Mack Lake Fire, Michigan, 1980

Summary of Literature & Cut & Paste assembled by

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I contacted USFS fire specialist John Caffin in the Southern Region, concerning the Georgia fires. He gave me some leads. "You've gotta look at the Mack Lake Fire" as well, he said. So, here goes…

Background

Historically, Michigan has had as dramatic a fire history as anywhere in the US. The lumber industry cut through the state in about 4 decades taking much of the pine, leaving behind slash from trees topped at the first limb. The volumes were enormous, as Michigan was a leading lumber state for several decades after the Civil War. Successional postfire vegetation proved highly flammable as well. At the same time as the famous Peshtigo Fire in northern Wisconsin in fall of 1871, several major blazes burned a total of 1.5 million acres in lower Michigan.

In Michigan in the past 50 years, only 3 years saw total area burned above 20,000 acres (1976, 77,and 80 – Dickmann and Leefers, 2003, p. 198). But after 1975 a number of large fires occurred. The Seney fire in 1976 in the UP had a perimeter enclosing 76,000 acres but burned only 36,000 acres of that. The 5,200 acre No Pablo Fire of 2000 re-burned part of the Mack Lake fire's burnt area. In May 1990, the Stephen Bridge fire covered 5,900 acres, destroying roughly 200 homes and buildings.

The Mack Lake Fire

In the 1970s, the USDA Forest Service on the Huron National Forest was in early stages of a habitat management program for the rare Kirtland's Warbler. This program called for patch clearcutting, prescribed burns, and planting to maintain a patchwork of a certain age class of open jackpine stands favored by this bird (See photos at end of this memo). This is a broad highland, primarily of sandy outwash with extensive natural jackpine stands, as well as

sprout stands of aspen/birch, some northern hardwoods, and wetlands. Experts estimate a historic fire return interval in the jackpine forest type of some 59 yrs, vs more than a thousand years in mesic northern hardwoods (Haight 2004). Though the topography is subdued to say the least, the area is well known for the Au Sable River, a famous trout fishing and canoeing stream. Widely scattered recreation and second home "interface" development is sprinkled everywhere. This situation and the larger region is described in Haight et al 2004.

In the morning of May 5, 1980, a Forest Service crew ignited a prescribed slash disposal burn which quickly escaped. This became the Mack Lake Fire which grew rapidly to burn 20,000 acres, 44 homes, and kill one firefighter.

From Zimet, et al, 2007, p. 134.

Table I. Table of significant Mack Lake Fire and weather activity that occurred between 1000 EDT 5 May 1980, and 0600 EDT 6 May 1980. (EDT is equal to UTDC minus 4 h).

Time UTC (EDT)	Fire and weather activity
1400 (1000)	Wind: 270° at 7 miles h^{-1} Temp: 75; RH 28%
1426 (1026)	Prescribed fire was ignited
1606 (1206)	Fire spotted into standing Jack Pine
1630 (1230)	Fire spotted across Highway 33; Fire boss reported a sudden increase in wind speed; Tractor/plow and armored tanker began work on north flank of fire
1632–1645 (1232–1245)	Wind shifted directions several times; Fire described as turbulent with heavy, rolling smoke
1710 (1310)	Fire crossed Country Road 489, and approaching village of Mack Lake which was evacuated Flame heights of twice the height of trees
1725 (1325)	Fire had passed the village of Mack Lake; 44 homes and cottages were destroyed. Observations indicate a spread rate of 6 to 8 miles h^{-1}, at 8000 acres h^{-1}
1800 (1400)	Wind: 290° at 15 mi h^{-1} with gusts of 25 mi h^{-1} Temp: 82; RH 22%
1930 (1530)	Wind shifted to west-north-west; advance of fire slowed slightly
2000–2225 (1600–1825)	Rate of area growth = 4000 acres h^{-1}
2100 (1700)	Wind: 330° at 17 mi h^{-1} Temp. 71; RH 46%
2200 (1800)	Crown fire weakened but fire on ground was still moderately intense
0400–1000 (0000–0600) (May 6)	Mechanised equipment still not able to work effectively on all section of the perimeter Fire stopped spreading; 15 miles of constructed control line

Simard and others (1983) prepared a detailed summary and analysis of the Fire and associated weather. In a later short article, Simard (2003) summarized the lessons:

Fire managers can learn several important lessons from the Mack Lake Fire:

1. Once a crown fire begins in the jack pine timber type, only a change in weather can slow the fire. Fire managers should consider

creating fuel breaks composed of hardwoods.

