restoration, resiliency and resource benefit objectives; hazardous fuels reduction; and accelerated restoration and resiliency objectives.

Cumulative effects

In addition to smoke emissions from land management activities, climate change would affect smoke emissions. Decreasing snowpack, earlier spring time conditions and snow melt, and longer, warmer fire seasons would increase the frequency and area burned by wildfires.

Effects common to all action alternatives

Air quality under the action alternatives would experience short and long term effects under proposed management alternatives. Continued use of prescribed fire has the potential to influence short-term air quality and visibility in local areas. All action alternatives must meet air quality standards established by the Environmental Protection Agency and MTDEQ through requirements of State Implementation Plans (concerning National Ambient Air Quality Standards) and the state smoke management plan. Use of prescribed fire under the all alternatives would be restricted by how much vegetation, (i.e. fuel loading/acre, acres that can be burned per day), when and where burns can occur and budget constraints. These constraints limit the use of prescribed fire and affect the rate of emissions and volume of smoke and particulates, which in turn limits impacts to human health and visibility.

Under alternatives B, C, and D, the amount of prescribed burning in forested ecosystems is anticipated to be about the same as it has been in the recent past, approximately 4,800 acres per decade. Under alternative E prescribed burning in forested areas would be about 3,000 acres per decade. The Forest would be treating nonforested ecosystems as well. However, nonforest areas were not modeled in appendix B. In the draft revised Forest plan there is an objective to treat 15,000 acres per decade within the WUI which would be a mix of prescribed fire and mechanical treatments. In addition, the current Forest fuels treatment target is around 10,000 acres a year, again a mix of mechanical, prescribed fire, and wildfire used for resource benefit purposes. Adherence to required air quality regulations is expected to minimize adverse effects to air quality due to prescribed burning, and thus minimize impacts to public health and visibility. Wildfire is expected to remain the primary source of smoke and potential degradation of air quality on the HLC NF.

Cumulative effects common to all action alternatives

Most impacts to air quality and visual quality are related to the contribution of smoke from areas to the south and west of the Forest including all the way to the west coast. Historically, when there are not large fires providing additional smoke to the area, prescribed fires and most wildfires have not produced long-term decreases in air quality or visibility. Occasionally, smoke from Canada also contributes to decreased air quality in the area. Currently, there is no coordination across the border regarding smoke management.

Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 32, for those plans applicable to air quality.

Table 32. Summary of cumulative effects to air quality from other resource management plans common to all alternatives

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address fire and fuels. Generally speaking, management of fire and fuels is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of fire and fuels would be generally complementary. This includes specific adjacent landscapes that cross Forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
Montana Statewide Forest Resource Strategy (2010)	This plan guides fire and fuels management on state lands. It includes many concepts that are complementary to revised plan components for the HLC NF, for example state direction is for suppression of wildfires. While specific desired conditions are not stated in

Resource plan	Description and Summary of effects
	the same terms as the HLC NF, it is likely that some elements such as provide for firefighter and public safety would be similar. State forest lands may be actively managed to a greater degree than NFS lands, and would likely contribute to achievement of desired fire and fuels conditions across the landscape.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to fire and fuels, and would therefore likely be complementary to the plan components for the HLC NF.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the fire and fuels characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, and calls for managing for fire and fuels. This plan would be generally complementary to the HLC NF through direct fire suppression outside the impact zone and the potential for the use of prescribed fire.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Fire and fuels is a component of these parks, although not always the primary feature. Specific fire and fuels conditions would not necessarily contribute to the desired conditions as described for the HLC NF.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy. The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF revised forest plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan emphases forest management and wildfire mitigation. This would be complementary to management on some HLC NF lands, specifically the South Hills Special Recreation area (alternatives B, C, and D).

Portions of the HLC NF adjoin other NFs, each having its own forest plan. Generally speaking, management of vegetation is similar across all NFs due to law, regulation, and policy. In addition, the HLC NF is intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some GAs contain fragmented inholdings of such lands, while others are less fragmented. The GAs which are island mountain ranges are typically surrounded by private lands.

Table 33 displays estimated acres of wildfire and prescribed fire for all alternatives based on modeled future projections over five decades. Future estimates are derived from a modeling analysis explained in appendix B.

Table 33. Projected average acres per decade of wildfire and prescribed fire by each alternative

Component and Indicator	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
All Wildfire (USFS): acres burned	126,469	122,741	122,741	124,446	125,412
Forested Areas Prescribed Fire (USFS): acres burned	48,760	47,840	47,840	47,870	27,780

Alternative A, no action

Current plan direction is to coordinate all FS management activities to meet the requirements of the State Implementation Plans and State Smoke Management Plan (Montana/Idaho Airshed Group (MDEQ 2010)), and Federal and State air quality standards.

Under the fire management program, direction is to conduct prescribed fire objectives under constraints established by the Montana/Idaho Airshed Group. Air quality is to be maintained at adequate levels as described by state, county, and federal direction, and all prescribed burns conducted on the HCL NF will be governed by this direction and meet this objective.

The airsheds of the Bob Marshall, Scapegoat and Gates of the Mountains Wilderness Areas are managed as Class I areas. The forest areas outside the Class I areas are managed as Class II.

Air quality under the no-action alternative would experience continued short and long term effects under current management, both from wildfire and prescribed fire. Continued use of prescribed fire has the potential to influence short-term air quality and visibility in local areas. The current management direction requires meeting air quality standards established by federal and state agencies through requirements of state implementation plans and smoke management plans. Current direction limits the use of prescribed fire by restricting how much vegetation can be burned and when and where burns can occur. The costs of conducting prescribed fires also increase as a result of burning regulations, which also constrains the amount of acres that is burned. Limited use of prescribed fire affects the rate and volume of smoke and particulate emissions, which in turn limits impacts to visibility.

Alternatives B and C

Compared to alternative A, alternatives B and C increase RWAs to 213,076 acres restricting the use of mechanized vegetation and fuels treatments and increases the area available for wildfire management (used for resource benefit). These alternatives increase the areas suitable for timber production to 443,057 acres and where harvest may occur for other purposes to 1,572,918 acres. Increased timber harvest would increase the use of prescribed fire for activity fuels and hazardous fuels reduction purposes.

Modeling results in appendix B show a decrease in wildfires (122,741 acres/decade, down from 126,469 acres in alternative A) and a slight decrease in prescribed fire (4,784 acres, down from 4,876 acres in alternative A).

