3.5 THE ROLE OF FIRE

Issue Statement

There are differing opinions about the use of prescribed fire on the Chippewa and Superior NFs. Forest Plan revision will determine how, where, and to what extent prescribed fire may be used to mimic natural processes, to restore natural processes and functions to ecosystems, and to reduce the accumulation of hazardous fuels.

Indicator 1 – Relative Fire Risk Index

Indicator 1 for the role of fire is the ranking of a mixture of species composition and age into groups of relative fire risk. Certain species and age classes, combined with whether or not timber harvesting occurred, were divided into three classes: low, medium, and high fire risk. This indicator provides a general characterization of fire risk over time and highlights the differences between alternatives by using a simple, qualitative index that characterizes fire hazard based on species composition, age, and fuel characteristics that varies by alternative and time.

Indicator 2 – Use of Management-ignited Fire for Ecological Objectives

Indicator 2 is the use of management-ignited fire to meet ecological objectives. This indicator will be measured in terms of the maximum number of acres available that could be treated with management-ignited fire to meet ecological objectives. This indicator highlights the differences between alternatives because each alternative reflects a varying number of acres available in each fire dependent ecosystem that varies by alternative and time.

Indicator 3 – Management-ignited Fire for Hazardous Fuels Reduction

Indicator 3 is the use of management-ignited fire for fuel reduction purposes. This indicator will be measured in terms of the maximum number of acres available that could be treated with management-ignited fire to meet fuel reduction objectives. This indicator highlights the differences between alternatives because it uses a simple, qualitative index that characterizes hazardous fuels based on species composition, age, and fuel characteristics that varies by alternative and time.

Indicator 4 – Use of Management-ignited Fire for Site Preparation

Indicator 4 is the use of management-ignited fire for site preparation purposes. Currently, fire is one of the many tools used for site preparation on both forests. This indicator will be measured in terms of the acres of land treated with management-ignited fire that meets site preparation objectives. This indicator does a good job of highlighting the differences between alternatives because it shows the variation of acres that are available for site preparation by fire over time.

Indicator 5 – Air Quality

The air pollutant of most concern that is generated by wildfire is total particulate matter (PM). Particulate matter is a mixture of solid particles and liquid droplets found in the air that varies greatly in size, composition and origin. Over the years, the U.S. Environmental Protection Agency (EPA) has focused on small sized particles since these particles can penetrate deep into the lungs and have been tied to observed adverse health affects. The most recent particulate standard promulgated by EPA is for particulate smaller than 2.5 micrometers (um) in aerometric diameter, known as $PM_{2.5}$. Combustion sources of all types are the major sources of $PM_{2.5}$.

$PM_{2.5}$ is also a major cause of visibility degradation due to its ability to absorb and scatter light.

Typical fuel types, fuels loads, fuel moisture and other parameters needed for inputs to the model were based on best professional judgment for the different fire types.

Analysis Area

The analysis area for indicators 1- 4 is all land administered by the Superior National Forest and the Chippewa National Forest that are within proclamation boundaries. These areas represent National Forest System land where fire management activities may take place.

For indicator 5 (Air Quality), the analysis area encompasses northeastern Minnesota.

For the cumulative effects analysis other lands included in the analysis were: tribal, State, county, and private lands; Voyagers National Park and portions of Quetico Provincial Park and Ontario, Canada.

Data from the first and second decade was used in the analysis for all indicators.

Table FIR-1: Chippewa National Forest Proposed Maximum Available Acres for Management-Ignited Fire by Indicator (acres). "Maximum available acres" refers to the total amount of acres that fit into each indicator. Not all acres will be treated, but can be considered for treatment. Decadal acres rounded to nearest one hundred.