2. Because residences near jack pine forests are increasing, an expanded program should be

developed to tell homeowners

about the potential for wildfire damage and how to locate and landscape their homes to prevent loss.

3. Fire managers need to plan carefully the transition from prescribed fire to wildfire control, because abandoning a prescribed fire when control actions begin can allow more escapes that threaten initial attack crews.

4. Because fires in jack pine can develop from initial attack to project scale in 15 to 30 minutes, fire managers need to develop mobilization procedures so that their organizations can respond within that time.

5. Procedures for the safe use and control of heavy-duty equipment need to be emphasized. The speed and ruggedness of the equipment can allow it to outrun backup forces and to lull the operator into a false sense of security.

6. Lake States fire managers need to recognize that, because staff turnovers in this area are more frequent than major fires, special emphasis on training is needed

so that firefighters can be prepared
for major outbreaks.

Later analysis by Haight et al 2004, produced this map indicating areas of fire risk based on actual detailed fire histories for 1985-2003. The Mack Lake fire occurred right in the middle of the high risk interface region.

SHOULDN'T WE HAVE A MAP LIKE THIS FOR OUR REGION? WHAT WOULD IT TAKE???

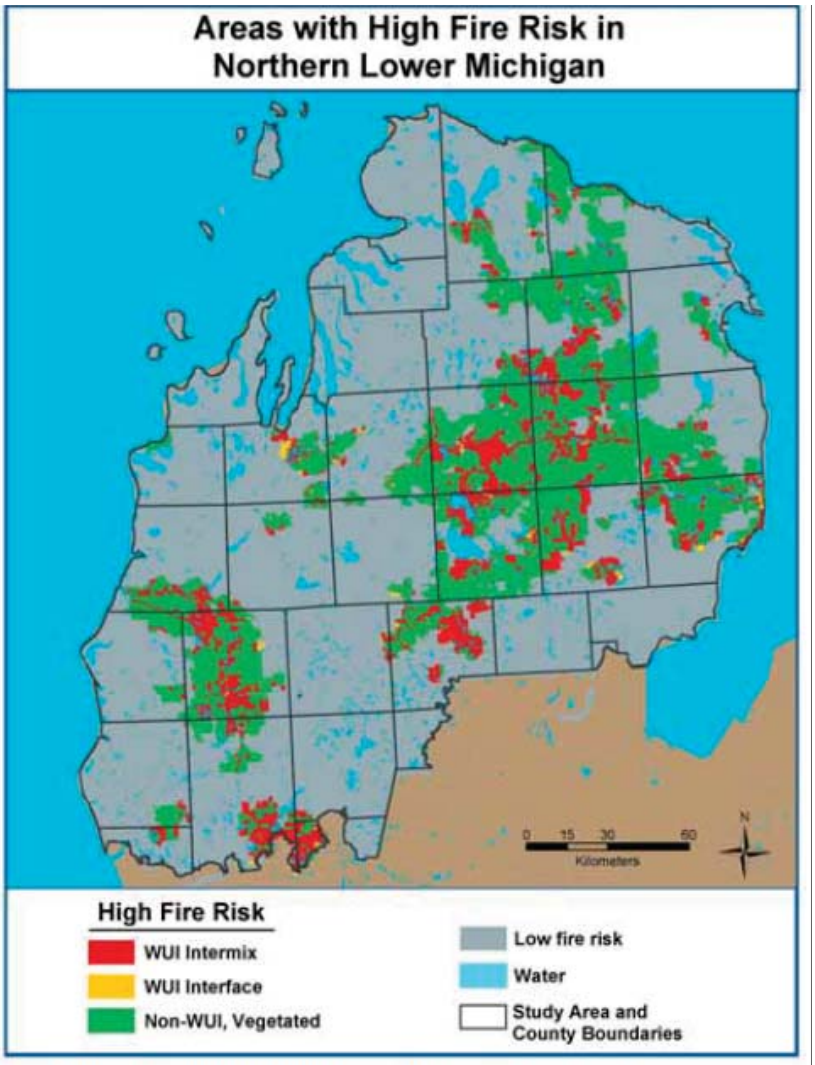


Figure 3. Areas with relatively high risk of severe wildfires in northern lower Michigan.