Alternatives B and C have additional acres in RWAs compared to alternative A. Increases in the use of lightening caused wildfire to meet resource objectives would increase smoke emissions from RWAs. There would be limitations on prescribed fire in these areas if RWAs become designated wilderness.

Alternative D

Compared to alternative A, Alternative D increases RWAs to 474,589 acres, restricting the use of mechanized vegetation and fuels treatments and increases the area available for wildfire management (used for resource benefit) substantially more than in alternatives B and C. This alternative increases the areas suitable for timber production to 435,014 acres and where harvest may occur for other purposes to

1,195,171 acres. Increased timber harvest would increase the use of prescribed fire for activity fuels and hazardous fuels reduction purposes and would be similar or the same as in alternatives B and C.

Modeling results in appendix B show a decrease in wildfires (124,446 acres/decade, down from 126,469 acres in alternative A) and a slight decrease in prescribed fire (4,787 acres, down from 4,876 acres in alternative A). The modeling results are similar to or the same as in alternatives B and C.

Alternatives D has about 14 times the amount of acres in RWAs compared to alternative A. Increases in the use of lightening caused wildfire to meet resource objectives would substantially increase smoke emissions in these areas. There would be limitations on prescribed fire in these areas if RWAs become designated and prescribed fire would be substantially reduced compared to current conditions. Smoke emissions from prescribed fire outside of wilderness would increase nearly two times compared to current conditions and be virtually the same as in alternatives B and C.

Alternative E

There are no RWAs that would restrict the use of mechanized vegetation and fuels treatments and would not increase the area available for wildfire management (used for resource benefit).

Modeling results in appendix B show a decrease in wildfires (125,412 acres/decade, down from 126,469 acres in alternative A) and a decrease in prescribed fire (2,778 acres, down from 4,876 acres in alternative A). The modeling results for wildfires are similar to alternatives B, C and D, and prescribed fire would be reduced by about 2,000 acres/decade compared to alternatives B, C, and D.

Prescribed burning would take place in many of the harvested forest stands, as well as in other non-forest areas. However, alternative E would result in less prescribed burning and smoke production because it is focused on timber production rather than prescribed burning.

Conclusions

The air quality in and around the HLC NF is generally good and the state of Montana forecasts improving air quality conditions across the state and improving visibility in wilderness areas. However, air quality is compromised during winter months in communities where wood smoke causes health standard exceedances, and during fire season months when wildfires causes exceedances across broad portions of the state. Prescribed fires, agricultural burning, and agriculture dust can adversely impact air quality, although the pollutants do not generally reach unhealthy levels.

The HLC NF forest plan revision proposed action incorporates legal and policy direction that implements actions designed to enhance and maintain ecosystem resiliency and sustainability, and protect values at risk of damage from wildfires. These actions include vegetation and fuels management practices that require the use of prescribed fire and the management of wildfires used for resource benefit. The proposed action would maintain current levels of the use of prescribed fire and the management of wildfires used for resource benefit, and increase smoke emissions, compared to current forest plan direction. The modeling analysis in appendix B shows that implementation of the proposed action would reduce wildfires and corresponding smoke emissions by about 3-4% under alternatives B, C, and D, and about 1% under alternative E. However, climate change effects could reverse the forecasted trend and increase the frequency of large wildfires and increase smoke impacts.

The Forest would continue to adhere to the state of Montana smoke management plan, and obtain required permits and approval from MTDEQ to in order to conduct prescribed burning operations and implementation of wildfires used for resource benefit purposes.

Therefore, the results of this action upon air quality would meet the purpose and need because the expanded use of prescribed fire and wildfires used for management for resource benefit would improve ecosystem sustainability and resiliency, and protect values at risk from damaging wildfires, while meeting

air quality requirements mandated by the Clean Air Act. Adverse effects of increased smoke emissions would be mitigated by the Forest's adherence to following the legal framework that regulates air pollution sources in the state of Montana.

3.7 Fire and Fuels

3.7.1 Introduction

Fire is a critical ecological function across the HLC NF that plays a central role in providing quality habitat for both plant and wildlife species. Wildland fire includes both wildfire (unplanned ignitions) and prescribed fire (planned ignitions). Fire management includes the strategies and actions used both before and during wildland fire. Management of wildland fire influences whether fire effects create beneficial or negative impacts to values such as water quality, air quality, habitat, recreation areas, or communities. Wildfire management includes a spectrum of responses from protection objectives to resource objectives. Suppression is a management strategy used to extinguish or confine an unwanted wildfire.

Manipulation of vegetation to change fire characteristics when it burns is called "fuels management".

Several indicators and measures are considered.

- The primary indicator is *future vegetation treatments*, measured in acres of projected harvest, mechanical and prescribed fire activities in forested types. Estimated acres treated provides an indication of potential movement toward desired vegetation conditions. The location of potential treatments relative to the WUI is considered as part of the measurement of acres.
- *Flexibility for fire management* is measured by the distribution of land allocations that influence the flexibility to carry out mechanical and prescribed fire treatments. Land designations that influence this management flexibility include wilderness, RWAs, and IRAs. Designated wilderness has the most restrictive requirements for mechanical and prescribed fire fuels management activities. Areas that limit mechanical treatment will result in a cascading effect on other fire and fuel treatment options. Without mechanical treatments, the use of prescribed fire would be reduced. With reduced mechanical and prescribed fire, managing unplanned natural ignitions would be reduced due to the lack buffer areas treated prior to a natural ignition. The primary measure for this indicator is the acres of RWAs by alternative.
- Expected *future wildfires and fire regimes* are an indicator of how vegetation change and other factors over time may influence fire's role on the landscape, which in turn would influence fire regimes. The measurement for this indicator is projected acres of wildfire burned by fire type.

The effects of fire on the landscape was raised as an issue by many members of the public, including an interest in allowing fire to play its natural role in the ecosystem, as well as concerns about the effects of large wildfires on other resources including water quality and quantity and scenery.

3.7.2 Regulatory framework

Wildfire Suppression Assistance Act of April 7, 1989 (HR 4936)

Healthy Forest Restoration Act of 2003 (HR 1904): Aimed at expediting the preparation and implementation of hazardous fuels reduction projects on federal land; encouraging collaboration between federal agencies and local communities; requiring courts to balance effects of action versus no-action prior to halting implementation; and requires federal agencies to retain large trees under certain conditions.

