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# FIRE EFFECTS OF SLASH BURNING ON XERIC SOILS

On The Huron-Manistee National Forests



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## **Fire Effects of Slash Burning on Xeric Soils for the Huron Shores Prescribed Burning Program**

The information in this summary is based on data gathered by the Huron Shores Prescribed Burning Program on the Huron-Manistee National Forest. The Data was collected from four prescribed burn projects implemented in six burn entries (some projects were broken into 2 burn units). The prescribed burn projects consisted of Brittle Burn Block 3 (667 acres), Brittle Burn Block 9 (698 acres), Jimny (184 acres), and Delightful (520 acres). All of the projects were located in the Tawas District of the Huron National Forest in Iosco County, Michigan (figure 1). The burn units are approximately 97% forested, have good ground cover, are almost entirely comprised of dry sandy plains, and major precipitation events occur when soils are frost-free. All of these conditions are very 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. Fuel loading on site was measured for Brittle Burn Block 3, 9, and Delightful Prescribed Burn, and estimated for the Jimny Prescribed Burn.

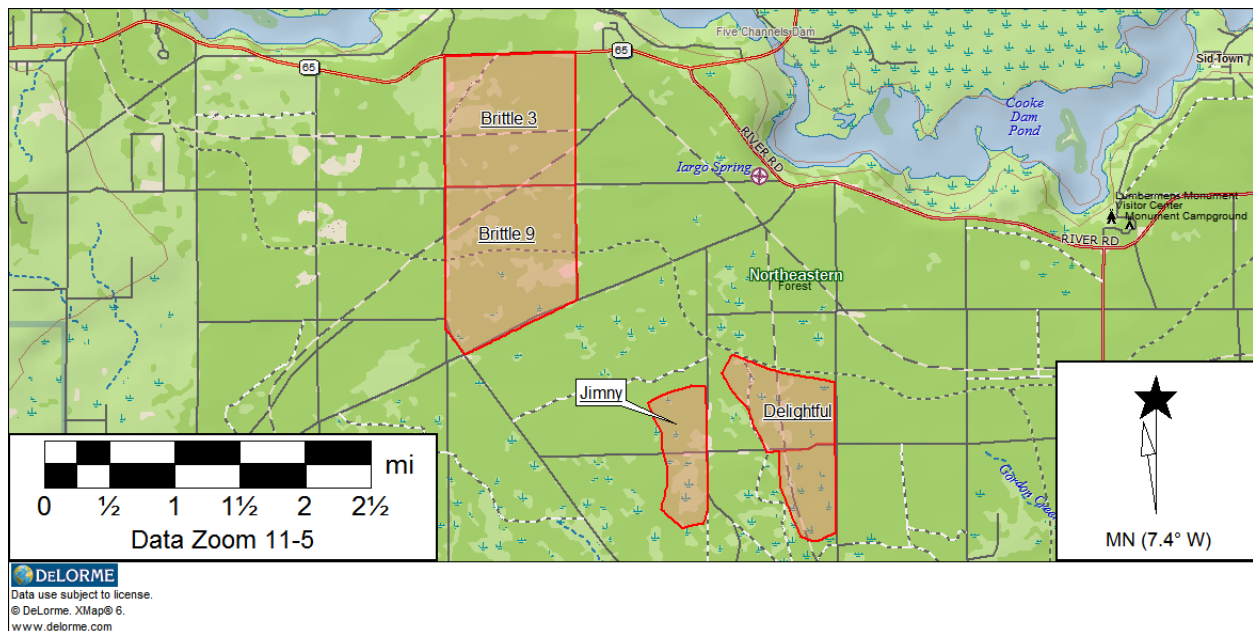


Figure 1. Area map showing the burn units.

### **Pre-Burn Conditions:**

The majority of the soils in the project areas consist of poorly developed and well-drained sands with slopes less than 3%. The soils are nutrient-impoverished and contain less than 3% clay and 5% silt. Water tables are generally well below the tree rooting zone, typically 6 to 15 feet below the surface. Forest cover consists primarily of species adapted to xeric conditions and frequent fire, including jack pine, red pine, and northern pin oak. The soils and vegetation recover at average rates from disturbance activities.

The Soil Horizons measured on two test sites (pre-burn) are consistent with County Soil Surveys for Grayling Sand.

Soil Horizons	Average Depth in inches
O -	1.2
A-	0.9
E-	0.2
C-	+36.0

Fig. 2 Soil test sites from Delightful Prescribed Burn (pre-burn).

