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SUMMARY FOR BRITTLE LANDSCAPE FUELS REDUCTION PROJECT

Huron Shores Ranger Station, Huron-Manistee National Forests

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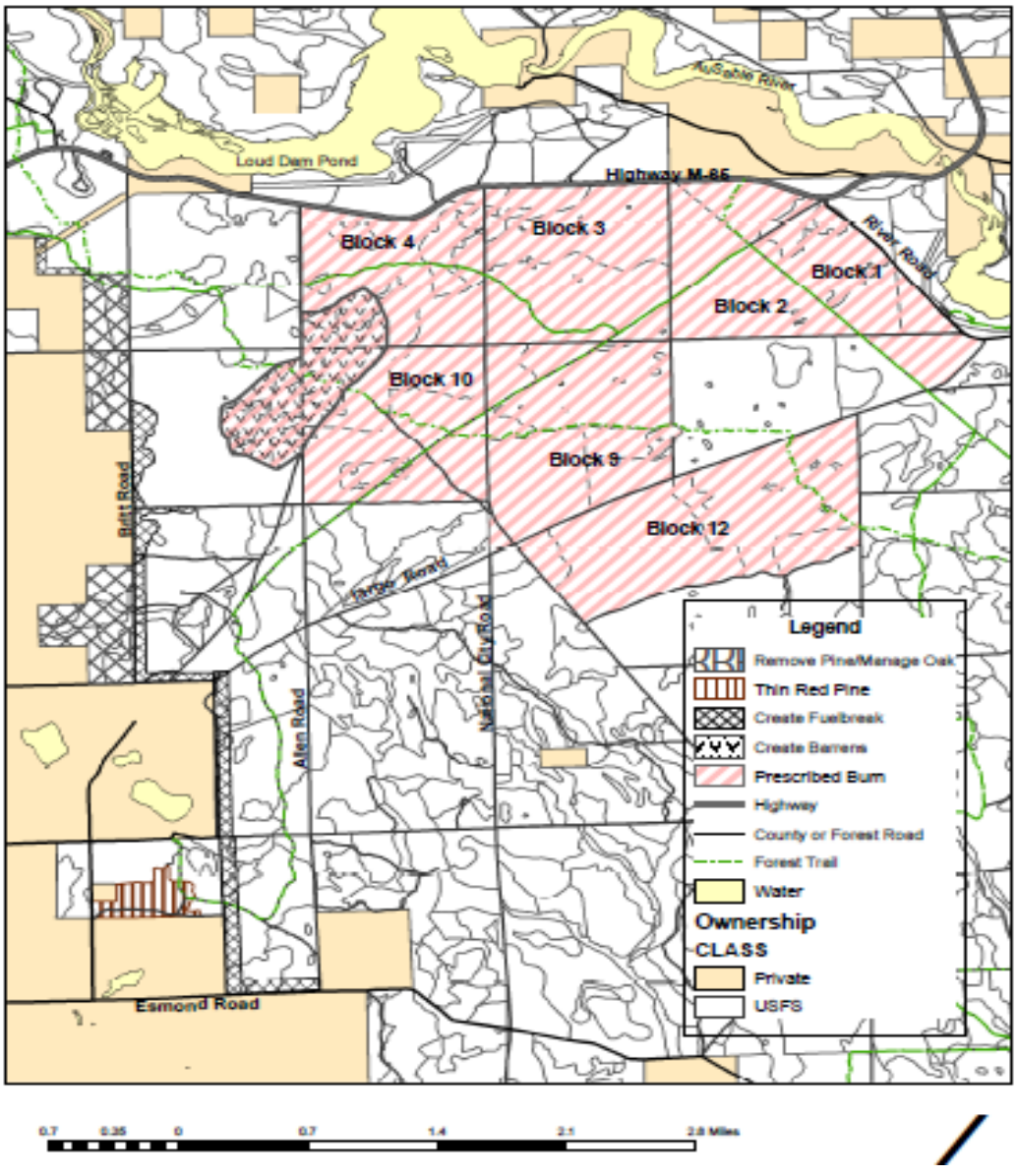
Purpose

The purpose of this document is to summarize all of the fuels monitoring for the Brittle Fuels Reduction Project on the Tawas District (Huron Shores Ranger Station) of the Huron-Manistee National Forests in Michigan. The Brittle Fuels Reduction Project was developed to reduce forest fuels and restore ecological condition class at a landscape level through use of low to moderate intensity prescribed fire. Approximately 4,323 acres of forest lands would be prescribed burned in burning units ranging in size from about 350 to 815 acres, over a period of approximately five years.

Project Location and Project Area Description

The project is located in Iosco County, in all or portions of T23N R5E, Sections 1 and 13, T23N R6E, Sections 3, 4, 6, 7, and 18, T24N R5E, Sections 25 and 36, (Plainfield Township) and T24N R6E, Sections 26 through 35, (Oscoda Township).

Brittle Fuels Reduction Project



Goals and Objectives

The goals for the Brittle Fuels Reduction Project are established in the documents that analyze the environmental impacts based on the National Environmental Policy Act (NEPA). These documents are based on the goals and objectives of the Forest Plan and the Forest Fire and Aviation Plan. The Brittle Fuels Reduction Project addresses the purpose and need for action, and accomplishes the following *Forests' Plan* and *National Fire Plan* objectives:

I. Improve Fire Prevention and Suppression *(Comprehensive Strategy – Goal 1)* and Reduce Hazardous Fuels *(Comprehensive Strategy – Goal 2).* Provide for the protection of National Forest System lands and for the property and safety of users. Base fire prevention and pre-suppression activities on past fire occurrence, fire intensities, and values at risk. Implement fuels reduction and fuelbreak projects where conditions warrant for the protection of life, property, and safety. Emphasize hazardous fuels treatment in wildland-urban interface and intermix areas (Forests' Plan II-3, III-4.4-3).

II. Restore Fire-Adapted Ecosystems *(Comprehensive Strategy – Goal 3).* Restore and maintain savannahs, prairies, dry grasslands, shrub/scrub and oak-pine barrens in areas where they were known to previously occur, to provide for habitat diversity and to meet species viability needs. Utilize prescribed fire to meet management direction as appropriate for the ecosystems involved. Provide ecological condition class restoration and fuel hazard reduction based on ecosystem health. Use prescribed fire to mimic natural processes to accomplish resource benefit objectives (Forests' Plan II-3, II-4).

