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Abstract

Prescribed fire is an important management tool used with increasing frequency for a variety of purposes throughout the central hardwood region. Oaks are identified as a fire-adapted species, and prescribed fire is often utilized near the end of the rotation to promote the next cohort. As the use of prescribed burning becomes increasingly widespread throughout the central hardwood region, concerns about the effects of this practice on the value of residual timber have increased. In this study, tree and wound measurements are conducted to estimate value loss to hardwood timber stands associated with prescribed fire. These measurements have occurred in Hoosier National Forest (Indiana) and Mark Twain National Forest (Missouri), and will be extended to additional sites to better represent the central hardwood region. Early results indicate that fire history characteristics, including number of fires that have occurred on site, and length of time since first application of fire can be important predictors of grade and value loss in timber. Site characteristics, particularly aspect, also appear to have an effect on value loss. Quantifying value loss impacts of prescribed fire on timber value will allow the practice to be used more appropriately as a management tool in the future.



Stand in Mark Twain National Forest subject to recent prescribed fire

Study Objectives

- The United States Forest Service has determined that addressing concerns about effects of prescribed-fire on hardwood timber is a major research need.
- Quantify prescribed fire value impacts to hardwood timber from differing prescribed-fire regimes
- Gain better understanding of effects of long (>15 year) prescribed-fire histories
- Understand regional differences in prescribed-fire effects on timber value
- Refine the use of Forest Vegetation Simulator (FVS) software for modeling stand value effects of prescribed-fire



Low intensity prescribed fire conducted on Purdue property in March, 2018

Materials and Methods

- Within each national forest, 30 stands (usually 15-40 acres) are selected for the study
- Stands are classified based on the number of prescribed fire treatments a site has received. The categories are: 0 (control sites), 1, 2, 3, and 4+.
- Stands are also classified by primary aspect (North or South)

Table 1. Number of stands sampled by number of prescribed burns and aspect category.

Number of Burns	North Aspect	South Aspect
0 (Control)	3	3
1	3	3
2	3	3
3	3	3
4+	3	3

- 15 grid-points are randomly placed in each stand to be utilized as sub-samples
- 20 Basal Area Factor Prism will be utilized at plot center to determine the trees that are to be included in the variable point plot. All trees >10 inches included in the sample.
- At each tree, species, diameter at breast height, merchantable height, diameter at merchantable height, and USFS tree grade are recorded.
- All trees are then carefully evaluated for fire-damage, and all wounds are measured (height, width, and depth, if applicable). Wounds are classified into the following categories:

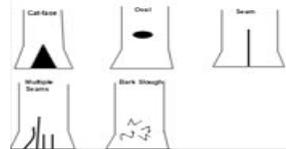


Illustration of fire wound classifications

- Trees are re-graded to account for fire damage, and quantify grade changes associated with prescribed-fire wounds.

Results

- Early results suggest that fire history characteristics have a significant effect on the probability of fire damage and probability of grade reduction occurring as a result of prescribed-fire (Table 2, Table 3).
- While there is generally an upward trend between number of fires occurring on a site, and likelihood of fire damage and grade reduction, this trend is not constant (Table 2).
- Primary aspect category for stands (north of south) appears to have a significant effect on the likelihood of grade change associated with fire damage, but has an insignificant effect on likelihood of fire-damage occurring at all.

Table 2. Percentage of trees with fire damage and grade change by burn number category

Number of Burns	% Damaged	% Grade Change
0	3.3%	1.1%
1	33.2%	17.2%
2	32.4%	8.8%
3	71.6%	45.3%
4+	42.5%	20.6%
Total	33.2%	16.1%

Results continued

Table 3. Significance of effects of burn number category (0,1,2,3, and 4+) and Aspect Category (North, South) on likelihood of fire damage and likelihood of grade change associated with fire

	Likelihood of Fire Damage and Grade Change	
	P-Value	Aspect Category
Fire Damage	<0.001	0.135*
Grade Change	<0.001	0.002

*Non-significant result

Future Directions

- Refine the use of Forest Vegetation Simulator (FVS) for analysis and prediction of value and stand effects of prescribed fire on timber
- Evaluate effects of prescribed fire on hardwood lumber recovery value based on sawmill studies. Sawmill study conducted in summer 2017 in Hoosier National Forest, slated to occur in 2018 in Mark Twain National Forest.
- In summer 2018, conduct inventories of prescribed-fire sites in Wayne National Forest (OH) and Daniel Boone National Forest (KY) to incorporate eastern portion of the Central Hardwood region
- Preparing sites and forming baseline for upcoming study on the effects of prescribed fire on hardwood regeneration

Conclusions

- Number of fires occurring on a site appears to have a strong effect on both the likelihood of fire damage occurring, and the likelihood of fire-related wounds leading to grade reduction
- Aspect appears to be a significant predictor of likelihood of tree grade being reduced due to fire damage, indicating that site conditions can have an important effect on value losses associated with prescribed-fire
- Future analysis using modeling software (FVS) will paint a clearer picture of the economic effects of prescribed-fire.



Example of a red oak board experiencing value loss due to prescribed fire (lumber recovery study in Hoosier National Forest)

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