"**Urban Wildland Interface Communities within the Vicinity of Federal Lands That Are at High Risk from Wildfire" Federal Register** Vol. 66, No. 3, 2001: List of communities in the vicinity of federal lands that are at high risk from wildfire.

National Fire Plan, August 2000: Outlines a plan of action for federal agencies in order to protect wildland-urban interface and be prepared for extreme fire conditions.

Federal Wildland Fire Management Policy of 1995 (updated January 2001): Guides the philosophy, direction, and implementation of wildland fire management on federal lands.

2002 President's Healthy Forest Initiative: Emphasizes administrative and legislative reforms to expedite fuels treatments and post-fire rehabilitation actions.

Interagency Prescribed Fire Planning and Implementation Procedures Guide 2014: Provides standardized procedures associated with the planning and implementation of prescribed fire.

Guidance for Implementation of Federal Wildland Fire Management Policy 2009: Guidance for consistent implementation of the 1995/2001 Federal Fire Policy.

National Cohesive Wildland Fire Management Strategy (2014): The National Cohesive Wildland Fire Management Strategy is a strategic push to work collaboratively among all stakeholders and across all landscapes, using best science, to make meaningful progress towards the three goals: 1) Resilient Landscapes; 2) Fire Adapted Communities; and 3) Safe and Effective Wildfire Response.

Interagency Standards for Fire and Fire Aviation Operations (NFES 2724): Documents the standards for operational procedures and practices for the FS fire and aviation management program.

3.7.3 Assumptions

- Climate trends will continue to be warmer and drier than historical conditions.
- Naturally ignited wildfire will continue to be the largest contributor to fuels management.
- Development in the WUI will continue.

3.7.4 Best available scientific information used

This analysis also draws upon the best available literature citations that were found to be relevant to the ecosystems on the HLC NF. Literature sources that were the most recent; peer-reviewed; and local in scope or directly applicable to the local ecosystem were selected. Uncertainty and conflicting literature was acknowledged and interpreted when applicable. In addition, local studies and anecdotal information that is not peer-reviewed is included where appropriate to provide context.

Best available information was used to build the fire suppression logic and assumptions within the SIMPPLLE model, including corroboration with actual data, and professional experience and knowledge. Refer to appendix B and the terrestrial vegetation section for detailed discussion on model development and outputs associated with fire and resulting vegetation changes.

3.7.5 Affected environment

Natural fire regimes and NRV

A fire regime represents the periodicity and pattern of naturally occurring fires, described in terms of frequency, biological severity, and aerial extent (Anderson, 1982). The natural fire regime is a classification of the role fire would play across a landscape in the absence of modern human intervention but including the influence of aboriginal fire use (Hann et al., 2008). Five natural fire regimes are classified based on the average number of years between fires (fire frequency or mean fire interval)

combined with severity (the amount of vegetation replacement) and its effects to the dominant vegetation (ibid). Table 34 displays the extent of the five natural fire regimes on the HLC NFs.

Table 34. Fire regimes on the HLC NFs

Fire Regime[3]	Definition[3]	Existing Vegetation Types[1, 3]	Approximate Acres[2]	Proportion (%)
I	0- to 35-year frequency; low / mixed severity	Mountain sagebrush; Ponderosa pine; Dry Douglas-fir; Wooded draws/ravines	1,214,264	38
II	0- to 35-year frequency; replacement (high severity)	Grasslands; Mixed-grass prairies; Great Plains shrubland	213,263	7
III	35- to 200-year frequency; mixed / low severity	Wyoming big sagebrush ; Low sagebrush; Riparian systems (cottonwood); Limber pine/Rocky Mtn juniper; Dry lodgepole pine; Moist Douglas-fir; Whitebark pine	686,748	21
IV	35- to 200-year frequency; replacement (high severity)	Aspen; Moist lodgepole pine; Subalpine fir Engelmann spruce	937,182	29
V	Greater than 200-year frequency; any severity	Poor-site lodgepole pine; Subalpine forbs and grasses	56,960	2
Sparsely Vegetated	National Land Cover Database (NLCD) class	N/A	15,441	<1
Barren	NLCD class	N/A	81,250	3
Snow/Ice	NLCD class	N/A	172	<1
Water	NLCD class	N/A	3,249	<1

[1]Vegetation types are not the same as existing vegetation types discussed elsewhere in this chapter.
[2] Acre summaries in this section may differ slightly due to the data source (raster versus vector GIS data).
[3]Table information is adapted from Barrett et al. 2010

Recent wildfire history and trends

Fire data in the forest GIS database shows wildfire areas burned since 1940 (Figure 3).

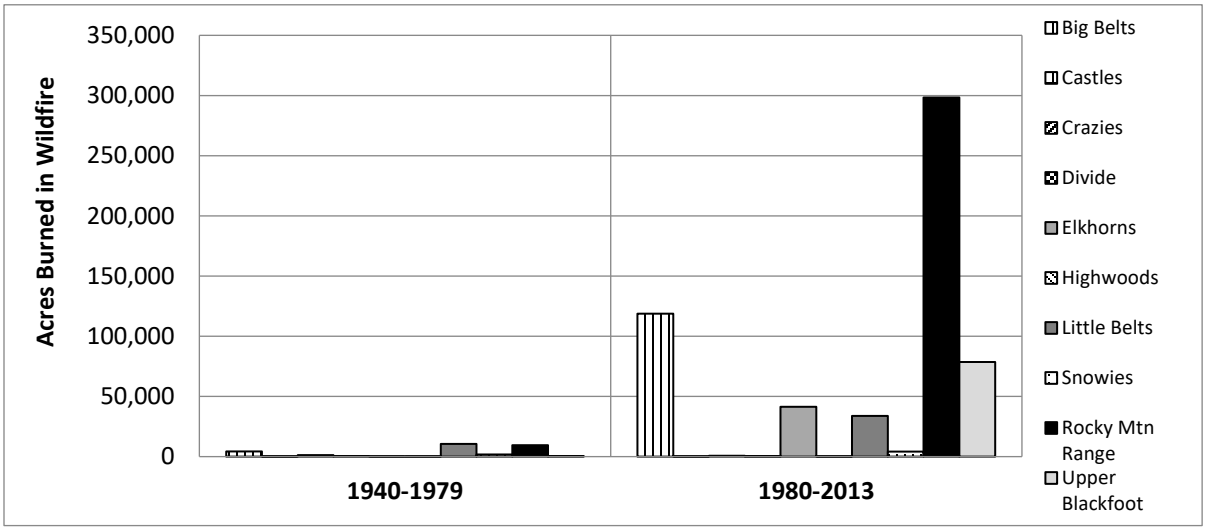

Figure 3. Wildfire acres burned by GA, 1940-1979 and 1980-2013

As described in the Forest NRV Analysis summary report March 2017, Figure 4 displays the average acreage burned per decade by GA, compared to the existing condition. The existing condition is represented by the acres burned from 2000 to 2009.

