Impact of wildfire disturbance and salvage harvesting on forest health 6 years after prescribed burning and harvesting treatments in naturally regenerated red pine forests

Location: Muskrat Lakes Fire/Fire Surrogate Site, Newberry, Michigan

Dates 9/30/2012 – 12/31/2013, Year 1 of 1 Year Project

Funding Source: Fire Plan

Personnel:
Andrew J. Storer (Project director), (906) 487-3470, storer@mtu.edu;
Linda M. Nagel (Co-Principal Investigator), (906) 487-2812; lmnagel@mtu.edu
School of Forest Resources and Environmental Science, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931

Cooperators:
Rita M. Koch, School of Forest Resources and Environmental Science, Michigan Technological University, 1400 Townsend Drive, Houghton, MI 49931; (906) 281-3891, rmkoch@mtu.edu
Linda Haugen, USDA FS FHP, St. Paul, MN; (651) 649-5029, lhaugen@fs.fed.us
Michael Ostry, Research pathologist, North Central Research Station, mostry@fs.fed.us
Keith Magnusson, Michigan Department of Natural Resources, magnussk@michigan.gov

PROJECT OBJECTIVES:

1. Determine the effects of wildfire disturbance following prescribed burning and mechanical treatments, alone and in combination, on incidence and impact of forest insect pests and pathogens in mature red pine stands in the Lake States.

2. Document the effects on forest health concerns of salvage harvesting operations following wildfire disturbance.

Initial visits to the site suggested that those areas which received prescribed burning treatments experienced lower fire intensity/severity than sites that were only harvested or used as controls (Figure 2). This project seeks to quantify these impacts and demonstrate to managers the potential protective function of prescribed burning in anticipation of wildfire events. In addition, salvage harvesting operations were implemented quickly following the wildfire and we seek to examine the impact of this additional disturbance on forest pests and disease and other ecosystem attributes.

JUSTIFICATION:

In May of 2012, lightning ignited the Duck Lake Wildfire, which over the course 3 weeks burned 21,069 acres in the Upper Peninsula of Michigan and stands as the third-largest fire in Michigan’s history. 42.6 miles of fireline were built in the course of control efforts, but in the end, this fire resulted in the loss of 136 structures. Many pine forests within the wildfire area experienced high intensity crown fire (Michigan DNR). Fire regimes in red and white pine forests typically involved frequent (20-40 yr interval) low to moderate intensity fires, with less frequent (100-300+ yr interval) high intensity stand replacing fires. However, recent studies suggest that extreme fire weather and extreme fire events could increase in frequency along with global climate change (Kloster et al, 2012).

The eastern edge of the Duck Lake Wildfire contained part of the Muskrat Lakes Fire/Fire Surrogate study site (Figure 1). This site had previously been treated with prescribed fire, harvesting, and a combination of these treatments in 2005-2006. Seven of twelve treatment areas burned over in the wildfire. This disturbance allows us a spectacular opportunity to evaluate the impact of previous treatments on wildfire severity and intensity in addition to continued shoot blight disease and wood-infesting insect monitoring. It must also be noted that salvage harvesting took place almost immediately after the fire, further changing the character of this site. Work at Muskrat Lakes has already demonstrated a reduction in
shoot blight spore catches in relation to active management. Plot re-establishment and further data collection will add to the unfolding story on this site which now includes wildfire and salvage harvesting.

The successful execution of this project would advance FHM Fire Plan goals by acquiring results soon after a disturbance and serving to advise managers in similar circumstances. Also, it would provide information about a disturbance event that has been rare on the landscape for many years, but could become a more commonplace occurrence as a result of climate change. Fire, bark beetle impacts, and climate change are all very current and important topics. Information from this study could advise managers on a regional and larger scale about these issues.

In addition, incidences of shoot blight pathogens remain an important forest health issue in pine stands across the Lake States, as evidenced by FHM survey data reported in the annual Forest Health Highlights. For instance, Diplodia shoot blight was reported as a hindrance to red pine regeneration in several parts of Michigan in the 2008 highlights report. Sirococcus shoot blight damage was reported in nearby Alger County, Michigan in 2010.

This project would remain cost effective by drawing on information and sampling infrastructure that is already in place from a previous study. The personnel involved in this study are familiar with the area and with prior data and would work closely with collaborators to take advantage of this excellent scientific opportunity.