III. Promote Community Assistance *(Comprehensive Stategy – Goal 4).* Encourage adequate fire prevention, fire-safe construction and presuppression activities on private lands in wildland/urban interface fire prone areas. Use a combination of personal contacts, brochures, maps, and informational signing to inform and educate users about forest mangement (Forests' Plan II-3, II-4).

IV. Measure and Monitor Outcomes *(Comprehensive Strategy – Guiding Principle).* Monitor and evaluate effectiveness of management practices (Forests' Plan II-4). Conduct monitoring of selected projects and evaluate the effectiveness of management activities. Monitor performance and outcomes and utilize results to inform future decisions (Comprehensive Strategy – Guiding Principle).

The objectives of the projects are:

- Provide for firefighter and public safety.
- Provide training opportunities for firefighters.
- Utilize prescribed fire to reduce fuel loading in forested stands within the project area.
- Reduce needle cast by no less than 15% but no more than 95%. Acceptable fuel loading reduction ranges by category are:
- 10 hr fuels - (5 - 100%)
- 100 hr fuels (0 - 85%)
- 1000 hr fuels (0 - 50%)
- Fuel reduction in piles may reach 100%

Project Considerations

a) Prescribed burns would not be conducted (May 1 to July 15) on any major holiday week-end, or during the peak growing season in Land Suitability Class (LSC) 500 stands.

Ground based or aerial ignition may be used, with the firing pattern selected to meet the following Rx burning objectives. An approved aerial ignition plan would be required if aerial ignition is used.

b) Isolated, short runs in the crowns of residual trees are acceptable if they occur in the interior of the Prescribed (Rx) burn. Fuels may be arranged prior to ignition to increase intensity to accomplish wildlife objectives (snag creation) within the interior.

c) In LSC 500 stands, overall mortality should not lower the residual stand to below B-level stocking in live, commercial trees qualifying as acceptable. If stocking falls below B-level, subsequent burning would be postponed until the stand recovers to B-level.

d) Prescribed burns would not be conducted with a wind direction that would produce smoke that would be a hazard to visibility on heavily used travel corridors. Heavy smoke should be avoided across M-65 and River Road.

e) To reduce impacts to soils to acceptable limits, no more than 9% of the project area would be severely burned. Up to 80% of the remaining area may be moderately or lightly burned. Severely burned areas are characterized by white ash. These are generally areas where heavy fuels were accumulated and burned (i.e. piles). In a moderately burned area, most of the litter is charred but not ashed (GTR - WO-7, 1979).

Typical PreBurn Site Conditions

The burn units are approximately 91% forested, consist of 98% ground cover, are almost entirely comprised of dry sandy plains, and major precipitation events occur when soils are frost-free. The onsite conditions are favorable for good water infiltration and sub-surface percolation. Overall, the watershed condition within the project areas is satisfactory due to the presence of forest canopy and litter cover over most of the area. Average age of the overstory is 50-70 years, and is comprises of red pine (P*inus resinosa*), northern pin oak (*Quercus ellipsoidalis*), and some jack pine (P*inus banksiana*). Surface fuels are comprised primarily of Pennsylvania sedge (*Carex pensylvanica*), grasses, blueberry, and needle cast.

Table 1: FCCS Run for Brittle Landscape Fuels Reduction for Typical Red Pine Fuels

CANOPY - TREES

Input variable	All trees	Trees - overstory	Trees - midstory	Trees - understory
Total percent cover (%)	95.0 (75.0 / 99.0)	65.0 (5.0 / 85.0)	45.0 (12.00 / 75.0)	25.0 (10.0 / 65.0)
Height (ft)		35.0 (24.0 / 65.0)	14.8 (20.0 / 45.0)	5.0 (2.0 / 12.0)
Height to live crown (ft)		10.2 (8.0 / 28.0)	4.6 (3.0 / 15.0)	0.8 (1.00 / 4.0)
Density (#/acre)		89.0 (17.0 / 110.0)	23.0 (7.0 / 70.0)	19.0 (7.0 / 45.0)
Dbh (in)		10.5 (8.0 / 18.0)	5.1 (3.0 / 12.0)	2.2 (1.00 / 6.0)
Species (relative cover %)		Pinus resinosa (65.00) Pinus banksiana (15) Quercus ellipsoidalis (20)	Pinus banksiana (15) Quercus ellipsoidalis (26.00) Prunus pensylvanica (10) Pinus resinosa (49.00)	Pinus banksiana (20) Quercus ellipsoidalis (45) Pinus resinosa (35)

CANOPY - SNAGS

Input Variable	Snags - class 1 with foliage	Snags - class 1 without foliage	Snags - class 2	Snags - class 3
Height (ft)			27.0 (20.0 / 60.0)	
Density (#/acre)			11.0 (0.0 / 35.0)	
Dbh (in)			7.0 (5.0 / 16.00)	
Species (relative cover %)			Pinus resinosa (50.00) Pinus resinosa (50.00)	

CANOPY - LADDER FUELS

Input variable	Ladder fuels
Minimum height (ft)	0.5 (0.50 / 10.00)
Maximum height (ft)	11.0 (2.00 / 60.00)
Is there a vertical continuity between canopy and lower strata?	No
Ladder fuel type	11

SHRUBS - NEEDLE DRAPE

Input variable	Shrubs - needle drapes
Is needle drape sufficient to affect fire behavior?	No

SHRUBS AND NONWOODY FUELS

Input variable	Shrub - primary layer	Shrub - secondary layer	Nonwoody fuels - primary layer	Nonwoody fuels - secondary layer
Percent cover (%)	80.0 (5.00 /80.00)		66.0 (20.00 /65.00)	
Height (ft)	0.5 (0.2 / 1.0)		1.0 (1.00 / 6.00)	
Percent live (%)	75.0 (60.00 /80.00)		58.0 (65.00 /100.00)	
Loading (tons/acre)			0.4 (0.00 / 2.00)	
Species (relative cover %)	Vaccinium angustifolium (70.00) Vaccinium corymbosum (30.00)		Carex pensylvanica (60.00) Maianthemum canadense (20.00) Schizachyrium scoparium var. scoparium (20.00)	

WOODY FUELS - ALL DOWNED AND DEAD WOODY FUELS

Input variable	All downed and dead woody fuel
Depth (in)	1.6 (0.50 / 24.00)
Total percent cover (%)	29.0 (5.00 /80.00)