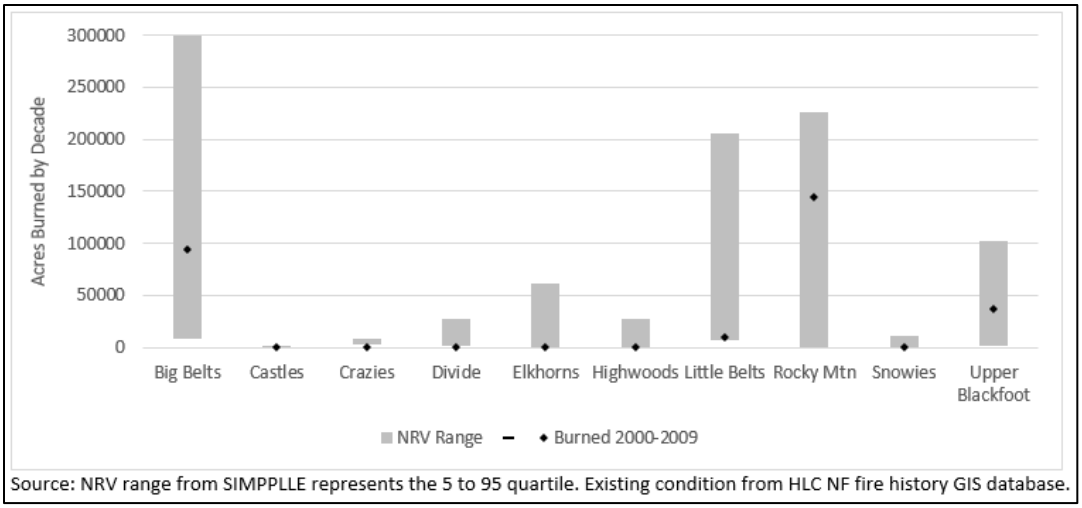

Figure 4. Acres burned per decade compared to acres burned 2000-2009, by GA

In areas that have burned recently, future fires may be somewhat self-limiting in extent because of the variability in residual vegetation conditions. Along with many other factors, the fire history of each GA has influenced the quantity and pattern of recent fires and will influence potential effects of future fires.

Naturally ignited wildfires have been used to meet resource objectives since the approval of the 1986 forest plans (Table 35). In recent years, including 2017 specifically, several fires burned into past wildfire footprints. It was observed that fire activity and spread was substantially reduced when fires burned into areas that have burned within the past two decades.

Table 35. Wildfire acres managed for resource benefit[1] by decade

1980-1989	1990-1999	2000-2009	2010-2017
89,735	5,723	79,121	160,530

1. Data obtained from Forest Activity Tracking System (FACTS) includes; Wildfire-Fuels Benefit, Wildfire-Natural Ignition, and Wildland Fire Use

There are many ignitions across the HLC NF every year and most are suppressed or are extinguished naturally. Over 5,000 detectable ignitions have been mapped since 1940. The number of ignitions is not necessarily proportionate to burned area. For example, fire starts were not especially numerous in the 1980's but the fires that escaped suppression grew to large sizes. Most fires are caused by lightning, but some by human causes such as campfires, smoking, vehicle or railroad sparks, or arson. The Helena NF, in particular, has shown a slight trend of an increasing proportion of human-caused fires, commensurate with urban development and recreation. Lightning strikes appear to be concentrated in some areas due to weather patterns and topography.

3.7.6 Environmental consequences

Effects common to all alternatives

Climate change

Of all of the ongoing and foreseeable future actions that have the potential to affect fire, especially unwanted wildfire, climate change is likely to be the single most important factor. Regardless of alternative, the effects of climate change would likely combine with some of the effects that result from implementing the alternatives, to produce cumulative impacts. In general, the fire seasons are expected to

become longer, large wildfires are expected to occur more often, and total area burned is expected to increase (Halofsky et al., in press-a). By increasing the amount of prescribed fire use, the action alternatives would be expected to partially offset predicted effects from climate change (Wiedinmyer & Hurteau, 2010). The more fire use (Parks et al 2016) (and mechanical treatments) that occurs as a result of the action alternatives, the greater the fuels will be reduced and the forest vegetation restored to more resistant and resilient conditions, which could mitigate climate change effects. The windows for prescribed fire may become longer with a warmer climate.

A recent comprehensive synthesis of the science surrounding climatic change and ecosystems (Walthall et al., 2012) concluded that all fire regimes in western forest ecosystems would experience some increase in fire risk. More fires occur in all forests because of longer fire seasons and higher human populations (Vose, Peterson, & Patel-Weynand, 2012). Fire intensity and severity would probably be higher as well because of more extreme fire weather (i.e., hotter temperatures) and higher fuel loadings (i.e., tree mortality, increased forest densities). In moderate (mixed) severity regimes, more frequent fires could convert lands to more of a low severity fire regime, where frequent fires favor more open stand conditions and tree species resistant to fire damage. Increased fire risk and fire sizes in high severity fire regimes could have substantial local effects, especially where close to human population centers. Not well articulated in the climate change discussion is that risk also increases because of increased occupation of the wildland environment.

Flexibility for fire management

Key considerations of fire management are that, in general, there are a very large number of burnable acres of NFS lands that cannot be actively managed by mechanical means. Additionally, policy prohibits the use of mechanical treatments and places limits on the application of prescribed fire within areas designated as wilderness. Appropriately managing wildfire in places with an opportunity to obtain resource benefits and a low risk of potential damages may be the only way in many areas to increase the pace and scale of ecosystem restoration activities. Informed management of wildfire would also be needed to maintain areas once restoration has occurred. Parks et al 2016 found that within the Northern Rockies fire occurrence creates a “self-regulating effect of wildland fire on subsequent ignitions” These effects were found to generally last up to 20 years.