General Lessons that might be Drawn –thoughts for discussion

This fire became famous as an unusually large one for the region, and as a bungled Rx burn, which will always attract a lot of news attention. Loss of real estate and a firefighter fatality added to the attention. Visits are conducted to the fire area even today to train firefighters.

(1) The principal lesson seems to be summarized as:

"never start an Rx Burn with a cold front inbound."

(2) At the time, a major lesson was that synoptic weather conditions that are not evident in local ground -level weather measurements can be critical for fire behavior. (I assume that this issue is now well in hand with weather data available to fire managers…is this so???)
(3) Severe preceding drought is **not** a necessary precondition for a large fire.
(4) Perhaps another lesson is that over time more can be learned from major fires, see clips noted below.
(5) … is there more???

A major lesson for us is that a fire of a size exceeding average annual statewide area burned can happen anytime, even in the absence of forewarnings by well-publicized drought….

Also -- we have to be aware of locations, overall extent, and characteristics of our <u>most flammable fuel types</u> – surely the onsite first responders are aware, but are the higher-ups, the general public, and policymakers?

Finally, local fire people know where the interface is. But its overall extent and importance may not be visible to state-level policymakers. You all know the Radeloff work on WUI at Univ Wisconsin (is there similar work in Canada?) Radeloff wants to update that to 2010 Census data, which is not yet available. He does not appear to have the funding, tho.

Perhaps this need is one that the Compact leadership could convey to the Northern Research station and sister institutions in Canada. I'm happy to draft a letter.

Later Meteorological Analyses

Brotak and Reifsnyder analyzed weather conditions associated with 53 fires from 1963 to 1973.

A paper by Charney et al. documented the importance of low level jets in the development of Mack Lake and similar large wildfires:

OK: so can we see these coming???

The environmental conditions for the 1980 fire season were slightly dry, with a Palmer Drought Index of 1.17 on the day of the fire, indicating a slight but insignificant soil moisture deficit. The National Fire Danger Rating System (NFDRS) Burning Index (BI) had varied from low to extreme through the month of April, with values in the very high range on May 5th. A high pressure system dominated the synoptic weather pattern for the 5 days leading up to the fire. On the day of the fire, a cold front approached Mack Lake, passing through the area just after 1400 EDT (1800 UTC) (Fig. 2). Upper air data from three rawinsonde stations in the region, at Sault Ste. Marie, MI (SSM), Green Bay, WI (GRB), and Flint, MI (FNT), indicated the presence of a weak low-level jet (LLJ) in the Great Lakes region (Fig. 3). Note that the LLJ is readily apparent in the GRB and FNT soundings, but is not evident at SSM. According to the final analysis of Simard et al. (1983), high surface wind speeds (15 mph and above) and low relative humidity (21%) were major contributors to the escape of the prescribed fire.

This diagnosis of a mesoscale feature that is often undetectable in surface and radiosonde observations indicates the potential for mesoscale models to improve the fire-weather information available to fire fighters and fire managers. Since these simulations are available in a forecast mode, it is possible to warn fire managers days in advance when this type of phenomenon might impact their operations.

Zimet at al, 2007, p. 147.

frontal dry air intrusion. It appears more than likely that two major ingredients for the spread of the Mack Lake Fire, very dry boundary layer air and gusty boundary layer winds, were made available to the fire environment as a result of its proximity to a developing upper level front. Given the frequency of such upper frontal systems in the Great Lakes region during peak fire season (March–May), consideration of such features, particularly in circumstances conducive to interactions with the planetary boundary layer, may benefit fire weather forecasters and fire managers as they consider risk assessment strategies.