Indicator	Exist. Condition		A		B		C	
	Decade		1	2	1	2	1	2
#2. Ecological Objectives	Prescribed Fire	6,463	6,900	6,000	7,800	8,400	7,200	6,400
#3. Hazardous Fuels Reduction	Prescribed Fire	29,615	25,600	22,300	28,200	27,800	22,700	18,600
#4. Site Preparation	Prescribed Fire		3,300	3,200	2,900	3,000	900	700
Proposed Maximum Available Acres Rx Fire			35,800	31,500	38,900	39,200	30,800	25,700

Indicator	D		E		F		G	
	1	2	1	2	1	2	1	2
#2. Ecological Objectives	9,000	10,100	7,900	8,200	7,500	7,900	6,800	6,900
#3. Hazardous Fuels Reduction	30,100	32,200	26,200	26,500	28,900	28,000	27,700	26,100
#4. Site Preparation	0	0	2,600	3,000	5,400	5,800	2,700	2,700
Proposed Maximum Available Acres Rx Fire	39,100	42,300	36,700	37,700	41,800	41,700	37,200	35,700

3.5.2.a Affected Environment

Historically (1700 – 1900), most forests were young and even-aged and were not susceptible to insect, disease, or wind damage. European settlement brought with it logging, fire suppression and fire exclusion, and that influence dramatically changed species composition and structure of the forests. For fire regime discussion, including fire return intervals for all forest types, please see Vegetation narrative Appendix G.

Table FIR-3 breaks down wildland fires by Forest over the last twenty-two years. The major ignition sources for human-caused fires on both of the forests are arson and debris burning. On the Chippewa National Forest, fires usually occur in the early to late spring in the marsh grasses, with some rare summer and fall fires in the timber during droughty conditions. On the Superior National Forest, fires occur in the late spring in the marsh grasses and throughout the summer and fall in the timber.

Table FIR-2: Superior National Forest Proposed Maximum Available Acres for Management-Ignited Fire by Indicator (acres). "Maximum available acres" refers to the total amount of acres that fit into each indicator. Not all acres will be treated, but can be considered for treatment. Decadal acres rounded to nearest one hundred.

Indicator	Exist. Condition		A		B		C	
	Decade		1	2	1	2	1	2
#2. Ecological Objectives	Prescribed Fire	6,607	7,600	7,800	8,000	9,000	7,200	7,600
#3. Hazardous Fuels Reduction	Prescribed Fire	70,070	62,000	54,000	68,200	66,500	56,300	44,200
#4. Site Preparation	Prescribed Fire		6,200	7,100	6,200	7,000	1,700	1,600
Proposed Maximum Available Acres Rx Fire			75,800	68,900	82,400	82,500	65,200	53,400

Indicator	D		E		F		G	
	1	2	1	2	1	2	1	2
#2. Ecological Objectives	9,200	10,600	6,200	7,200	6,800	7,900	7,100	7,800
#3. Hazardous Fuels Reduction	69,300	71,800	66,100	64,300	66,400	63,000	65,700	61,600
#4. Site Preparation	0	0	6,700	7,300	15,100	19,000	7,000	8,200
Proposed Maximum Available Acres Rx Fire	78,500	82,400	79,000	78,800	88,300	89,900	79,800	77,600

Table FIR-3: Number of Natural and Human-Caused Fires on the Superior and Chippewa National Forests, 1980 - 2002

National Forest	Total No. of Fires	Natural Ignitions	Human Ignitions	Median Size‡
Chippewa	1,160 (50/yr)	28 (2%)	1,132 (98%)	276 acres
Superior	1,402 (61/yr)	351 (25%)	1,051 (75%)	141 acres

Source: Local Fire Reports from 1980 - 2002
‡Notes: Median fire size is large due to a few but significantly large fires on both forests between 1980 – 2002.

Throughout the 20th century, fire management policy has continued to evolve in response to land and resource management needs, growing knowledge of the natural role of fire, and increased effectiveness of fire suppression. During the earliest years of wildland fire management (i.e. 1940s), the existing state of knowledge indicated that aggressive, total suppression was the best solution to limit widespread, damaging fires. As knowledge, understanding, and experience expanded, it became apparent that complete fire exclusion was not the best management direction to support a balanced resource management program. This has led to the development of current Forest Service fire policy.

A "wildland fire" is any non-structure fire, other than prescribed fire, that occurs in wild lands. All wildland fires on both the Superior National Forest and the Chippewa National Forest receive a specific level of response that implements the protection and/or fire use (Superior NF only) objectives outlined in each forest's Fire Management Plan. Fire protection objectives in both the Chippewa and Superior Fire Management Plans for 2003 state that all wildfires will be suppressed at minimum cost, considering firefighter and public safety, benefits, and values to be protected, in a manner that is consistent with resource objectives.