The alternatives vary from the fuels management perspective on the allocation of acres to different designated areas. The primary designated area that impact fuels management is recommended wilderness; this varies by alternative and is addressed in the section below. Within RWAs for each alternative it is expected there would be very little change in the occurrence of human caused fires. This is a result of very few fires being caused by vehicles within the HLC NF. From 1970 – 2016 there were 95 fires caused by equipment (about 3%). During the same span of time there were 534 fires caused by campfires (about 17%). The largest cause is lightning with 2,005 (about 64%).

Other management limitations apply to all alternatives. In IRAs, there are limitations on road construction and timber cutting, relating to the purpose and location of treatments in relation to identified WUI. Additionally, the implementation of the NRLMD (U.S. Department of Agriculture, Forest Service, 2007c) constrains treatments in lynx habitat outside the wildland-urban interface where multi-storied hare habitat or stand initiation hare habitat is present.

The use of prescribed fire within the WUI is a high-risk action and is often more expensive. Additionally, impacts from smoke emissions adjacent to homes for extended periods limit the number of acres that can be treated. Within the WUI, there is an increased need to rely on mechanical and hand treatments rather than fire. In addition, social issues (i.e., effects of treatments on scenery, air quality, noise, and wildlife viewing) can be more contentious.

Future wildfire and fire regimes

Natural, long-term variations in temperature and precipitation patterns have resulted in continuously changing fire regimes (Whitlock et al., 2008), and thus continually changing forest conditions. This past climatic variability has had major effects on the timing, frequency, intensity, severity, and extent of wildland fires, as would future changes in climate. The effect may be due to direct climate-related factors, such as increased temperature and greater drying of forest fuels; or indirectly, related to potential changes in forest composition and structure due partly to climate change. These climate-induced changes in fire regimes could have substantial impacts on ecosystems, with associated effects to communities and economies (Mckenzie, Peterson, & Littell, 2009).

Modeling predicts that wildfire will continue to a similar degree under all alternatives because of both natural and human caused ignitions and an expansive fuel source. Modeling shows only subtle differences in the predicted number of acres burned by alternative; generally the differences between alternative is likely due to inherent modeling uncertainty rather than a measurable change on the ground. There are also subtle difference between the amount and type of fire within and outside the WUI by alternative, as shown in Table 36. The expected results are similar across alternatives.

Table 36. Average acres burned over 5 decades, by alternative, inside and outside the WUI

Fire Type	Location	Alternative A	Alternative B/C	Alternative D	Alternative E
Light severity	WUI	1,617	1,598	1,615	1,557
	Non-WUI	2,581	2,608	2,593	2,591
Mixed severity	WUI	16,626	16,430	17,023	16,405
	Non-WUI	35,388	33,919	34,641	35,319
Stand-replacing	WUI	18,056	17,523	17,735	16,879
	Non-WUI	51,998	50,550	50,852	52,638
Total acres		126,266	122,628	124,459	125,389

Effects from plan components associated with:

Air quality management

The consequences to fire from air quality are the same for all alternatives. All alternatives have the same plan components to meet air quality standards established by federal and state agencies. The FS would meet the requirements of state implementation plans and smoke management plans. Laws and regulations on smoke emissions can limit opportunities to conduct prescribed burning. These limitations are most frequently encountered in high population density areas that reduces the use of prescribed fire in and around the WUI.

Canada lynx management

The NRLMD (U.S. Department of Agriculture, Forest Service, 2007c) would be implemented under all alternatives. This direction recognizes the importance of fuel treatments within the wildland-urban interface as designated by the Healthy Forest Restoration Act. However, opportunities to conduct vegetation treatments, including prescribed fire or mechanical fuels reduction treatments, outside the wildland-urban interface are limited under current lynx management direction. Restrictions on treating within these forest conditions is likely to reduce the ability and effectiveness of achieving desired forest and fuel conditions outside the WUI.

Lynx management direction restrictions on treatments in multi-story hare habitat and young seedling/sapling forests have the most impact. These forest conditions are widespread and common across the HLC NF, due to the dominance of subalpine fir-spruce forests and of fire as a natural disturbance process, creating large areas of seedling/sapling forest. Thinning of dense sapling stands is typically

designed to create future forests composed of larger trees and desired species (such as fire resistant Douglas fir). These forests are more resilient in the face of future wildfire events, and may burn less severely, reducing potential future impacts to values at risk. Thinning in these young stands is generally not allowed under lynx management direction.

Prescribed fire is often the only feasible management tool available across much of the HLC NF. Typically, the objective of prescribed fires is to reduce stand densities by removal of the understory, and in some forest types (such as subalpine fir and lodgepole dominated forests), removal of portions of the overstory to create patches of more open forest conditions across the landscape. Prescribed fire management with these objectives would not be able to occur in multistory hare habitat, limiting the ability to manage landscape patterns and fuel conditions to achieve desired conditions. Use of wildfire (unplanned ignitions) to achieve desired conditions is frequently infeasible due to seasonal changes weather and fuel conditions.

Effects common to all action alternatives

All action alternatives contain desired conditions and guidelines that articulate what role fire should play. Management direction recognizes that risks to important values changes depending on seasonal changes in weather and fuels, providing the opportunity to use fire as a management tool when conditions are conducive to meeting various plan objectives. The revised plan continues to recognize that with certain weather, fuels, and topography fires can be managed with minimal risk to values. The acres of each designated area influence how fire management can be implemented for each alternative.

Alternative A, no action

The current Helena and Lewis & Clark NF plans, as amended, are the existing management direction being used by the HLC NF to address fire and fuels management. This direction represents the no-action alternative. However, because the no-action alternative is the baseline to which the action alternatives are compared, it is important to understand what actions would continue under the no-action alternative.

The existing Helena NF Plan (1986), and Lewis and Clark NF Plan (1986) include management area direction relating to fire and fuels management. Both existing plans specifically call for fire being permitted in wilderness and for prescribed fire to maintain healthy and stable ecosystems (1986 HLF Plan appendix R and 1986 LCF Plan, appendix P).

Under the no-action alternative, management of fire and fuels would continue following existing forest plans. With the focus on mechanical treatments, the use of unplanned ignitions to meet resource objectives could be expected to increase relative to all other alternatives. This is a result of the opportunity to treat critical areas prior to an unplanned ignition resulting in an increase in favorable forest structure.