WOODY FUELS - SOUND AND ROTTEN WOODY FUELS

Input variable	Sound wood	Rotten Wood
0 - 1/4 inches (tons/acre)	0.0	N/A
1/4 - 1 inches loading (tons/acre)	0.1	N/A
1 - 3 inches loading (tons/acre)	0.2	N/A
3 - 9 inches loading (tons/acre)	2.0	2.9
9 - 20 inches loading (tons/acre)	0.1	0.1
> > 20 inches loading (tons/acre)	0.0	0.0
Species (relative cover %)	Pinus resinosa (70.00) Quercus ellipsoidalis (20.00) Pinus banksiana (10.0)	Pinus resinosa (60.00) Pinus banksiana (20.00) Quercus ellipsoidalis (20)

LITTER LICHEN MOSS

Input variable	Litter	Lichen	Moss
Depth (in)	1.69 (0.60 / 1.00)	0.50 (0.20 / 1.50)	1.30 (0.20 / 2.10)
Percent Cover (%)	93.0 (60.00 / 90.00)	5.00 (1.00 / 10.00)	20.00 (10.00 / 30.00)
Litter arrangement/moss type	Normal	N/A	Other moss (e.g., feathermoss)
Litter type (relative cover %)	Long needle pine 70.00 Other conifer 24.00 Broadleaf deciduous 5.00 Grass 1.00		

GROUND FUELS - DUFF

Input variable	Duff	Upper duff	Lower Duff
Percent Rotten	5.00 (0.00 / 10.00)	N/A	N/A
Depth (in)	N/A	1.04 (0.0 / 2.25)	0.08 (0.25 / 2.0)
Percent Cover (%)	N/A	90.0 (60.00 / 90.00)	85.00 (60.00 / 90.00)
Derivation	N/A	Partially decomposed dead moss and litter	Fully decomposed dead moss and litter

Fire Behavior

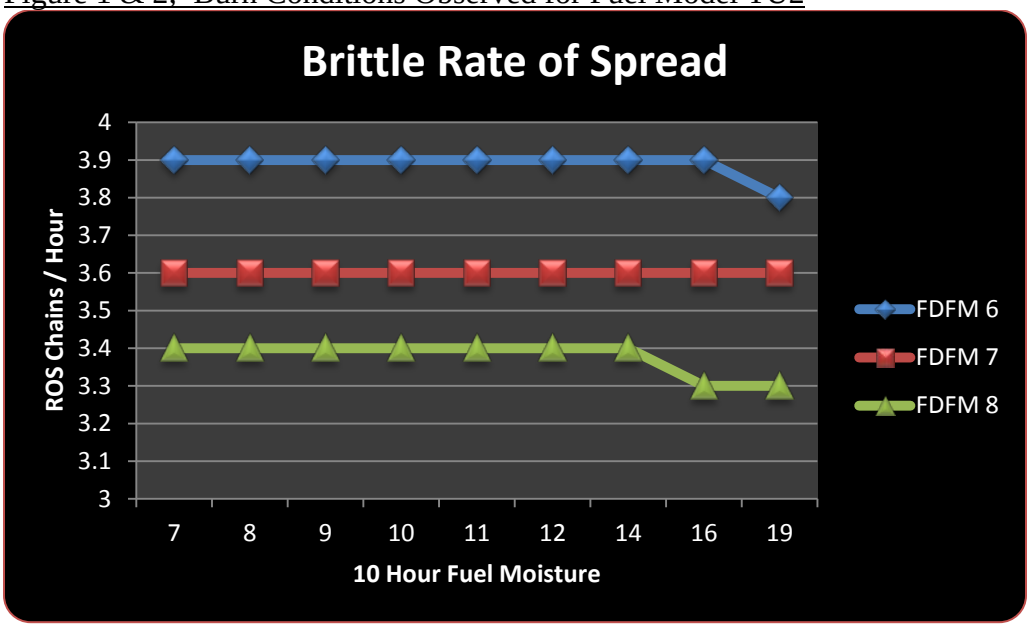
The pre-burn primary fuel models are the standard TU2, TL9, SB2, and TL6 with the main fuel being grasses, sedges, blueberry, and needle cast. In Brittle burn blocks 3, 4, 9, and 10 accumulations of slash (typically 12' X 12') from logging activities may be present. The pockets of slash (SB2) increased fire behavior within those areas. TL9- Areas of red pine trees with needle cast – Fine fuel load is an average of 16 tons / acre, 1-3" diameter coarse woody fuels have an average depth of 2'. TU2- Timber understory red pine and northern pin oak, fuel bed has a moderate load with blueberry component and best represents any open area such a pine or oak barrens. TL6- Areas of oak and aspen, they have low to moderate fuel loading. TL8- this model best depicts areas that have already received a prescribed fire treatment. TL8 has low to moderate fuel loading including herbaceous fuels, with moderate rates of spread and low flame length. Table 2 depicts the change in fuels that was measured before and after prescribed burning was implemented on the Brittle Landscape Fuels Reduction Project.

Table 2: Fire Behavior for Brittle Landscape Fuels Reduction

	Red Pine		Opening		Slash		Aspen	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
Fuel Model	TL9	TL8	TU2	TU2	SB2	TL8	TL6	TL5
Reaction Intensity (BTU/ft²/sec)	75	34	80	80	113	34	19	12
Flame Length (ft)	3.3	2.3	3.4	3.4	4.0	2.3	1.8	1.4
Rate of Spread (ch/h)	3.9	2.6	10.7	10.7	6.2	2.6	2.4	1.9

Figure 1 and 2 depict the observed fires behavior (flame length & rate of spread) based on fine dead fuel moisture. The Behave runs used the maximum wind speed observed on every burn of 8mph.