Note the observation on frequency of these systems – where do we get that info???

Documents:

Brotak, E. A. and W. E. Reifsnyder. 2003. Predicting major wildland fire occurrence. FMT 63(4). (based on phd Thesis at Yale by Brotak)

Charney, J.J., B. Xindi, B. Potter, and W. E. Heilman. 2003. Low level jet impacts on fire ecvolution in the Mack Lake and other severe wildfires. 2d Int'l Wildland fire ecology and fire management conference Nov 2003, Orlando FL. American Met Assn.

Dickmann, D. . and L. A. Leefers. 2003. The forests of Michigan. Ann Arbor University of Michigan Press. 297 pp.

Haight, R. G. et al. 2004. Assessing fire risk in the Wildland-urban interface. Jour. Forestry. Oct/ Nov.

Simard, A. J., D. A. Haines, R. W. Blank, and J,. S. Frost. 1983. The Mack Lake Fire. USDA FS NCFES. Gen Tech Report NC-83.

Simard, A. J. 2003 Mack Lake Fire. Fire Mangement Today. 63 (4).

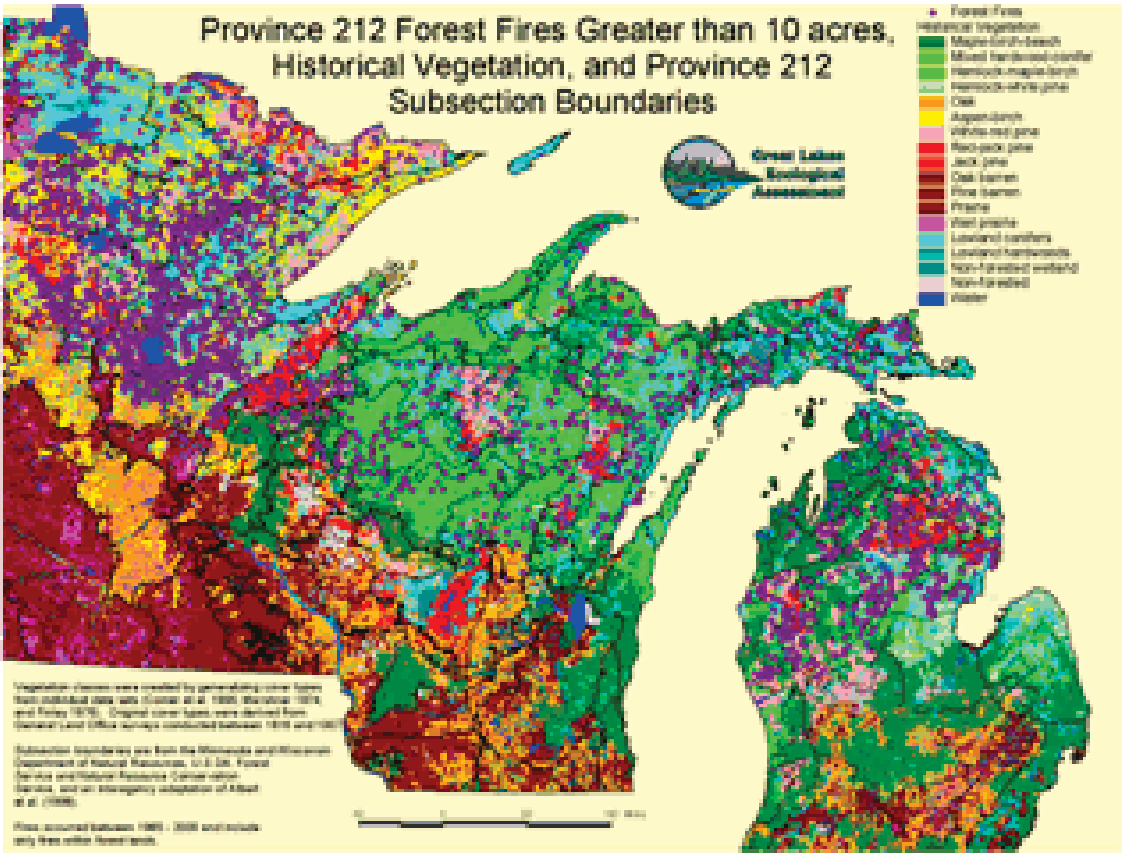
Zimet, T, J .E. Martin, and B. E. Potter. 2007. Influence of an upper-level frontal zone on the Mack Lake fire environment. Meteorological Applications. 14: 131-14

Loose Ends:

Look for and review the Lake States Fire Database, 1985-2000.