Effects that vary by alternative

Future vegetation treatments

Prescribed fire is essential to reducing fuels; (E. D. Reinhardt, Keane, Calkin, & Cohen, 2008) found that it is possible to craft treatments that achieve both ecological restoration and fire hazard reduction, but ecological restoration will also include reintroducing fire and other active management. The most effective ecosystem treatments should include prescribed fire (E. D. Reinhardt et al., 2008).

In all alternatives, prescribed fire would continue to be used to move the forest toward desired future conditions. The amount of anticipated prescribed fire within forested areas varies by alternative as shown in Table 37. Alternative E is projected to result in the least amount of prescribed fire within forested vegetation types, due to an emphasis on timber production. Additional potential treatments in nonforested vegetation types are not reflected in the projections.

Table 37. Average prescribed fire acres[1] per year by alternative.

Time period	Alternative A	Alternative B/C	Alternative D	Alternative E
Decade 1	6,479	6,358	6,449	2,777
Decade 2	3,757	3,711	3,714	2,173

1. Acres are from the SPECTRUM model and only include forested areas. Non-forested area is not included in these figures. Figures include areas both inside and outside the WUI.

Harvest treatments can also be used to achieve fuel management objectives, such as reducing forest densities and favoring fire-resistant species. Relative to impacts to fire and fuels, treatments that may occur in the WUI may be the most important. Each alternative results in differing amounts of projected harvest treatments inside the WUI, as shown in Table 38. Alternatives A, B, C, and D treat similar amounts of the urban interface where alternative E treats less in the first two decades as a result of maximizing timber production. Alternative E emphasizes harvesting in high productivity forests, whereas alternatives A, B, C, and D focus treatments on dry vegetation sites that are most departed from desired conditions. Alternative E would be the least responsive in obtaining desired fuel conditions within the urban interface in the first two decades.

Table 38. Average harvest acres per year[1] in the WUI by alternative

Time period	Alternative A	Alternative B/C	Alternative D	Alternative E
Decade 1	2,201	2,137	2,126	1,078
Decade 2	2,408	2,255	2,254	1,427

1. Source: Spectrum model, average acres per year for decade 1 and 2, all harvest types, projected to occur in the WUI.

Flexibility for fire management

The alternatives vary from the fuels management perspective on the allocation of acres to different designated areas. The primary designated area that impacts fuels management is RWAs due to policy limitations on both mechanical treatments and prescribed fire. In RWAs, initial limitations would be for mechanical treatment of fuels. Wildfire would be used to meet resource objectives, with an emphasis on non-mechanical treatments and limited use of prescribed fire as allowed on these acres. There would be additional limitations on prescribed fire in these areas if RWAs become designated wilderness.

Within RWAs, there would be an additional focus on the natural role of fire. However, fuel management would be dependent upon the use of unplanned ignitions and the risk assessment associated with each season and event that may require suppression actions instead. The ability to use wildfire for resource benefit would likely be reduced due to constraints on mechanical treatments. This would limit opportunities to pretreat areas that would serve as buffers for naturally ignited wildfires. Additionally, the location of the ignition would weigh heavily on decisions relating to suppression. Table 39 displays the total amount of RWAs by alternative, and the acres of RWAs that occur within the WUI.

Table 39. Recommended wilderness and WUI by alternative

	A	B/C	D	E
Acres RWAs	34,222	213,076	474,588	0
Acres of WUI in RWAs[1]	4,551	31,694	97,189	0

1. WUI will change over time as population growth continues.

Alternative B would have more acres of RWAs compared to alternative A. The use of motorized/mechanized means for access and management would be restricted in RWAs. The use of prescribed fire and mechanical treatments could be expected to be less relative to alternatives A and E, but greater than alternative D. Alternative C is the same as alternative B with respect to RWAs, except

that it would allow existing motorized use to continue in those areas. This would add flexibility allowing for some mechanical treatments and increased use of prescribed fire as compared to alternative B. A result of increased mechanical and prescribed fire activities would lead to increased flexibility to manage unplanned natural ignitions.

Alternative D includes the greatest amount of RWAs, especially in the WUI, and restricts motorized/mechanized access in those areas. Alternative D provides for the least flexibility for fire suppression and fuels management, resulting in the fewest opportunities of mechanical and prescribed fire treatments. This alternative may result in reduced flexibility for unplanned natural ignitions used to meet forest plan desired conditions. This alternative would require greater dependence upon the use of unplanned natural ignitions to meet forest plan desired conditions. However, with less flexibility in conducting associated fuel management activities, unplanned natural ignitions may require suppression actions instead.

Alternative E provides for the most flexibility for fire suppression by including no RWAs, resulting in the greatest opportunities for mechanical treatments and prescribed fire. Other existing constraints, however (such as IRAs), would result in similar fuel treatment opportunities as in alternative A. Access would be less restricted in this alternative compared to B, C and D. Alternative E would likely result in more opportunities for prescribed fire, increased opportunities for unplanned ignitions being used to meet forest plan desired conditions, and an increase in mechanical treatments. However, as shown in the future vegetation treatment discussion, an emphasis on timber production with this alternative could actually result in moving fewer acres toward desired future conditions within the WUI with fuels treatments.

Effects from plan components associated with:

Recommended wilderness

It is possible that RWAs could be designated by Congress as wilderness at some point in the future. Wilderness designation would result in reduced flexibility and options for vegetation and fuels management to achieve desired conditions. Use of prescribed fire is typically not allowed within designated wilderness areas, and the ability to use unplanned ignitions (wildfire) as a tool would be very limited within some of the RWAs due to proximity to the WUI. This is because of the small size and/or in locations that likely have to be aggressively suppressed to protect identified values (i.e., private lands). This effect would be most pronounced under alternative D, with some impact, though much less, under alternatives B and C modified. There would be little impact under alternatives A. Alternative E would have no effect as there are no RWAs in this alternative.

General wildlife management

Wildlife management direction has low impact on fire and fuels management, especially within the WUI, because management direction recognizes the importance of managing vegetation to modify fire behavior. Fire on the landscape is an important part of the natural function of the ecosystem, and as such helps create and maintain habitat conditions for native wildlife species.

Specific plan components for wildlife may limit fuels management activities. For example, all alternatives include plan components that would limit disturbance to some species during critical times, such as nesting or calving, in specific areas. Such timing restrictions may result in missed prescribed fire windows at times.

All alternatives would adopt the Grizzly Bear Conservation Strategy. Associated plan components may limit access and disturbances such as prescribed burning within the primary conservation area, which would apply to the Upper Blackfoot and Rocky Mountain Range GA.