In response to the reintroduction of fire into fire-dependent ecosystems in the United States, the Forest Service has prepared a report titled "Protecting People and Sustaining Resources in Fire-Adapted Ecosystems – A Cohesive Strategy" (USDA Forest Service 2000). This document outlines a strategy based on the premise that sustainable resources are predicated on healthy, resilient ecosystems.

The Current Hazard/Risk Index examines the current fuel conditions that indicate the relative risk of wildfire in wildland/urban interface areas. There is concern that increased fuel loading across the forest will lead to an increasing risk of large wildfires occurring within the wildland/urban interface areas. Risk is based on a variety of factors including ignition sources, ignition patterns, and spatial distribution of vegetation in conjunction with the location of human developments. This index is measured by a narrative assessment based on forest species composition, age, fuel characteristics, and spatial distribution. Because this index reflects current condition only, it is used in the FEIS to illustrate current fire hazards. The Current Hazard/Risk Index is not included as an indicator for the role of fire.

Indicator 1 – Relative Fire Risk Index

Using the outputs from the Dualplan Model, untreated upland conifer over forty years old constituted the high fire risk. Untreated grasslands, lowland conifer, hardwoods, and mixed conifer/hardwoods over 40 years old made up the medium fire risk. Finally, any forest type that had been treated and was over 40 years old constituted the low fire risk.

Based on the above criteria, the Relative Fire Risk Index for the Chippewa NF is considered moderate and the Relative Fire Risk Index for the Superior NF is considered to be moderate to high at this time.

Indicator 2 – Use of Management- Ignited Fire for Ecological Objectives

Currently, timber harvesting is the primary management tool used to meet ecological objectives

on each forest. However, fire provides an additional tool for mimicking natural processes and disturbance. There are different effects on resources when using fire versus timber management as a tool to achieve ecological objectives. Acres were identified that concentrated on the more fire dependent ecosystems on these forests which are red pine and white pine. The number of acres in the red pine and white pine landscape ecosystems determined the maximum amount of acres available for prescribed fire treatments. A reduction factor was applied to the number of acres available to help determine a feasible amount of acres that could be treated. Tables FIR-1 and FIR-2 break down the maximum number of acres available for prescribed fire treatments.

There is little use of fire to meet ecological objectives on the Chippewa NF or on the Superior NF (outside of the BWCAW) at this time. There is a Wildland Fire Use program on the Superior NF within the BWCAW. From 1993 to 2002, the BWCAW had an average of 787 acres burned per year using Fire Use fires with all of those acres burned prior to the July 4, 1999 storm.

Indicator 3 – Management-Ignited Fire for Hazardous Fuels Reduction

There is currently a higher than normal fuel loading across both forests due to natural disturbances (winds, insects, disease) and the absence of fire on the landscape. This has created a need for aggressive fuels reduction projects. This indicator takes the acres identified in Indicator 1 and uses the "high" and "medium" risk categories as the basis for determining the maximum amount of acres available for burning. A reduction factor was applied to the number of acres available to help realize a feasible amount of acres that could be treated. Tables FIR-1 and FIR-2 break down the maximum number of acres available for prescribed fire treatments.

Both forests currently have active hazardous fuels prescribed fire programs that range from burning an average of 3,000 acres per year for the Chippewa NF, to an average of 3,300 acres per year for the Superior NF from 1993 to 2002.

Indicator 4 – Use of Management-Ignited Fire for Site Preparation

Currently, fire is one of the many tools used for site preparation on both forests. The numbers of acres available were determined by totaling the number of acres that had a clearcut or shelterwood treatment scheduled then assigned a percentage of those acres that reflected the relative amount of fire that would be used for site preparation in each alternative. A reduction factor was applied to the number of acres available to help realize a feasible amount of acres to be treated. Tables FIR-1 and FIR-2 break down the maximum number of acres available for prescribed fire treatments.

Both forests currently have active prescribed fire site preparation programs that range from burning an average of 150 acres per year on the Superior NF, to burning an average of 200 acres per year on the Chippewa NF.

Indicator 5 - Air Quality

The state is responsible for monitoring particulate concentrations in populated areas. There are no permanent, federally approved, particulate monitors on the forest. Nevertheless, monitors in nearby cities are useful to approximate the situation on the forest. The Minnesota Pollution Control Agency (MPCA) has recently deployed a monitoring network to measure $PM_{2.5}$. With less than two years of sampling data (through September 2000), concentrations for the following sites are shown in Table FIR-4 (MPCA, 2001).