Figure 1 & 2; Burn Conditions Observed for Fuel Model TU2



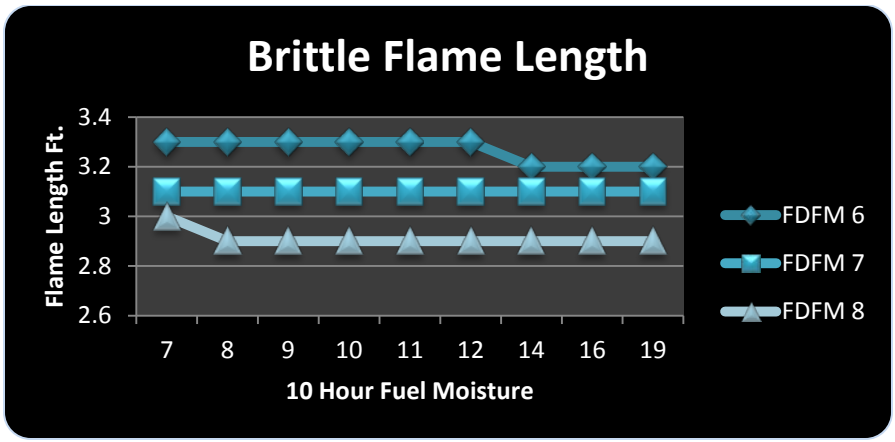


Table 3; Observed Weather for Each Burn Entry

DATE	Burn Name	Day of Last Rain	Temp (F)	Rh %	Wind Spd (mph)	Wind Dir	Acres
4/24/2007	Brittle Block 12	4/23/07 (1)	47-64	24-39	0--7	NW / SE, S	814
4/17/2008	Brittle Block 9	04/12/08 (5)	68-64	30-33%	1 to 8	SW to E	694
4/17/2008	Brittle Block 3	04/12/08 (5)	64-59	33-38%	1 to 8	E	648
4/28/2009	Brittle Block 1	04/28/09 (0)	55-57	45-47%	3 to 8	ENE	318
4/28/2009	Brittle Block 2	04/28/09 (0)	55-57	45-47%	3 to 8	ENE	448
4/18/2010	Brittle Block 4	4/15/2012(2)	49-53	46-55	1 to 3	NNW	637
4/18/2010	Brittle Block 10	4/15/2012(2)	53-54	43-44	1 to 5	N - NNW	382
8/16/2012	Brittle Block 1	8/13/2012(2)	80-83	40-45	2 to 5	NW	318
8/16/2012	Brittle Block 2	8/13/2012(2)	80-83	40-45	2 to 5	NW	448

Fuels Monitoring

Huron Zone fuels / fire monitoring begins with pre-burn Brown's transects and photo plots to determine the baseline fuel loading. The number of plots is based on acreage, and the locations of the plots are generated randomly. The method of collecting the data is standardized and is outlined in "Huron Shores Downed Woody Debris / Fire Effects Monitoring Plots Handbook". This handbook is designed as a quick reference for fire effects monitoring protocol on the Huron-Manistee. The sampling design is based on James K. Brown's "Handbook for Inventorying Downed Woody Material" (GTR-INT16, 1974), the National Park Service's "Fire Effects Monitoring Handbook." The averages (in tons / acre) for the fuels monitoring beginning in 2007 are summarized in Table 4.

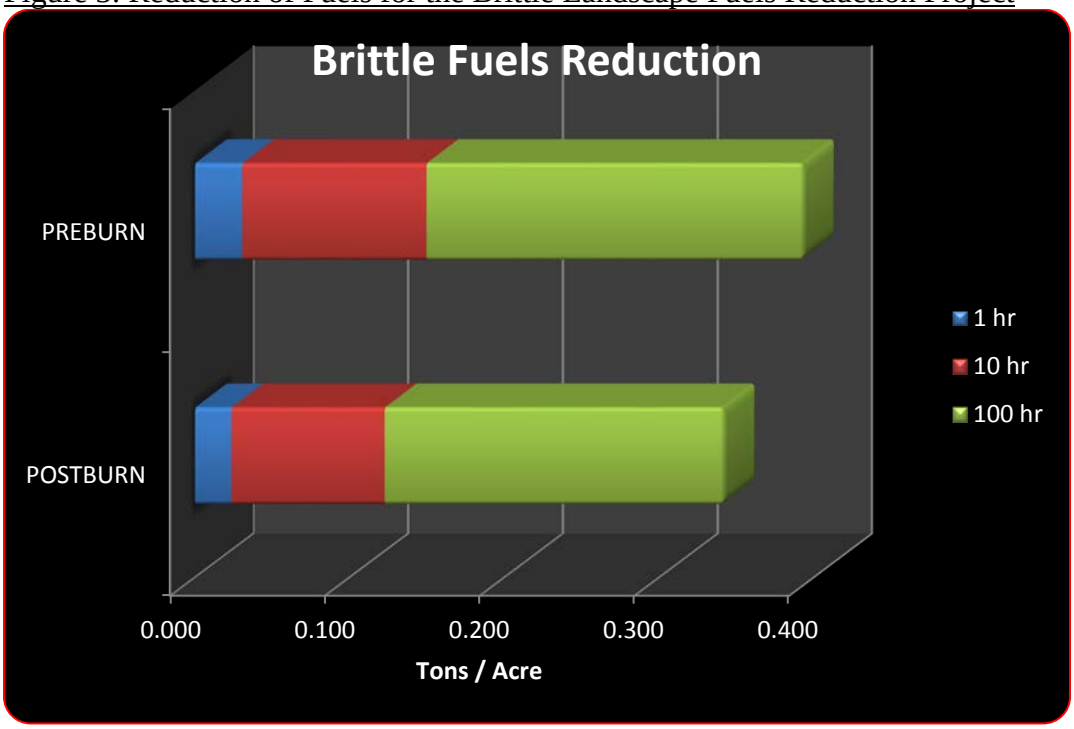
Duff and litter depth have been identified as a primary measure for identifying the appropriate time to return fire to a project area. Monitoring these factors will help ensure

that the sandy soils are not damaged. Table 4 shows the average pre-burn and post-burn fuel loading / duff & litter depths.

Table 4; Average Pre-Burn / Post-Burn Fuel Loading in Tons / Acre

PREBURN					POSTBURN			
Block #	BLK 4	BLK 10	Average		Block #	BLK 4	BLK 10	Average
1 hr	**0.029**	**0.032**	0.031		**1 hr**	**0.029**	**0.018**	0.024
10 hr	**0.119**	**0.119**	0.119		**10 hr**	**0.119**	**0.079**	0.099
100 hr	**0.216**	**0.271**	0.244		**100 hr**	**0.216**	**0.222**	0.219
1000 hr Solid	**0.549**	**3.428**	1.989		**1000 hr Solid**	**0.476**	**2.746**	1.611
1000 hr Rotten	**1.796**	**4.078**	2.937		**1000 hr Rotten**	**1.598**	**2.423**	2.011
Litter loading	**7.297**	**9.035**	**8.166**		**Litter loading**	**1.992**	**1.485**	**1.739**
Duff loading	**6.882**	**11.426**	9.154		**Duff loading**	**4.206**	**8.475**	6.341
Litter depth	1.54	1.84	1.69		**Litter depth**	0.35	0.30	0.32
Duff depth	0.84	1.23	1.04		**Duff depth**	0.50	0.92	0.71

Figure 3: Reduction of Fuels for the Brittle Landscape Fuels Reduction Project



The reduction of fuels in the various strata of the Brittle Landscape Fuels Reduction Project has been calculated in Consume v3.0 based on the data collected for the project.