It would appear not. See http://www.ncrs.fs.fed.us/gla/natdist/firedb.htm

This DB contains mapped info on individual fires. Any such thing ever done in our region?

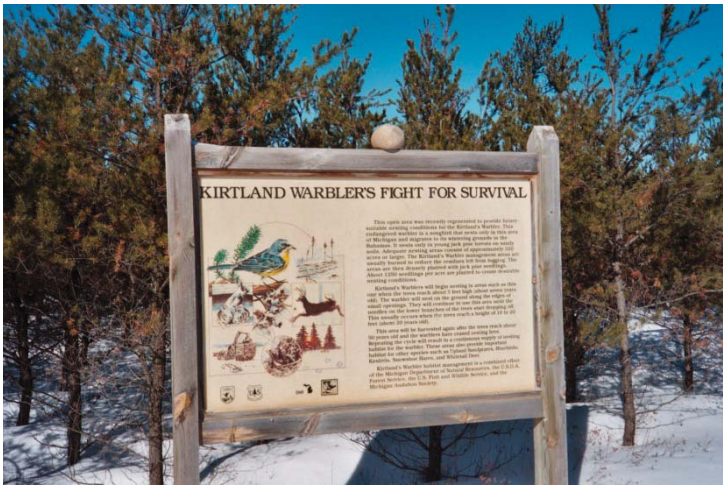


Higher res versions of above available.

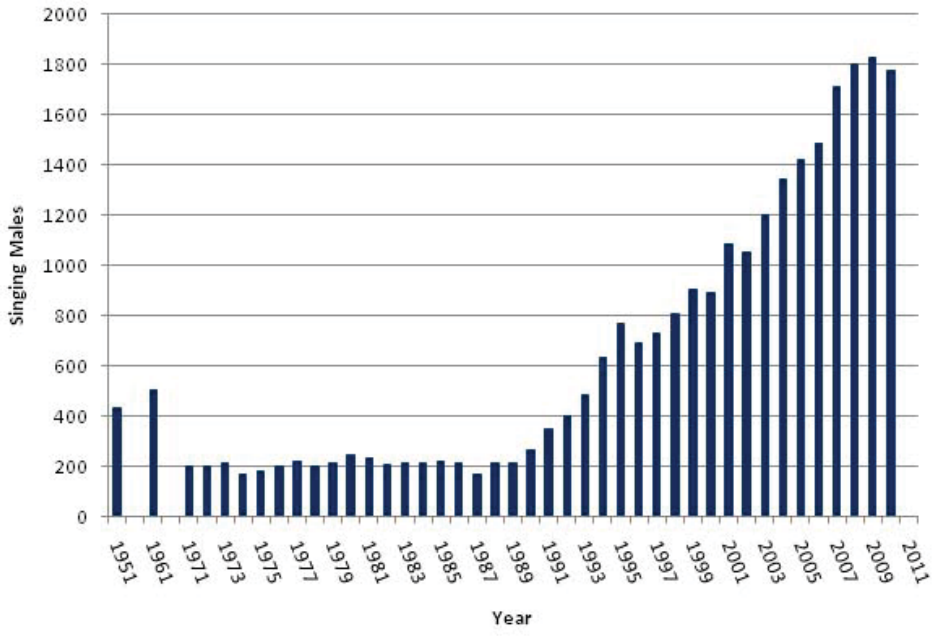
Pictures March 15

Mack Lake Area Fuel types & landscape

Irland photos.



Index of Kirtland's warbler populations.



Courtesy Don Dickmann, Michigan State U.