The $PM_{2.5}$ standard is 15 ug/m3 (annual average) and 65 ug/m3 (24-hour average). In general, higher concentrations are observed in winter than at other times.

Referring to table FIR-4, the current overall condition of the air resource on the forest, in reference to particulates, is quite good. Annual average concentrations are about one-third of the annual standard for $PM_{2.5}$, and the maximum 24-hr values are about one-third of the 24-hour $PM_{2.5}$ standard.

A historical air quality assessment of Boundary Waters Canoe Area Wilderness (BWCAW) was completed in April of 2000 (Air Sciences, Inc., 2000) in support of the Boundary Waters Canoe Area Wilderness Fuel Treatment EIS. The assessment used the documented fire history of the BWCAW to reconstruct the wildland fire emissions for the period 1727 through 1972. This 245-year period was divided into three periods: the Pre-settlement Period with Good Record (1727-1868), Settlement Period (1868-1910), and Suppression Period (1911 to 1972). The Pre-settlement Period with Good Record correlates well with the reference period described in part 3.1.3 for determining the Range of Natural Variability (RNV). During the Pre-settlement Period with Good Record, the area burned per decade was extremely variable, ranging from a low of 1280 acres (1830-1839) to a high of 445,440 acres (1860-1869). This equated to a range of 105 tons of $PM_{2.5}$ to 36,684 tons of $PM_{2.5}$. In contrast to the Pre-settlement Period with Good Record time period, the most acres burned during the Suppression Period (since 1910) was 51,200 (1910-1919), with all other decades in the period less than 15,500 acres.

It should be noted that the historical assessment records primarily reflect stand replacing fires. Consequently, this analysis is based on a conservative (i.e. low) estimate of the actual fire activity and smoke emissions that occurred in the BWCAW.

3.5.2.b Environmental Consequences

Effects Common to All Alternatives

Resource Protection Methods

Management-ignited prescribed fire, though an important tool in restoring ecosystem process and function, can have varying effects depending on conditions. Forest Plan direction is intended to help define those situations where management-ignited prescribed fire will be appropriate based on resource, social, or economic concerns.

General Effects Common to All Alternatives

Fire contributes to a host of functions and processes in ecosystems. Fire reduces accumulations of organic material, which in turn reduces wildfire hazard (Harrington 1996). It recycles nutrients and alters soil chemistry, aids in decomposition, and influences soil structure and stability (Arno et al. 1995). Fire alters vegetative characteristics that contribute to course and fine scale vegetative mosaics on the landscape (Heinselman 1996). Fire also modifies vegetative succession, providing early seral stages important to some wildlife species (Lyon et al. 2000). Fire effects can vary depending on fire intensity, severity, and frequency, the primary factors that define fire regimes.

The effects of not using fire are also the same across the alternatives. Acres not treated (with fire,

Table FIR-4: Measured $PM_{2.5}$ Concentrations in Northern Minnesota in ug/m^3

Data Sample Areas	Annual Average	24-hour Maximum	24-hour Minimum
Duluth (UMD)	7.7	21.6	0.9
Duluth (Lincoln Park)	9.1	36.3	1.0
Virginia	8.2	25.8	1.1
Silver Bay	7.9	21.0	1.0
BWCAW	5.0	22.0	0.5

‡Notes: The $PM_{2.5}$ annual standard is 15 ug/m^3. The 24-hour standard is 65 ug/m^3.
The data labeled "BWCAW" is from a site at the end of the Fernberg road for the years 1992 through 1997, which uses a slightly different sampling methodology (IMPROVE, 2000).

mechanical means, or a combination) will continue to advance toward climax successional stages, and understory seral species (shrubs and herbs) will decline or become more decadent. Coarse and fine scale landscape patterns will become more homogenous as succession advances. Ecosystem process and functions – like nutrient cycling, in which fire was historically a primary agent – will be affected.