Table 5. Summary of Consumption Results for Brittle

Summary of Consumption Results

1/30/2011

Name	Area (acres)	Pre-burn Loading (tons/acre)	Consumption (tons)	Consumption (tons/acre)
Project Brittle Landscape	4,323	40.23	72,917.42	16.87
- Canopy		13.27	10,976.55	2.54
- Shrub		4.14	1,750.60	0.40
- Nonwoody		0.37	1,483.10	0.34
- Woody		6.72	18,853.88	4.36
- Piles		0.00	0.00	0.00
- Litter, Lichen & Moss		4.73	20,428.95	4.73
- Ground Fuels		11.00	19,424.33	4.49

Fire Effects Monitoring

During the implementation of the prescribed burn the burn boss typically designates someone to monitor and record the fire behavior and on-site weather. The method for monitoring typically includes measuring flame length, flame height, rate of spread, smoke volume, all weather parameters, and photos of fire behavior. A post-burn evaluation is then completed within 5 days of the prescribed burn to document the results. A summary of the observations for the prescribed burns covered in this review are shown in Table 3.

Figure 4. Fire Behavior Photos

Fire behavior from aerial ignition Timber Litter 9 (TL9). Flame leigth 2.5’	Fire behavior from aerial ignition Slash Model 2 (SB2). Flame Leigth 7’
	

5’ post

Table 6. Fire Behavior Burn Day Data.

DATE	Burn Name	F.L. (ft)	R.O.S (ft/min)	Acres
4/24/2007	Brittle Block 12	0.5--8	1--2	814
4/17/2008	Brittle Block 9	2-8 (50')	1 to 2	694
4/17/2008	Brittle Block 3	2 to 6	1 to 2	648
4/28/2009	Brittle Block 1	1 to 4	0.5 to 1	318
4/28/2009	Brittle Block 2	1 to 4	0.5 to 1	448
4/18/2010	Brittle Block 4	1 to 7	.5-1	637
4/18/2010	Brittle Block 10	1 to 7	.5-.8	382
8/16/2012	Brittle Block 1	1 to 3	0.5 to 1	318
8/16/2012	Brittle Block 2	1 to 3	0.5 to 1	448

The focus of the burn day observations (Table 6) is to help provide a better understanding of fire behavior for understory burning of red pine (P*inus resinosa*) stands. This summary covers data from landscape burning of 4,323 acres of red pine understory prescribed burning in 5 burn entries. This data has highlighted the importance of "days since last rain" when burning red pine occurring on sandy soils. The best burn results occur within 1 to 5 days since the last significant rain. Fire typically begins to burn up the bark and into the crowns after 7 days since last rain. The data has also highlighted a range of desired temperatures of 40-75°, relative humidity between 30-45%, and wind speeds of 5-12 mph, however satisfactory results have been obtained outside of these desired conditions. Burn prescriptions are typically allowed a greater range from these parameters when writing burn prescriptions.

Table 7. Summary of the Heat Release for Brittle.

Summary of Heat Release Results

1/30/2011

Name	Area (ft2)	Heat Release (btu)	(btu/ft2)
Project Brittle Landscape	188,309,880	1,166,678,666,384	6,195.53
- Canopy		175,624,873,227	932.64
- Shrub		28,009,634,239	148.74
- Non woody		23,729,569,280	126.01
- Woody		301,662,020,501	1,601.94
- Litter, Lichen & Moss		326,863,278,240	1,735.77
- Ground Fuels		310,789,290,897	1,650.41