In addition, there are plan components that specify specific habitat conditions such as thermal cover, security, or hiding cover for species such as elk. These components are the most specific and limiting

with alternative A. The action alternatives contain plan components with more flexibility related to elk habitat conditions. Alternatives C and D are the least limiting related to elk habitat, because no specific guidelines for elk security are included, whereas B and D do have guidelines related to elk security.

Watershed, soil, riparian and aquatic management

Consequences from forest plan components on the ability to restore or maintain ecosystems or reduce hazardous fuels would be generally similar for all alternatives. In order to meet the plan direction associated with these resources there would likely be occasions where prescribed or natural fires cannot be used due to potential negative effects that those activities could have on these resources. Fuels management activities occasionally require some soil disturbing activities or road construction, which may be limited to meet other plan components. Although it is difficult to quantify the effects, all the alternatives have components that would limit fire for ecosystem maintenance or fuels treatments in certain circumstances.

All alternatives would contain components that limit equipment use on steep slopes. However, the action alternatives also include guidelines that require a minimum amount of organic matter to be present following treatments, which may be difficult to achieve following prescribed fire in some cases. The revised plan also contains guidelines for the retention of coarse wood debris which would also factor in to prescribed burning prescriptions. Finally, the action alternatives include the adoption of RMZs, which are greater in size from the riparian zones currently identified for streams east of the Continental Divide. The plan components associated with RMZs would also influence prescribed burning prescriptions and techniques.

In summary, all alternatives include plan components for the protection of water, soil, and aquatic resources. The components for the action alternatives (B, C, D, and E) are more specific and potentially limiting to prescribed fire operations than those in the no-action alternative (A).

Timber management

Vegetation treatments are typically designed and implemented to achieve multiple resource, social and economic objectives, including those associated with fuels management. Where fuels reduction is an identified objective, the timber management program supports the accomplishment of that objective.

Under alternative A, the existing forest plan directs suppression of all wildfires in some of the Management Areas where timber production is an objective. The action alternatives do not have this limitation, but recognize that not all fire is detrimental to timber production. Therefore there is opportunity to allow wildfires to burn and help maintain/restore fire adapted ecosystems.

Access and recreation management

Changes in road access are the most under alternative D and least for alternative A. Alternatives B and C have a moderate change in access due to additional RWAs compared to alternative A and less RWAs than in alternative D. Alternative E would likely have the greatest access due to the most land suitable for timber production and no RWAs (refer to Recreation and Access section). This would influence fire management activity access and remove it where roads are decommissioned. Alternative means of treating fuels may be more expensive and thus prohibited.

Cumulative Effects

Human population increases and/or shifts towards wildland-urban interface

For the last several decades there has been more human development occurring around the "edges" of lands administered by the Forest. This trend is expected to continue in the future and is likely to have effects on the forest vegetation that are similar to those discussed above under the item titled "National Fire Plan, Healthy Forest Initiative, and Healthy Forest Restoration Act." In addition, with a greater

number of people living and recreating in these wildland-urban interface areas, there is a greater probability of more human-caused wildfire ignitions that could have effects on the forest vegetation, in spite of efforts to suppress human-caused fires.

WUI has become the focus of suppression resources when large wildfires occur (Gude et al 2008). The future increase in WUI will continue to challenge wildfire management during large fire events as "Firefighters will likely have to protect dispersed housing over an extremely large area of fire-prone forest." (Gude et al 2008). To work individually with property owners is costly and creates a patch work of defendable properties among those that are not.

The current trend of rural fire department staffing is on the decline, leading to limitations on their ability to support fire suppression and/or structure protection in their jurisdictions. This may lead to increased spread of fire from off forest.

To the extent that plan components (such as those related to soils and wildlife) limit the implementation (or increase the complexity) of prescribed fire, the ability for fire managers to use this tool for landscape fuels management in the WUI may be lessened.

Increased regulation and concern over smoke emissions

The ability to use fire to maintain and/or restore the fire-adapted ecosystems on the Forest, or to use fire to reduce hazardous fuels in the wildland-urban interface, is dependent upon air quality regulations. Therefore, to the extent that air quality regulations may become more stringent in regards to the quantity and timing of smoke emissions, there could be substantial effects on the ability of the Forest fire management program to utilize these fire tools. If past trends of increasing regulations and decreasing burn opportunities continue, the effects could be substantial and would likely result in not being able to use fire enough to make meaningful improvements to forest and fuel conditions and meet objectives.

Timber product manufacturing infrastructure and economics

The ability of the Forest to positively affect forest vegetation is partially dependent upon the ability to sell forest products to manufacturing companies and to use harvesting process (including the residual slash disposal activities) as a means to positively affect the forest vegetation and reduce hazardous fuels. If the forest products industry declines in areas surrounding the Forest to the degree that it is difficult to sell forest products or "stumpage prices" decrease substantially, it would affect how many acres could be treated and fuels reduced. While some treatments could be accomplished by using prescribed burn-only, it is generally very risky in the wildland-urban interface and expensive, leading to fewer acres treated.

Other plans

Since they were developed, national level plans, initiatives, and acts such as the National Fire Plan, Healthy Forest Initiative, and Healthy Forest Restoration Act (these are called "other plans" for the rest of this discussion) have influenced the vegetation and fuel management programs on the Forest. Therefore, they have had some effects on hazardous fuels and it is anticipated that they will continue to do so for the foreseeable future. In general, these plans have resulted in more vegetation treatments being implemented near wildland-urban interface areas with the objective of reducing hazardous fuels, and fewer vegetation treatments being conducted in areas located away from communities. In addition, the types of fuel treatments that are being used in response to these other plans are often more expensive due to the need to rely on mechanical and hand treatments rather than fire. Additionally, social issues can be more contentious. Therefore, higher public involvement, planning and implementation expenses are likely to lead to fewer acres being treated within a given budget level. Not only do these other plans emphasize the need to reduce hazardous fuels in the wildland-urban interface, but they also stress the need to restore the natural fire regimes and forest conditions to the larger NF landscape. These plans encourage the development of more resistant and resilient forest vegetation that would be less susceptible to large undesirable wildfires and/or insect outbreaks.