In all ecosystems, under the appropriate conditions, wildland fires will occur regardless of past vegetative treatments. In addition, other factors such as weather, timing of ignition, species composition, age, fuel characteristics, and spatial distribution influence the severity, size, and duration of wildland fires. In general, vegetative treatments can affect species composition, age, and structure, which may reduce the severity, size, and duration of a wildland fire. Reducing or increasing the effects of wildland fire, as it relates to severity, size, and duration could be affected by vegetation treatments but is more likely to be affected by the appropriate conditions and factors that are present at the time of ignition.

Direct and Indirect Effects

Indicator 1 – Relative Fire Risk Index

Alternatives A and C

The direct and indirect impacts of Alternatives A and C on relative fire risk are small and long-term. The timber harvest in these alternatives creates the most amounts of acres that normally do not support wildland fire under normal weather patterns. The number and size of wildland fires would remain at or below historical averages (1920 to 2002) at the beginning of the first decade and throughout the planning period.

Alternatives B and D

The direct and indirect impacts of Alternatives B and D on relative fire risk are high and long-term. There is little timber harvest in these alternatives that allows a change in species composition and structure from a high fire hazard to a low fire hazard. By the end of the first decade and through the planning period, the number and, more significantly, the size of wildland fires would increase over historical averages (1920 to 2002) but not to the levels of pre-European settlement.

Alternatives E, F, and G

The direct and indirect impacts of Alternatives E, F, and G on relative fire risk are moderate and long-term. The amount of timber harvest is less than alternatives A and C, but more than B and D. The number and size of wildland fires would be at or slightly above historical averages (1920 to 2002) at the beginning of the first decade through the planning period.

Indicator 2 - Use of Management-Ignited Fire for Ecological Objectives

Alternatives A and C

The direct and indirect impacts of Alternatives A and C on the use of management-ignited fire for ecological objectives are small and long-term. Alternatives A and C produce the lowest number of acres available for management-ignited fire in the red pine and white pine landscape ecosystems. The continued lack of fire in these fire dependant ecosystems would contribute to the decline of these species and their associated ecosystems over the first decade and throughout the planning period.

Alternatives B and D

The direct and indirect impacts of Alternatives B and D on the use of management-ignited fire for ecological objectives are high and long-term. Alternatives B and D produce the highest number of acres available for management-ignited fire for ecological objectives. These alternatives produce the most amounts of red pine and white pine acres available for treatment with management-ignited fire. Mimicking natural disturbances by utilizing fire on a moderate scale (Alt B) and on a large scale (Alt D) would greatly contribute to the enhancement of these fire dependant species and their associated ecosystems over the first decade and throughout the planning period.

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Alternatives E, F, and G

The direct and indirect impacts of Alternatives E, F, and G on the use of management-ignited fire for ecological objectives are moderate and long-term. Alternatives E, F, and G produce a moderate amount of acres available for management-ignited fire for ecological objectives. Mimicking natural disturbances by utilizing fire on a small scale (Alts E and G) and on a moderate scale (Alt F) would somewhat contribute to the enhancement of these fire dependant species and their associated ecosystems over the first decade and throughout the planning period.
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Indicator 3 - Use of Management-ignited Fire for Hazardous Fuel Reduction

Alternatives A and C

The direct and indirect impacts of Alternatives A and C on the use of management-ignited fire for hazardous fuel reduction are small and long-term. Alternatives A and C produce the lowest number of acres for hazardous fuel reduction. The high amount of timber harvest in these alternatives allows for a very small percentage of acres available to be treated for hazardous fuels. The number and size of wildland fires would remain at or below historical averages (1920 – 2002) at the beginning of the first decade and throughout the planning period.

Alternatives B and D

The direct and indirect impacts of Alternatives B and D on the use of management-ignited fire for hazardous fuel reduction are high and long-term. Very little timber harvest in these alternatives creates a large opportunity to use management-ignited fire to treat hazardous fuels. By the end of the first decade and through the planning period, the number and, more significantly, the size of wildland fires would increase over historical averages (1920- 2002) but not to the levels of pre-European settlement.

Alternatives E, F, and G

The direct and indirect impacts of Alternatives E, F, and G on the use of management-ignited fire for hazardous fuel reduction are moderate and long-term. A moderate amount of timber harvest activity creates a moderate opportunity to use management-ignited fire to treat hazardous fuels. The number and size of wildland fires would be at or slightly above historical averages (1920 – 2002) by the end of the first decade and throughout the planning period.