Figure 5. Pre-Burn Fuels Map

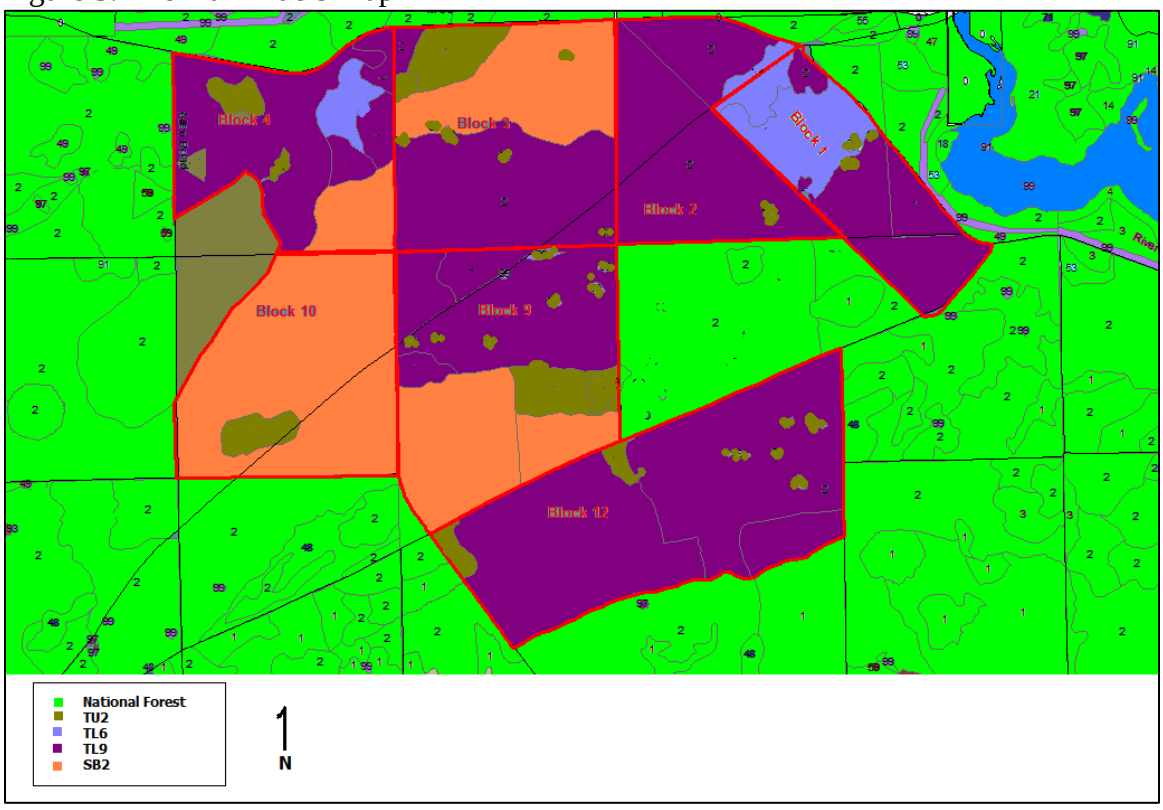


Figure 6. Post-Burn Fuels Map

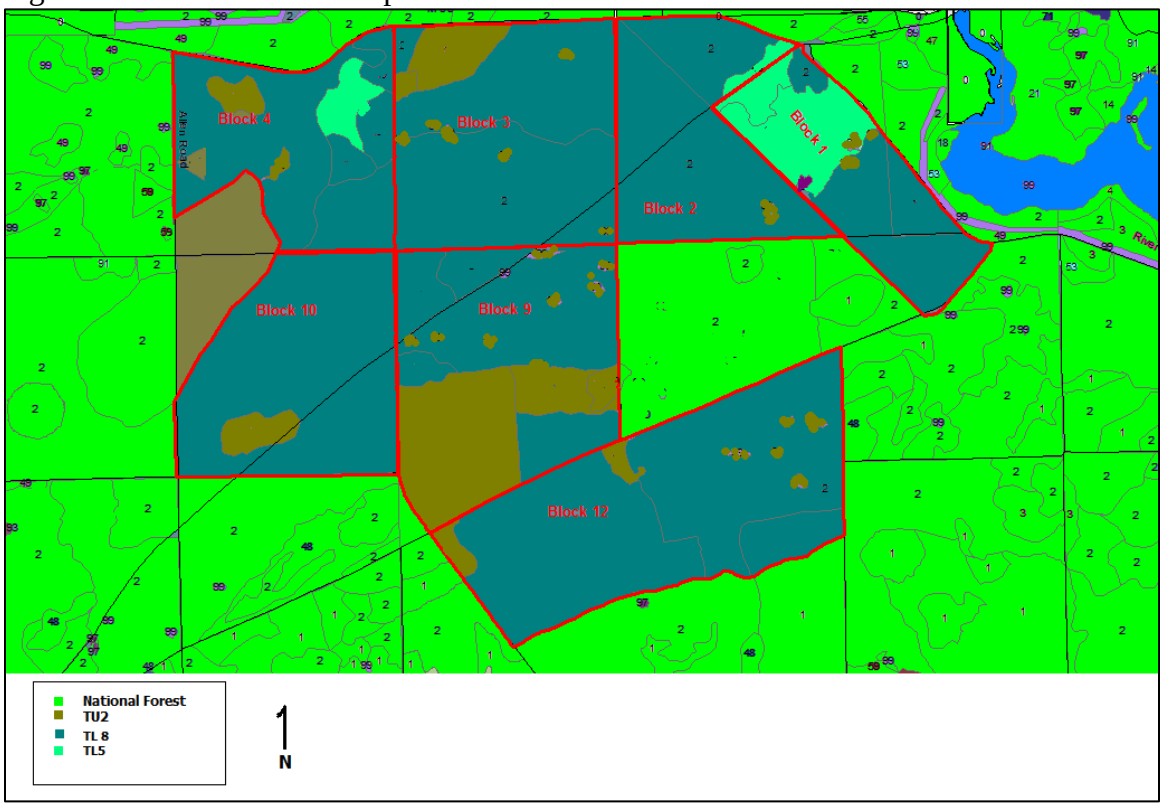


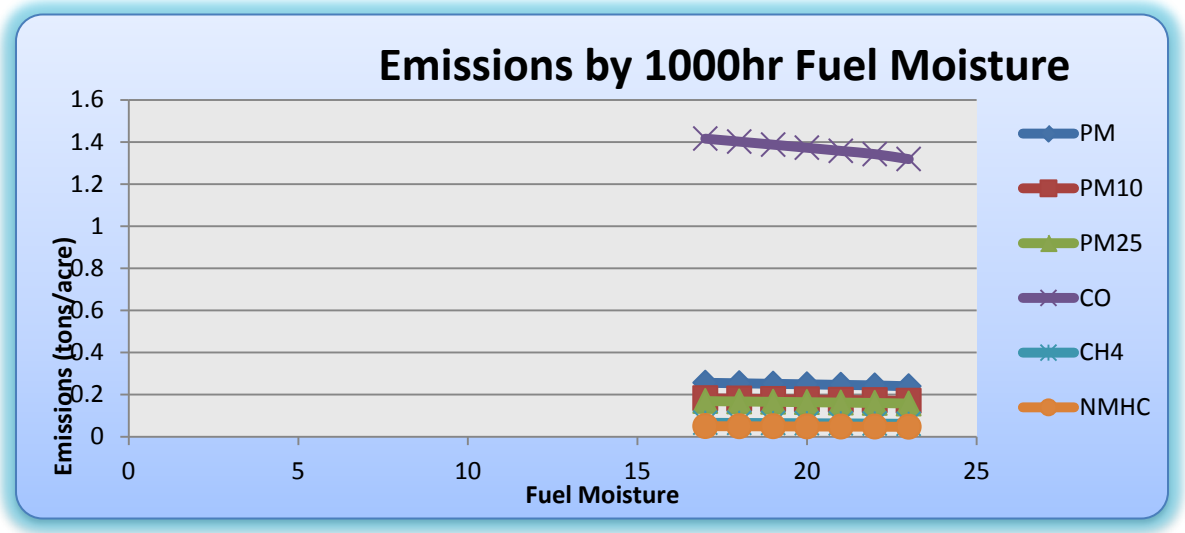
Table 8. Fuel Potential for Brittle (Pre and Post-Burn)

Fuel bed	Fuel Model	Surface Fire Potential (1-9)	Crown Fire Initiation Potential (1-9)	Available Fuel Potential (1-9)	FCCS Fire Potential Code
Opening in Brittle Pre-burn	TU2	5	6.5	4	534
Opening in Brittle Post-burn	TU2	6	5.9	4	634
Red Pine-Oak Brittle pre-burn	TL9	6	4.3	3	653
Red Pine-Oak Brittle post-burn	TL8	5	4	3	543
Red Pine with slash pre-burn	SB2	6	4.3	3	653
Red Pine with slash post-burn	TL8	5	3.8	2	542
Red Pine with Aspen pre-burn	TL6	4	5.3	3	443
Red Pine with Aspen post-burn	TL5	4	4.7	3	433

Smoke

Emissions were calculated based on pre-burn fuel loading and 1000 hour fuel moisture. Figure 4 depicts the emissions from the average burn conditions for the entire Brittle Project. Smoke volume was typically moderate to heavy with good lift. Smoke sensitive receptors were avoided for every burn entry of the Brittle Fuels Reduction Project.

