INTEGRATING FUEL AND FIRE INTO FOREST MANAGEMENT

Jeremy Kolaks, Bruce Cutter
The School of Natural Resources
University of Missouri – Columbia
jjkea1@mizzou.edu, CutterB@Missouri.edu

Edward Loewenstein
School of Forestry and Wildlife Science
Auburn University
Loeweed@Auburn.edu

Keith Grabner
USGS Northern Prairie
Wildlife Research Center
atmokg@usgs.gov

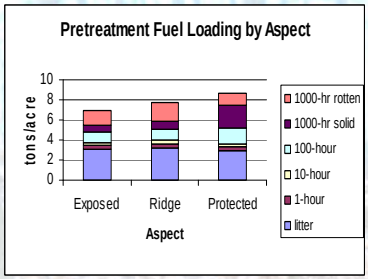
George Hartman
Missouri Department
of Conservation
George.Hartman@mdc.mo.gov

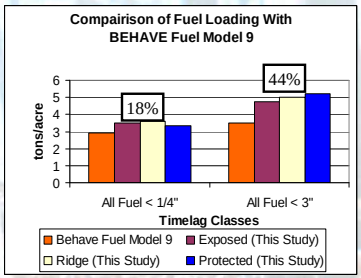
John Kabrick
USDA Forest Service
North Central Research Station
Jkabrick@fs.fed.us

Abstract -- Fire, and the lack thereof, has influenced Missouri's forest for hundreds of years. Today's forests are, in part, the result of fire suppression that began in the 1930's. At the same time, Missouri's forest resources had been almost completely exhausted. Today's forest resources are plentiful and in many cases being actively managed using prescribed fire and thinning, or other like silvicultural techniques. However, the effect of these treatments on fuels and fire behavior is poorly understood. We collected fuel data in the southeast Missouri Ozarks as part of study funded by the Joint Fire Science Program. The purpose was to better understand interactions between aspect and fuel loading, and the effects that they have on fire behavior in mature forested stands that have been thinned, burned, burned and thinned, and not managed (control).

FUEL LOADING → MODEL SELECTION

Pretreatment

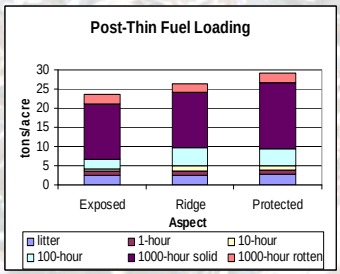


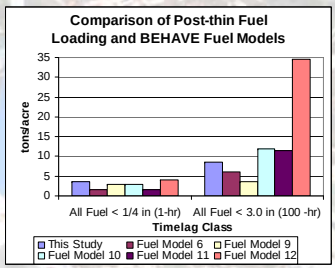


➢**Fuel loading varied from 6.8 tons/acre on exposed (south and west facing) slopes to 8.6 tons/acre on protected (north and east facing) slopes. No category was significantly different by aspect except 1000-hour solid. Since only fine fuels (litter, 1, 10, and 100-hour) are used to predict fire behavior a single value may reliably be use to predict fire behavior on any slope.**

➢**On average, fuel loading was 18% greater for all 1-hour fuels and 44% greater for all fuels < 3" (litter, 1, 10, and 100-hour) than that assumed by the fire behavior prediction model BEHAVE (Anderson 1982). This could lead to an under prediction of fire behavior by BEHAVE in unburned stands in the Missouri Ozarks.**

Post-thinning





➢**Commercial thinning increased total fuel loading by 300% with 1000-hour solid fuels replacing litter and 1-hour woody fuels as the heaviest component.**

➢**All fuel < 3 in (litter, 1, 10, and 100-hour) was significantly greater on protected slopes and ridges than on exposed slopes indicating that a different fuel loading value needs to be used to predict fire behavior than on exposed slopes.**

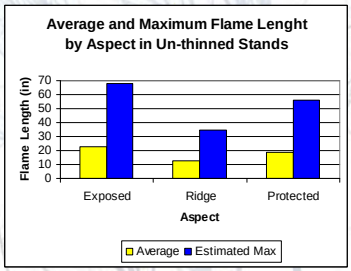
➢**Since no single fuel model best describes overall post-thinning fuel loading, the selection of a fuel model based on fire behavior may be warranted (Anderson 1982).**

Thanks to Mike Morris, Cliff Smith, Randy Jensen, David Whitener, Keith Crabtree, the Ellington Work Team, Ironton Work Team, Garwood Work Team, and other employees of the Missouri Department of Conservation who helped as well as Kenneth Davidson, Chris Hopfinger, Tim Parsons, Texas Nall, Ralph Yohai, and Shawn Maijala of the USDA Forest Service North Central Research Station and the Mark Twain National Forest. Finally I would like to especially thank Sandra Clark, Nick Cahill, Michael Garcia, Dr. Mark Ellerseick as well as my fellow students.

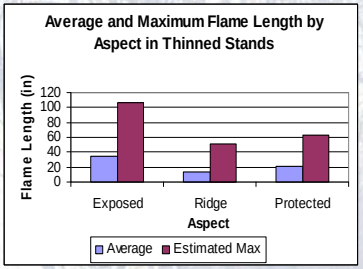
FIRE BEHAVIOR

Flame Length

Un-thinned (6-9 tons)



Thinned (22-29 tons)



➢**Flame lengths were greater on the slopes than on the ridges. They were also greater on exposed slopes than on protected slopes. The difference between exposed and protected slopes probably would be more pronounced given a south wind on burn days.**

➢**Though it may be common knowledge, given longer flame lengths on the slopes, control lines for both prescribed fire and wildfire should not be placed on slopes where fire will be advancing from below, especially on exposed slopes.**

➢**Average observed flame length off of slash piles was 14 ft with maximum flame lengths nearing 50 ft, greatly increasing the chance of spot fires from fire brands and endangering firefighter safety.**

➢**Given the control line width rule-of-thumb of 1 ½ times the (maximum) flame length, placement would be most effective on ridges only requiring a 6 ¼ ft wide control line in thinned stands and a 4 ½ ft wide control line in un-thinned stands.**

➢**Longer flame lengths in stands that received a thinning also increase the chance of injury and mortality to the residual stand. When mortality and damage are of concern we do not recommend burning after a thinning has taken place.**

Rate of Spread

➢**Observed rates of spread varied from ½ chain/hour to 16+ chains/hour.**

➢**Though data was highly variable, trends observed include:**

- ✓**More consistent rates of spread (ROS) in un-thinned stands.**
- ✓**Greater ROS on the slopes than on ridges.**
- ✓**Greater ROS in un-thinned stands than in thinned stands except when fire brands off of slash piles ignited spot fires ahead of the main fire.**

Literature Cited:

Anderson, H.E. 1982. Aids to determining fuel models for estimating fire behavior. GTR-INT-122. USDA Forest Service, Intermountain Forest and Range Experiment Station. 22 p.