Indicator 4 - Use of Management-ignited Fire for Site Preparation

Alternative C

The direct and indirect impacts of Alternative C on this indicator are small and long-term. Alternative C would produce the lowest number of acres available for the use of management-ignited fire for site preparation over the first decade and for the rest of the planning period. Methods other than fire (mechanical, etc) would be used most often to prepare the areas for reforestation or natural regeneration.

Alternatives A, B, E, and G

The direct and indirect impacts of Alternatives A, B, E, and G on the use of management-ignited fire for site preparation are moderate and long-term. Alternatives A, B, E, and G produce a moderate amount of acres available for the use of management-ignited fire for site preparation over the first decade and for the rest of the planning period. Methods other than fire (mechanical, etc) would be used more often to prepare the areas for reforestation or natural regeneration

Alternative F

The direct and indirect impacts of Alternative F on this indicator are high and long-term. Alternative F produces the highest number of acres available for the use of management-ignited fire for site preparation over the first decade and for the rest of the planning period. Other methods (mechanical, etc) than fire would also be used to prepare the areas for reforestation or natural regeneration

Alternative D

Alternative D has no acres that require site preparation so there are no direct and indirect impacts of Alternative D on this indicator.

Indicator 5 – Air Quality

An estimate of the amount of smoke generated under each alternative was generated as an aid in making comparisons between them regarding impacts to air quality. This indicator provides a consistent measure to gauge smoke impacts since the amounts of the different types of fires vary between alternatives and each type of fire has a different emission rate. The state of the art software, First Order Fire Effects Model, Version 5.0 (FOFEM5.0), was used to generate the emissions estimates. FOFEM5.0 is a computer program that was developed by the USDA Forest Service Intermountain Fire Sciences Laboratory (Missoula, Montana) to meet the needs of resource managers, planners, and analysts in predicting and planning for fire effects.

In general, Alternative C would have the lowest emissions of any of the alternatives in each decade The rest of the emission rates for other alternatives are from 6,000 to 8,000 tons per decade for the Chippewa and 15,000 to 22,000 tons per decade from the Superior (Refer to table FIR-5 and FIR-6). All of the emission rates are in the low to middle of the historic range of emissions for the BWCAW. For the Superior, the EIS analysis only included those lands outside the BWCAW, which is similar in area to the BWCAW). Therefore, not only the gross emissions level, but also the emission level per acre, is similar between the historical BWCAW assessment and the land outside it (as projected for this EIS) on the Superior. No historical emission estimates are available for the Chippewa.

As stated earlier, the historical emissions for the BWCAW does not include surface and other low intensity fires, making it a conservative (i.e. low) estimate of the total acres of fire and hence also a conservative estimate of the historical emissions. For the reasons described below, the level of emissions under any alternative cannot be directly related to health or visibility impacts because the airborne concentration of the emissions can not be determined at this time.

As suggested in the Interim Air Quality Policy on Wildland and Prescribed Fires (EPA 1998), the State of Minnesota has prepared a Smoke Management Plan. The goal of the plan is to ensure that burning takes place in such a way that impacts to air quality are minimized. All burns on the forest follow this plan. In addition, specific steps to address smoke management are included in the burn plans that are prepared for each burn. If smoke issues are identified in the burn plan process, smoke modeling or smoke monitoring may be implemented. Past experience on the forest with monitoring $PM_{2.5}$ from prescribed burning in the BWCAW has shown that the smoke can be managed such that the concentrations are generally below health standards.

The health and visibility impacts of wildland fire smoke ultimately depend on the concentration of smoke (airborne particulates in this analysis) in the air and not the amount of smoke generated from a certain area of land. To attempt to predict this would require translating the previous emissions estimates into ambient air concentrations. This step is impossible to do in a forest plan without having to make a myriad of assumptions due to the fact that a number of factors are site specific and cannot be known or predicted ahead of time. These assumptions include: length of time to ignite the unit, fuel moisture, fuel availability, atmospheric stability, wind direction and speed, the existence of other nearby fires, the size of the individual fires, when the burns are ignited, how many burns are ignited within a given time period, and the location of sensitive receptors. We believe the results produced by such an exercise to be arbitrary, of little use, and have virtually no relationship to the air quality impacts that will actually occur when the burns are actually carried out.