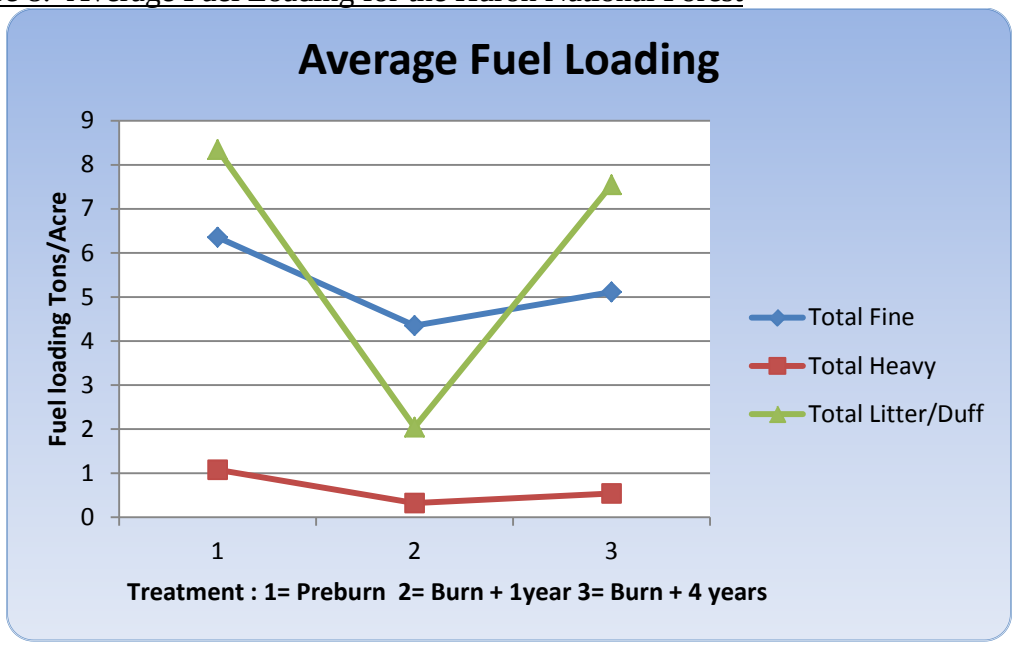
Figure 7. Emissions for Brittle Based on 1000 hour Fuel Moisture



Post-Burn Surveys and Results

Post-burn surveys for fuel loading and tree mortality are conducted within 1 year and again 4 to 5 years after the burn has been completed. The method for these surveys is to revisit the same plots and measure all of the plots again along with taking post-burn photos. This information has shown how the fuel loading rebuilds over a 4-to-5 year time frame. Post-burn mortality surveys are typically completed on burn sites for red pine understory burns to identify the impact that prescribed burning is having on the timber. Data from most prescribed burn units have been collected since 2004 and a summary of its results is shown in figures 8. Figure 8 shows the fuel loading in each treatment and how the fuel loading has rebuilt over the four years following the prescribed burns.

Figure 8. Average Fuel Loading for the Huron National Forest



During the post-burn fuel monitoring treatment a mortality survey is typically done at each plot site. The survey records tree species, DBH, crown ratio, crown class, % live crown scorched, bole char, live or dead tree, and BA. The data summary is shown in Figure 9 for the burn blocks. The data reflects an area of the Brittle burn block 9 that experienced a crown fire (70 - 100 acres) in which most of the timber was killed. A review of the burn pointed out the heave slash accumulations and the strip-head firing method were likely factors that caused the crown fire. A simple change in ignition pattern resulted in satisfactory results for Burn Block 3 that was completed the same day as Burn Block 9 with the same fuel loading.

Figure 9. Photo Series

Brittle Block 10 Pre-Burn	Brittle Block 10 Post-Burn
	

Photos were taken at each plot point both before and after treatment to visually demonstrate the effects of prescribed burning on the various fuels found within the Brittle Landscape Fuels Reduction Project.

Burn Severity Mapping

Burn severity was measured using on site assessments in addition to the United States Geological Survey (USGS) burn severity imagery based on the Landsat data. Severity was measured based on crown scorch and consumption of the duff layer. Figure 10 is an example of imagery taken from a May 2010 flight for Brittle Burn Blocks 4 and 10 with overlays of measurement taken from May 2008 Flight for Brittle Burn Blocks 3 and 9.

Figure 10. Burn Severity Map of Brittle Burn Blocks 3, 4, 9, 10

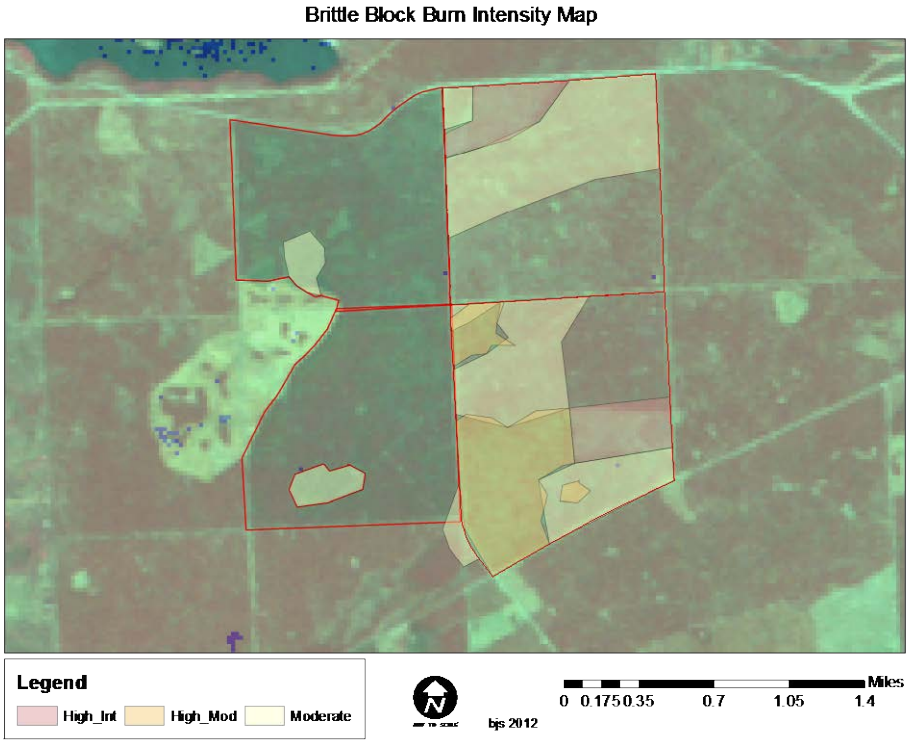


Table 9. Averages for Post-burn Tree Mortality

Project Name	Brittle Block 4	Brittle Block 10	Brittle Block 12
Total Pre Rx dead tree (%)	9.7	0.02	7.5
Average live BA	118	111	116
Average DBH (in)	12.1	11.5	10.5
Total acres	637	382	803
Total number plots	10	10	88
Acres/plot	63.7	38.2	9.1
Rx Mortality (%)	<0.5	< 0.5	< 0.5