### a. Background:

Fire can act as a natural control of certain insects and diseases (Hardison 1976, McCullough et al. 1998). Fire has been linked to reductions in the incidence of Armillaria and Annuosus root rots (Froelich et al. 1978, Reaves et al. 1990), and certain rust diseases (Parmeter and Uhrenholdt 1974). Shoot blight pathogens have been increasing in importance in the Lake States (Ostry et al. 1999, Nichols and Ostry 1990, Ostry et al. 1990). Surface fires reduce understory vegetation and may raise the lower-level of the canopy, changing microclimate and eliminating or reducing populations of shoot blight pathogens. High intensity fires, however, can exacerbate forest health problems. Trees stressed by excessive crown scorch
are subject to colonization by bark beetles, wood-borers and root weevils. Low intensity prescribed fires, therefore, should be considered an option for integrated pest management programs in red pine stands. Initial reconnaissance of this site show it could serve as an excellent visual demonstration area for the positive impacts of prescribed burning in anticipation of wildfire. These impacts include reduced bole and crown scorch and, as a result, reduced tree stress leading to insect and disease problems (Figure 2).

In 1997, Linda Haugen, Mike Ostry, and Al Saberniak began a preliminary study in a 400 acre red pine stand on the Hiawatha National Forest, which was partially prescribed burned in 1998 and 2000. We used this effort to determine what response variables and means of data collection are feasible. Andrew Storer is an entomology and pathology site discipline leader at the Blodgett forest site (in CA) of the National Fire/Fire Surrogate (FFS) study funded by the Joint Fire Sciences Council. In 2002, Dr. Storer and Dr. Linda Nagel selected and undertook preliminary work on Michigan DNR land in the Upper Peninsula of Michigan, in the vicinity of Muskrat Lakes in Luce County, to establish an independent fire/fire surrogate site in naturally regenerated red pine. Harvesting and prescribed burning took place in 2005-2006 and the study was monitored as part of Rita M. Koch’s doctoral research for the next several years. This same group of personnel would be available to tackle the new challenge presented by the profound changes to this site.

b. Methods:

Study site and treatments: Twelve treatment areas of approximately 17 hectares each have been divided into 3 blocks based upon predominant species composition. Twenty plot centers, 50 m apart, were permanently marked in each treatment area and will be relocated using a metal detector and remarked. Overstory tree information has been collected from each of the plot centers. The cost for establishing this site, estimated at over $10,000, has been paid for from Michigan Technological University sources. The treatment types are:

1. Untreated control - No cutting or burning in these blocks.
2. Prescribed fire only - No trees harvested in these blocks, spring prescribed burn used.
3. Harvest down to 50% crown closure favoring red and white pine.
4. Harvest followed by prescribed fire. An initial cut reducing crown closure to below 50% favoring red and white pine. An understory burn took place under Michigan DNR supervision in 2006.

Seven of these treatment areas, including all 4 treatment types, burned over in the Duck Lake wildfire and would be re-assessed in this study. The treatment areas outside the burn area could serve as areas for comparison (Figure 1).

Data collection: New data on incidence of insects and pathogens will be collected in all treatment areas. This sampling will be based around the plot centers already established in each treatment area. 1/10 acre plots will be resampled to assess overstory characteristics of the forest following wildfire and salvage harvesting. All trees in each treatment area will be assessed for beetle activity by conducting 360 degree scans from each plot center and recording trees with discolored crowns or thin crowns. Wood infesting insects will be assessed using passive flight intercept traps (Storer et al, 2002). Pathogens will be evaluated using spore traps (Vaseline-coated slides).

c. Products: Results will be incorporated into recommendations that enable managers to make more informed decisions about how the tool of prescribed fire can impact subsequent wildfire disturbance and forest health issues. We will provide this information to end-users in “how-to” leaflets, extension bulletins, web sites (e.g. USFS FHP web site in St. Paul), and visual media that show before and after differences in treated versus untreated forests. Our results and recommendations will be presented at state and regional meetings of federal, state and private forest managers and landowners, and presented at FHM working group meetings. We will also document results in technical reports and scientific publications.

d. Schedule of Activities:

| May 2013 | Finalize study plan and acquire equipment and supplies |
| July-Aug 2013 | Field data collection |
| Sept-Dec 2013 | Data analysis, sample processing, preparation of outreach materials and visual materials for managers, publish results; FHM report, and FHM fact sheet. |
f. Literature cited in proposal and other supporting references


COSTS

The 2013 funding request is $9095.88

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