It is worth noting that the same amount of land that is burned at one time, under dry conditions (a wildfire, for example), can have a greater impact to air quality than burning the same amount of land in smaller parcels, under more moderate moisture conditions, spread over a longer period of time, (a number of smaller prescribed fires, for example), and with meteorology that gives good dispersion. Preventing wildfire and permitting prescribed fire can reduce emissions over the long term. This was shown in the "Boundary Waters Canoe Area Wilderness Fuel Treatment Environmental Impact Statement".

Cumulative Effects

Overall, when considering other past, present, and reasonably foreseeable future actions in the vicinity of

the Chippewa and Superior National Forests, none of the alternatives would be expected to result in adverse cumulative effects on any fire dependant ecosystem. A number of projects are currently in progress or are planned near the Chippewa and Superior National Forests on state, county, and private lands as well as Voyagers National Park and Quetico Provincial Park and Crown Lands in Canada. Ninety eight percent of these projects are using management-ignited fire for ecological objectives. The combined area of these projects that are on non-National Forest System lands amounts to approximately 188,000 acres (about 6.5% of the analysis area) over the next decade. When added to the total area of the non-Federal projects, the acreage of all areas proposed for treatment (maximum available acres) under the action alternatives would range from 7.8 percent (Alt C) to 8.5 percent (Alts D and F) of the total analysis area. This assessment is based on the size of the analysis area as a whole compared to the areas of burning likely from either management-ignited fire or wildland fires (future levels of wildland fire cannot be determined).

Air Quality

The Forest Service and all land management agencies must coordinate efforts and follow the Minnesota Smoke Management Plan. According to the EPA "Interim Air Quality Policy on Wildland and Prescribed Fires" (April 1998) "The purposes of Smoke Management Plans are to mitigate the nuisance and public safety hazards (e.g. on roadways and at airports) posed by smoke intrusions into populated areas; to prevent deterioration of air quality…and to address visibility impacts in mandatory Class I Federal areas" (EPA 1998). Therefore, by following the Smoke Management Plan, none of the alternatives would be expected to result in adverse cumulative effects on air quality.

Table FIR-5: Chippewa National Forest Emissions per Decade. (lb $PM_{2.5}$/acre)

Indicator	Alternative		A		B		C		D		E		F		G	
	Decade		1	2	1	2	1	2	1	2	1	2	1	2	1	2
	Exist. Cond		tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
#2. Ecological Objectives	Prescribed Fire	300	1,100	1,000	1,300	1,400	1,200	1,000	1,500	1,700	1,300	1,300	1,200	1,300	1,100	1,100
#3. Hazardous Fuels Reduction	Prescribed Fire	300	4,400	3,800	4,800	4,700	3,900	3,200	5,100	5,500	4,500	4,500	4,900	4,800	4,700	4,500
#4. Site Prep.	Prescribed Fire	768	1,200	1,200	1,100	1,100	400	300	0	0	1,000	1,200	2,000	2,200	1,000	1,000
Maximum Proposed Tons of $PM_{2.5}$			6,700	6,000	7,200	7,300	5,400	4,500	6,600	7,200	6,800	7,000	8,200	8,300	6,900	6,600

‡Tons rounded to the nearest one hundred.

Table FIR-6: Superior National Forest Emissions per Decade (lb $PM_{2.5}$/acre)

Indicator	Alternative		A		B		C		D		E		F		G	
	Decade		1	2	1	2	1	2	1	2	1	2	1	2	1	2
	Exist. Cond.		tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons	tons
#2. Ecological Objectives	Prescribed Fire	549	2,000	2,100	2,200	2,500	2,000	2,000	2,500	2,900	1,700	2,000	1,900	2,200	2,000	2,100
#3. Hazardous Fuels Reduction	Prescribed Fire	341	10,600	9,200	11,600	11,300	9,600	7,500	11,800	12,200	11,300	11,000	11,300	10,800	11,200	10,500
#4. Site Preparation	Prescribed Fire	961	3,000	3,400	3,000	3,400	800	800	0	0	3,200	3,600	7,300	9,100	3,400	3,900
Maximum Proposed Tons of $PM_{2.5}$			15,500	14,800	16,800	17,200	12,400	10,400	14,300	15,100	16,200	16,500	20,500	22,000	16,500	16,500

‡Tons rounded to the nearest one hundred.

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