A breakdown of the three basic types of dead trees surveyed follows. Further explanation on these groups is found below:

Average snags created thru contract (1.9%) (11) Red pine (7 -11" dbh)
(3) Jack Pine (9-12" dbh)
(2) Black Oak (8 & 11" dbh)

Pre burn mortality average (6.33 %) - (20) Jack Pine (8-11" dbh)
(14) Black Oak (5-19" dbh)
(11) Red Pine (5-9" dbh)

Fire related mortality average (1.3 %) (1) Jack Pine (7" dbh)
(1) Red Pine (5"dbh)
(1) Black Oak (8" dbh)

Crown Class

The crown class and it's affect on mortality was considered for each tree surveyed. The trees were assigned a crown class based on its relative dominance in the canopy, using accepted FS data collection procedures. The following are the criteria that were considered for the crown class.

Snags – trees in this group were created by topping. Due to the absence of tops, no data was collected on these trees.

Pre-burn mortality – The total number of trees that appeared to have died before prescribed burning took place were recorded for each plot. Of these trees, the ones that had some limbs present, indicating more recent mortality, were given a crown class and crown ratio.

Of the trees with limbs present (recent dead) the following crown positions were recorded: **dominant, co-dominant, intermediate, suppressed**. This indicates harvest related mortality may be at least 3.4%. If this mortality was only related to stress you would expect trees with fewer available resources (intermediate and suppressed) to have a higher incidence of mortality, relative to their abundance, not a lower rate of mortality.

The remaining trees in this group were classified as older dead and did not have enough limbs present to estimate crown position. Trees in this group either had their tops removed by wind, breakage (these should not be confused with the any of the dead trees "topped thru contract"), or were older dead (pre-harvest).

Based on the information recorded on snag decay, these trees may have died before harvest or shortly after harvest was completed. If these trees were dead before the harvest event, an existing mortality rate (independent of harvest) could be as high as 1.8%. If all of the trees in the pre-burn mortality group are considered (as related to harvest), the combined mortality rate is 5.2 percent.

Fire Related Mortality

During the prescribe burning of Memorable North and Brittle Block 9 the occurrence of crown fire was documented. Within these areas high rates of tree mortality were observed, and are not the typical results of prescribed burning on the Huron National Forest. Both of these occurrences have been documented and reviewed to avoid crown fires occurring on future projects. The summery of tree mortality discussed in the following paragraph does not include data from crown fire.

The initial fire related mortality is less than 0.5 percent of total tallied trees. Important observations from this survey concerning fire related mortality show that no dominants or co-dominant trees received any measurable mortality rates. Intermediate and suppressed trees were the crown class that received measurable mortality rates. Smaller diameter, increased stress, and reduced height making limbs and needles closer to ground would explain why trees in these groups (not dominants & co-dominants) were killed compared to the dominant or co-dominant trees.

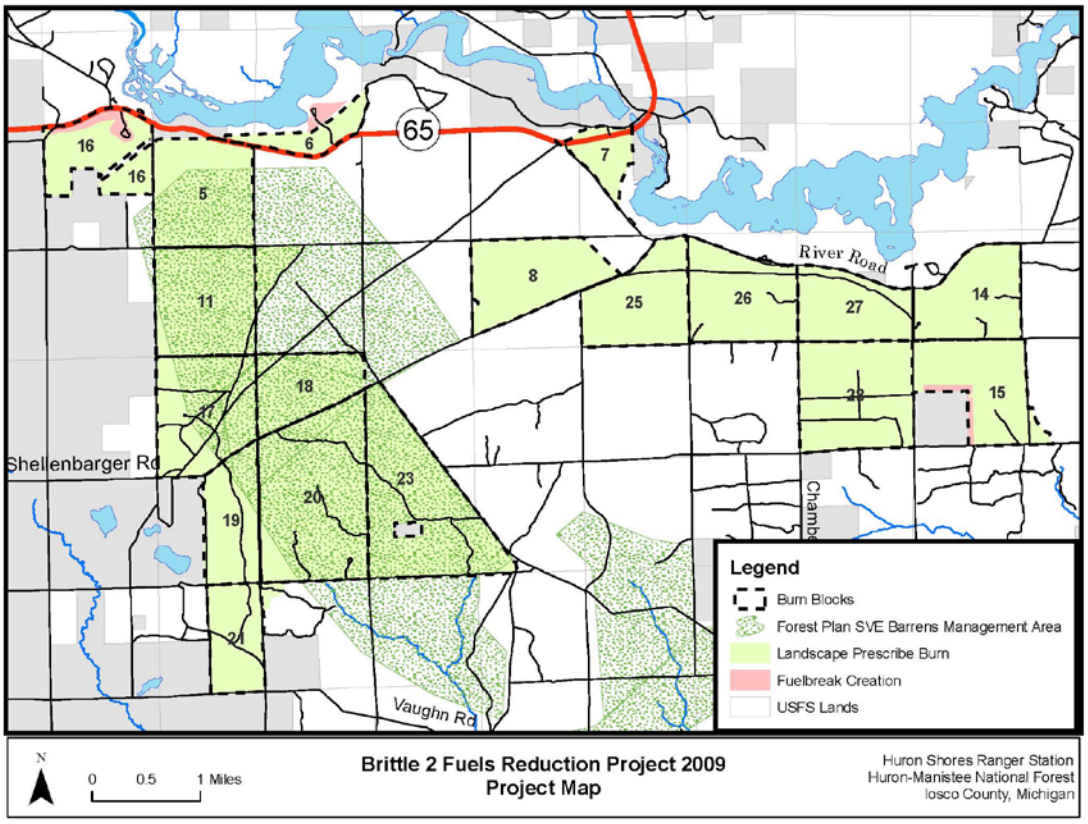
Basal Area

No correlation was found between BA and fire related mortality. Due to the limited sample size and the homogeny of the basal area for all of the stands that were studied no observations are discussed.

Next Step

An expansion of the landscape area is planned to start implementation for 2012. The project will increase to more than 15,000 acres (figure 11). Within the project area are designated pine barren restoration areas that will be thinned and prescribe burned to restore a more historic condition. The project should also help protect outlining communities from larger catastrophic wildfires.

Figure 11. Brittle Landscape Map Showing the Additional Landscape Project



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