Each of the projects contained a significant quantity of logging slash (Anderson’s fuel model 11). The objectives for the Jimny and Delightful Rx burns were site preparation for jack pine planting, and hazardous fuels reduction. The objectives of the two Brittle burns were primarily ecosystem restoration and fuels reduction, so they were burned in the spring. Between August and September of 2007 Browns’ transects were conducted in Brittle Blocks 3 & 9, averaging 13 plots each. Photo plots were also established for each transect. In July of 2009, four Browns’ transects were conducted for the Delightful burn and helped estimate the fuel loading for the Jimny burn.

**Fuel Loading Information**

Burn Unit	Average Tons / Acre	Average Litter Depth	Average Duff Depth
Brittle Block 3	9.7	1.3	0.8
Brittle Block 9	13.1	1.6	0.6
Jimny Rx Burn	16.0	1.0	0.4
Delightful Rx Burn	18.8	1.2	0.4

Fig. 3 fuel loading summary (pre-burn).

**Pre-Burn Photos**



Delightful .



*Fuel at Delightful*



*Delightful*



*Brittle Block 3*

## Burn Day Observations:

DATE	Burn Name	Time of Burn	Day of Last Rain	Rain (in)	Temp (F)	Rh %	Wind Spd	Wind Dir	F.L. (ft)	R.O.S (ft/min)	Notes
4/17/08	Brittle Block 9	14:00 - 16:30	04/12/08 (5)	0.26	68-64	30-33%	1 to 8	SW to E	2-8 (50')	1 to 2	Moderate slash within unit and wind change caused a crown fire.
4/17/08	Brittle Block 3	17:00 - 20:00	04/12/08 (5)	0.26	64-59	33-38%	1 to 8	E	2 to 6	1 to 2	Used flanking fire with helicopter
07/29/09	Jimny (south)	13:00 - 1530	07/26/09 (3)	.38	73-75	40-44%	5-8	wnw	2-9	2-4	Good results
08/06/09	Delightful north	13:30 - 1630	08/04/09 (2)	0.15	73-80	49-62%	0-5	wnw/s w	3-8	2-3	1 spot 50'x75' Ice cap on column
08/07/09	Jimny north	14:00 - 15:00	08/04/09 (2)	0.15	71	45-49%	0-3	e	1-5	1-2	80 acres, good results
08/13/09	Delightful south	14:00 - 16:00	08/11/09 (2)	0.11	80-82	49-57%	0-3	w/s	2-7	1-2	Flanking fire worked well

Fig. 4 Burn day summary.

## Post-Burn Observations:

In all of the project areas post-burn evaluations show no significant damage to soils or watershed. In areas of concentrated fuels the typical results consisted of complete removal of litter. Duff layers had an average reduction of 1.0 inch, leaving an average of 0.2 inches. A noticeable response from warm season grasses occurred in Brittle Block 3 & 9. Both the Jimny and Delightful burns showed a rapid response of the herbaceous layer within two weeks of the burn. All four projects temporarily reduced the amount of forested coverage in the watershed, which increased the water yield; this means more water flows out of the watershed (Stone, et.al., 1978; Ursic and Douglas, 1978; Stone, 1975). For the Brittle Burn Blocks the vegetation was reestablished within one month, which is consistent with the publication cited (USDA 1986; Stone, et.al., 1978).





*Jimny 2 months after the burn*



*Delightful 1 week Post-Burn*



*Delightful 1 week post Post-Burn.*

The practice of pile burning has shown some significant impacts to the soils. The increase in fire intensity usually sterilizes the soils so only moss tends to grow at the sites (fig. 5). The typical burn duration for these piles is 1 hour+ and exceeds the recommended fire intensity. The effect of fire on soil properties is directly related to fire intensity and the resulting degree of exposure of mineral soil to heat. Soil stability is adversely affected by excessive heat. Soil properties are unaffected, or may even be enhanced, if the aboveground fuels are burned at sufficiently lower intensity so that soil temperature is not greatly increased (Wells, et.al., 1979). Prescribed fire used in forest management is designed to minimize damage to forest ecosystems by mitigating conditions that affect fire behavior and fire intensity.



*Fig. 5 Burn pile site 4 years after the burn.*

### **Summary:**

The fire impacts of slash burning on the xeric soils of the Huron-Manistee National Forest demonstrate an overall beneficial effect. The native herbaceous species seem to better outcompete invasive species, duff layers are reduced to less than 1 inch, and little or no erosion has been observed on the burn units. Pile burning does seem to sterilize the soil due to the increase in fire intensities, and often results in only sustaining the growth of moss. The observations and data collected for the Huron Shores Fuels Monitoring Program is consistent with information found on Fire Effects Information System [www.fs.fed.us/database/feis/](http://www.fs.fed.us/database/feis/). Additional questions or request for plot data should be directed to:

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