FIRE AND FUELS

Key Points

- Monitoring results validated that the mitigations outlined in the (Boundary Waters Environmental Impact Statement) and implementation of burn plans was successful in protecting the soil organic layer, eagle nests, shoreline old forest, and interior old forest from impacts by prescribed fire.
- The frequency of fire in blowdown areas demonstrates the continued high fire risk of these fuels eight years following the 1999 windstorm. This risk is further enhanced by conifer succession, particularly increased balsam fir and spruce budworm infestations.

A. MONITORING AND EVALUATION

Forest Plan Direction

This monitoring was conducted to address Forest Plan Objective: O-ID-3 Treat areas of highest fire risk to minimize effects of unwanted wild land fire, Forest Plan Objective: O-ID-4 Reduce fuels and control vegetation in the under-story of stands that had naturally occurring low intensity surface fires and Forest Plan Objective: O-ID-2 Establish, maintain, or improve the condition of vegetation using prescribed fire, mechanical treatments, and other tools.

Monitoring Conducted

Wilderness Burn Units

There were no prescribed fires completed within the Boundary Waters Canoe Area Wilderness (BWCAW) during 2008. However, about 30 prescribed burn units were monitored during fiscal year (FY) 2008 that were burned during prior years, initially burned during the 2006 Cavity Lake wildfire or the spring 2007 Ham Lake wildfire and/or were re-burned during the wildfires (Wilderness chapter).

Fuel Reduction Accomplishments

Approximately 10,380 acres, within 25 projects outside the BWCAW, were treated to reduce fuels during FY 2008. Primary fuels projects were completed on 5,271 acres through prescribed burning, hand piling of downed fuels (dead wood) and burning of piles. An additional 5,109 acres were completed through integrated vegetation management projects (projects conducted to achieve multiple Forest Plan vegetation objectives besides fuel reduction) through various silvicultural treatments including timber harvest, thinning and site preparation.

5.2 Fire and Fuels

Fuel Assessment Monitoring

The effects of various vegetative/fuel treatments on fuel loadings over time were monitored within 25 treatment units. This was a continuation of the monitoring that was initiated in 2006. Various treatments including prescribed burns, clear cuts, commercial thins, patch clear cuts and shelter-wood harvests were documented and compared with one another. Plots were randomly selected within treatment areas. Fuels data was collected using Brown's transects to measure fuel loadings in tons/acre along with fuel and duff depth in inches. Stocking surveys were completed using $1/300^{th}$ of an acre plot for seedlings and $1/100^{th}$ of an acre plot for saplings. This monitoring will continue during 2009 and the conclusions will be included in the FY 2009 Monitoring and Evaluation (M&E) report.

Wildfires

There were 41 wildfires during FY 2008. The smallest fire was one-tenth of an acre, the largest was 20 acres, and the average area burned was one acre.

Fire plays a critical role in wildlands by recycling nutrients, regenerating plants and reducing high concentrations of fuels that contribute to disastrous wildland fires. Land managers recognize the role that wildland fire plays in ecosystems and can manage naturally occurring fires, such as lightning ignitions, to benefit the resource. The Superior National Forest (SNF) did not manage any wildland fires to benefit the resource during FY 2008. Table 5.1 displays FY 2008 fires, the number of acres burned, and the time of year the fires occurred for those one acre or larger. Table 5.2 shows wildfire occurrence on the SNF during the past five years.

Fire Effects in the Wilderness

Fire effects were monitored and evaluated within 30 prescribed burn units that were initially burned or re-burned during the 2006 Cavity Lake and 2007 Ham Lake wildfires (Figure 5.1). The intent of this monitoring was to validate how effective previous years prescribed burning was. The following goals were considered: 1) preventing or minimizing blowdown wildfires from exiting the wilderness and threatening life and property and 2) protecting wilderness resources through effective implementation of mitigation measures. Fuel reduction including anticipated treatment duration effectiveness, effects on the soil organic layer, fire severity, vegetative succession including conifer establishment and effects on old forest shoreline and interior forest were all measured. The conclusions from the analysis of these data will provide managers with insight on fire effects of future wildfires and prescribed fires.

Wildfire Risk Assessment

Data collection to assess fire risk in terms of fuel loading (tons of down fuel per acre) and ladder fuels (fuels that can carry a ground fire into the forest canopy) within unburned blowdown monitoring plots was accomplished within 11 burn units during 2006, 2007, and 2008. The information that was collected included vegetative succession, including conifer establishment, and fuel loading in tons per acre. This information provides managers with knowledge on the current probability of ignition and the expected burn

intensity and severity resulting from a wildfire. All of the plots visited were scheduled to be burned to reduce the wildfire hazard.