Portions of the HLC NF adjoin other NFs, each having its own forest plan. The HLC NF is also intermixed with lands of other ownerships, including private lands, other federal lands, and state lands. Some adjacent lands are subject to their own resource management plans. The cumulative effects of these plans in conjunction with the HLC NF revised forest plan are summarized in Table 40, for those plans applicable to fire and fuels.

Table 40. Summary of cumulative effects to fire and fuels management from other resource management plans

Resource plan	Description and Summary of effects
Adjacent National Forest Plans	The forest plans for NFS lands adjacent to the HLC NF include the Custer-Gallatin, Lolo, Flathead, and Beaverhead-Deerlodge NFs. All plans address fire and fuels. Generally speaking, management of fire and fuels is consistent across all NFs due to law, regulation, and policy. The cumulative effect would be that the management of fire and fuels would be generally complementary by creating resilient landscapes, fire adapted communities, and safe and effective wildfire response. This includes specific adjacent landscapes that cross forest boundaries, such as the Upper Blackfoot, Divide, Elkhorns, Crazies, and the Rocky Mountain Range.
Montana Statewide Forest Resource Strategy (2010)	This plan guides fire and fuels management on state lands. It includes some concepts that are complementary to revised plan components for the HLC NF, for example, state direction is for suppression of wildfires which addresses safe and effective wildfire response. While specific desired conditions are not stated in the same terms as the HLC NF, it is likely that some elements such as provide for firefighter and public safety would be similar. State forestlands may be actively managed to a greater degree than NFS lands, and would contribute to achievement of desired fire and fuels conditions across the landscape.
BLM Resource Management Plans (RMP)	BLM lands near the HLC NF are managed by the Butte, Missoula, and Lewistown field offices. The Butte plan was recently revised (2009) while the existing plans for the Missoula and Lewistown areas are under revision. These plans contain components related to fire and fuels, and are complementary to the plan components for the HLC NF by creating resilient landscapes, fire adapted communities, and safe and effective wildfire response.
National Park Service - Glacier National Park General Management Plan 1999	The general management plan for Glacier National Park calls for preserving natural vegetation, landscapes, and disturbance processes. Broadly, the fire and fuels characteristics in this area are therefore likely similar to the wilderness areas in the adjacent Rocky Mountain Range GA and would likely complement these conditions.
Montana Army National Guard – Integrated Natural Resources Management Plan for the Limestone Hills Training Area 2014	This plan is relevant to an area adjacent to NFS lands in the Elkhorns GA. The Limestone Hills area is primarily nonforested, and calls for managing for fire and fuels. This plan would be generally complementary to the HLC NF through direct fire suppression outside the impact zone and the potential for the use of prescribed fire.
Montana State Parks and Recreation Strategic Plan 2015-2020	These plans guide the management of state parks, some of which lie nearby or adjacent to NFS lands. Fire and fuels is a component of these parks, although not always the primary feature. Specific fire and fuels conditions relating to protection of values through treatments within the WUI and through safe and cost effective suppression of wildfires contribute to the desired conditions as described for the HLC NF.
Montana's State Wildlife Action Plan	This plan describes a variety of vegetation conditions related to habitat for specific wildlife species. This plan would likely result in the preservation of these habitats on state lands, specifically wildlife management areas. This plan would interact with the Montana Statewide Forest Resource Strategy (above). The vegetation conditions described would be complementary to the conditions being managed for with the HLC NF revised forest plan.
County wildfire protection plans	Some county wildfire protection plans map and/or define the WUI. The HLC NF notes that these areas may be a focus for hazardous fuels reduction, and other plan components (such as NRLMD) have guidance specific to these areas. Managing for open forests and

Resource plan	Description and Summary of effects
	fire adapted species may be particularly emphasized in these areas. Overall, the effect of the county plans would be to influence where treatments occur to contribute to desired vegetation conditions.
City of Helena Montana Parks, Recreation and Open Space Plan (2010)	This plan is relevant to an area that lies adjacent to NFS lands in the Divide GA, in proximity to the City of Helena. The plan emphases forest management and wildfire mitigation. This would be generally complementary and additive to management on some HLC NF lands, specifically the South Hills Special Recreation area (alternatives B, C, and D).

Conclusions

The following key points summarize the conclusions for fire and fuels management:

- Fire is a critical ecological function across the HLC NF that plays a central role in providing quality habitat for both plant and wildlife species. All alternatives would ensure fire remains a part of the ecological system and would move the forest toward desired future conditions. This is achieved through a variety of management actions including wildland fire and mechanical treatments.
- *Future vegetation treatments:* Alternative E would achieve the least amount of harvest and prescribed fire in forested areas, including in WUI areas due to focusing on maximizing timber harvest. Alternatives A, B, C, and D would tend to treat more dry forest types in WUI areas. However, there are also other factors that affect the number of acres treated to meet forest plan desired conditions relating to fire and fuels management. Some of these factors include budget allocation, climate and seasonal weather variation, and wildfire occurrence. Budget directly affects how much we are able to treat mechanically and with prescribed fire. Climate and seasonal weather variation affect the ability to conduct prescribe burns. Wildfire occurrence activity locally uses personnel and other resources that would be used for implementing mechanical and prescribed fire treatments.
- *Flexibility for fire management:* Different management designations, specifically RWAs, affect where different management tools, such as mechanical treatments and prescribed fire can be used. Alternatives B, C, and D would limit mechanical treatment options within RWAs, with D having the most area restricted. If these areas became designated wilderness then additional constraints on prescribed burning would exist. Under alternatives B, C, and D there may be increased opportunities and need to manage natural-wildfire to move toward desired future conditions because of the limitations on mechanical activities which would affect the use of prescribed fire. Alternative E has the greatest flexibility for fire and fuels management, but conversely may reduce the use of prescribed fire and wildfire managed for resource benefit because of the emphasis on timber production.
- *Future wildfire and fire regimes*: The projected levels of future wildfire, and their subsequent impact on fire regimes, is generally the same across alternatives. This is because vegetation over time is generally the same for all alternatives, and projected future treatments are also similar. Factors such as climate have a greater bearing on vegetation change and potential wildfire activity.

3.8 Terrestrial Vegetation

3.8.1 Introduction

The 2012 Planning Rule adopts a complementary ecosystem and species-specific approach, known as “coarse-filter/fine-filter”, to provide the natural diversity of plant and animal communities and ensure long-term persistence of native species in the plan area. Coarse-filter plan components are designed to maintain or restore ecological conditions for ecosystem integrity and diversity within agency authority