Evaluation and Conclusions

Wilderness Burn Units

Prescribed burning accomplished the purpose and need of the Boundary Waters Environmental Impact Statement (BWEIS) Fuel Treatment, which was to prevent or minimize the escape of wildfires into non-wilderness areas while protecting or maintaining wilderness values. Monitoring of prescribed fires and wildfires by the SNF reaffirmed conclusions reached by the Fire Behavior Assessment Team (Fites et al. 2007) and the Remote Sensing Application Center (RSAC) (Clark & Schwind 2009). The following conclusions were drawn from this collaborative effort.

Fuel Reduction Comparisons

The greatest fuel reduction occurred within both the prescribed burns and late summer Cavity Lake wildfire re-burned plots (58% fuel reduction). The spring Ham Lake Fire plots showed the least amount of fuel reduction (30%) (Figure 5.2). However within three to five years following the prescribed burns, fuel loading increased from 29 tons per acre to 39 tons per acre (34% increase) due to snags falling into the plot over time.

Prescribed Fire Fuel Reduction Influence on Fire Behavior and Fire Suppression

Within the Ham Lake wildfire area, there was evidence of less intense and lower severity fire behavior where previous fuel reduction treatments had been completed according to some sources of information. These same areas were utilized during suppression along several flanks of the fire which constrained its eastward progression endangering houses. Within the Cavity Lake wildfire area, the fire extinguished itself and was readily suppressed with direct attack in sections that had been previously treated with a prescribed burn. Those sections were concentrated on the west portion of the Gunflint Trail wildland urban interface (WUI), which again constrained the fire from endangering houses. In both fires, previous fuel reduction treatment areas modified fire behavior. Fire behavior was less extreme in the Cavity Lake wildfire area in the summer than in the Ham Lake wildfire area in early spring.

Wildfire Effects on Soils

The Cavity Lake wildfire reduced the soil organic layer by 85 percent while prescribed burning reduced the soil organic layer by 50 percent, on average. The Ham Lake wildfire plots showed the least loss of the soil organic layer (30%) (Figure 5.3)

Burn Severity

Approximately two-thirds of the prescribed burn plots were of moderate severity while two-thirds of the Cavity Lake wildfire plots were high severity. Within the Ham Lake wildfire, one-half of the plots were low severity and one-half were moderate severity.

Conifer Abundance (Post Burn)
All conifers were substantially reduced in both wildfires and prescribed burning. However balsam fir cover was reduced the least on the Ham Lake wildfire and red and white pine was reduced the least during prescribed burning.

Post Blowdown (Not Burned)
Balsam fir cover remained at 15 percent while white pine cover remained at three to four percent ten years after the blowdown that occurred in 1999. Red and jack pine disappeared from plots between the fifth and 10th years after the blowdown.

Mitigation Effectiveness
Mitigation practices were effective in protecting soils along with both shoreline and interior old forest. Over one-half (56%) of the shoreline old forest (primarily white cedar and pine) survived prescribed burning due to pre-wetting and selective lighting (Figure 5.4). Both interior and shoreline old forest survival was much greater in the prescribed burns when compared to adjacent wildfires. Therefore, mitigation practices were successful in protecting eagle nests found within or adjacent to the burn units.

Wildfire Risk Assessment
No Forest Plan objectives or projected desired conditions exist for wildfire acreage. However, active wildfire behavior observed during 2006 and 2007 demonstrates the continued high fire risk of blowdown fuels eight years following the 1999 windstorm. This elevated risk is further enhanced by conifer succession, particularly increased balsam fir and spruce budworm infestations. Monitoring of unburned blowdown plots in the BWCAW, that were intended for prescribed burn treatments showed an elevated fire risk. Balsam fir cover remained at a minimum of 15 percent ten years after the blowdown (Figure 5.5).

B. REFERENCES

Clark, J. and B. Schwind. 2009. Burn severity in Ham Lake and Cavity Lake Fires. USFS Remote Sensing Applications Center (RSAC).

Fites, J., A. Reiner, M. Campbell, and Z. Taylor. 2007. Fire behavior and effects, suppression, and fuel treatments on the Ham Lake and Cavity Lake Fires.

Table 5.1. Wildfires occurring on the Superior National Forest during fiscal year 2008 that were one acre or larger in size.

Fire Name	Acres Burned	Time of Year
North Myrtle Lake	20.0	May
Oberg Rd	4.0	May
Van Vac	8.6	May
North Brule	1.0	August
Bridal Falls	1.0	September

Table 5.2. Total acres of wildfire on the Superior National Forest during the past five years shown by reason for ignition.

Cause	2004	2005	2006	2007	2008	5-Year Average
Lightning	9	20	39,970	16.2	22	8,007*
Equipment	1	0	7	0	0	2
Smoking	0	3	1	0	0	1
Campfire	7	22	9	75,500	2	15,108**
Debris Burning	7	6	2	1.3	13	6
Railroad	6	0	3	0	0	2
Arson	0	3	0	0	0	1
Children	3	4	2	0	1	2
Misc.	9	5	3	0.6	4	4
TOTALS	42	61	42,003	74,518	42	

*Includes the large 2006 acreage burned. **Includes the large 2007 acreage burned.

Figure 5.1. Immediately following a prescribed burn on the Superior National Forest.

Figure 5.2. Fuel reduction within burn plots in the Boundary Waters Canoe Area Wilderness.

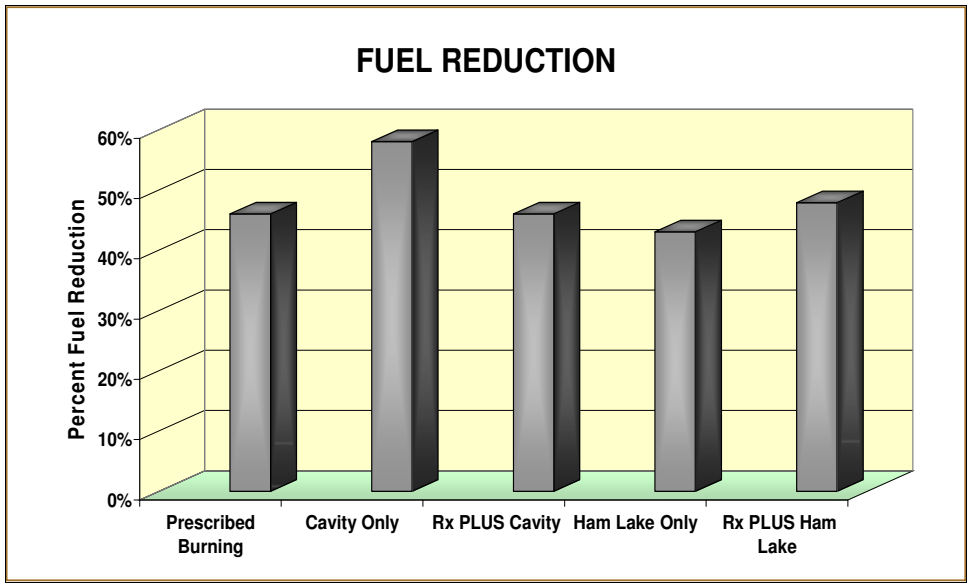

Figure 5.3. Soil organic layer reduction in burn plots within the Boundary Waters Canoe Area Wilderness.

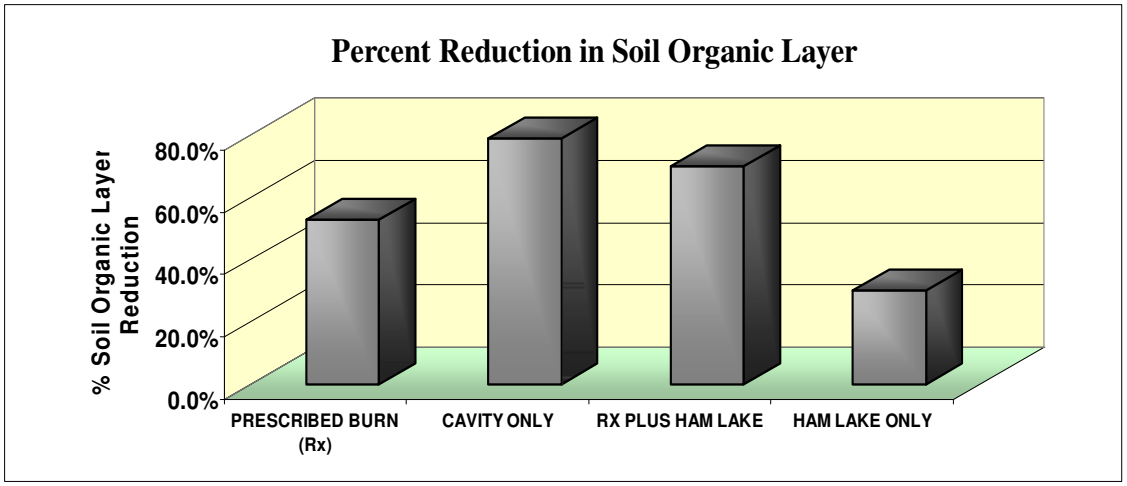

Figure 5.4.Aerial images taken after a prescribed burn in the Boundary Waters Canoe Areas Wilderness showing the survival of shoreline old forest due to effective mitigation.

Figure 5.5. Change in conifer abundance following the 1999 blowdown in the Boundary Waters Canoe Area Wilderness.