

Managing for Northern Hardwoods at the Landscape Scale: The Role of Family Forest Owner Preferences

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Abstract.—Managing northern hardwood forests using high frequency, low intensity silvicultural systems—such as single-tree selection—favors shade-tolerant species and can reduce tree species diversity. Management decisions among family forest owners (FFOs) can affect species and structural diversity within northern hardwood forests at regional scales. We surveyed FFOs in the western Upper Peninsula (WUP) of Michigan to understand likely future use of three silvicultural treatments: single-tree selection, shelterwood, and clearcut. Our results indicate FFOs were most likely to implement single-tree selection and least likely to implement clearcut within the next 10 years. According to logistic regression, prior use of a treatment and perceived financial benefits significantly increased the odds of likely use for all three treatments. Having received professional forestry assistance increased likely use of single-tree selection but decreased likely use of shelterwood. We discuss these results within the context of species diversity among northern hardwood forests throughout the region.

INTRODUCTION

Single-tree selection is often a preferred silvicultural system in northern hardwood forests among forest managers (Pond et al. 2014). However, recent research has shown that applying single-tree selection over multiple cutting cycles can result in conditions that strongly favor shade-tolerant sugar maple (*Acer saccharum*) over less shade-tolerant species, with implications for reduced tree species diversity (Hupperts et al. 2019). Misapplication of this system, which is associated with deviations from the Arbogast (1957) and other silvicultural guidelines, is also common (Pond et al. 2014). Combined, these factors motivate interest to explore alternative silvicultural methods when managing northern hardwood stands (Hupperts et al. 2020), with an objective of increasing species and structural diversity at landscape scales. Efforts to manage northern hardwoods across property lines are challenged by a mosaic of private and public forest owners, whose objectives, management history, and planning horizons can differ greatly (Bergman and Bliss 2004).

Family forest owners (FFOs) own a significant portion of the forested land in northern hardwood regions and their decisions affect the provision of ecosystem services at multiple scales (Aguilar and Kelly 2019). This study seeks to better understand the preferences and likely implementation of three silvicultural treatments among FFOs in the western Upper Peninsula (WUP) of Michigan. This research is linked to the Northern Hardwood Silvicultural Experiment to Enhance Diversity (NH-SEED) that was initiated in 2017 on the Ford Research Forest at Michigan Technological University (Webster et al. 2023, these proceedings). Thus, we only focused on the three main silvicultural methods used in NH-SEED: single-tree selection, shelterwood, and clearcut.

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Few studies have focused on FFOs familiarity with and likely future use of specific silvicultural methods. Specifically, understanding WUP FFOs willingness to implement treatments other than single-tree selection in northern hardwood stands will illuminate the potential for increasing structural diversity across the region. The results of this study will also inform efforts to coordinate ecosystem management across ownerships, such as landowner cooperatives. In that regard, information about FFO treatment preferences can help forestry professionals plan treatments on industrial and public forest land that consider the likely treatments applied to family forests in the region.

We hypothesized that expected outcomes regarding financial benefits, aesthetics, and wildlife habitat would affect FFOs' willingness to use each method. Additionally, we hypothesized that owner demographics and the characteristics of their property would affect implementation of each treatment.

METHODS

Using tax data, a simple random sample of 1,600 FFOs who owned at least 20 acres or more of contiguous forest land in the WUP were selected to be included in the mailing list. The survey booklet included questions to measure respondents' familiarity with the harvest treatments, their past use of treatments, and the likelihood that they would implement each treatment within the next 10 years. Respondents were shown images of each treatment from the NH-SEED study site and provided a short description of each treatment. The survey received a response rate of 31 percent. Descriptive statistics and logistic regression models with odds ratios were used to estimate the effects of explanatory variables on the probability that a landowner would implement a treatment in the next 10 years.

RESULTS AND DISCUSSION

Respondents reported being moderately or extremely familiar with terminology in the following order: clearcut (87 percent), single-tree selection (57 percent), and shelterwood (28 percent). About half of respondents reported previously implementing single-tree selection (52 percent) and of those respondents, 87 percent were either satisfied or very satisfied with the outcomes. Of the 11 percent of respondents who implemented a clearcut, 73 percent indicated that they were either satisfied or very satisfied with the outcome. When asked which of the three treatments they were most likely to implement in the next 10 years, a majority (66 percent) indicated they were most likely to use single-tree selection, while nearly 19 percent of respondents selected shelterwood and less than 4 percent selected clearcut.

According to the regression analysis, three variables were significant at the $\alpha = 0.10$ level for all three treatments: having conducted a commercial harvest previously, having experience with a given treatment, and the importance of financial factors when considering likely use of a treatment. Odds ratios for landowners who had previously conducted a commercial harvest were less than one for all three models, indicating that the odds of using a treatment again were less than the odds of not using a treatment.

Previous use of a given treatment resulted in an odds ratio greater than one, indicating likely future use of that treatment. Financial factors proved to be a strong motivator with greater-than-one odds ratios across all treatments. Unlike shelterwood and single-tree selection, which had positive significant results for landowners concerned about wildlife habitat, there were no positive significant results for the clearcut method other than financial factors.

Table 1.—Harvest method most likely to be implemented by respondents (n = 455)

Method	% of Respondents
Clearcut	4%
Shelterwood	19%
Single-tree selection	67%
None	11%

Single-tree selection was clearly the preferred method among FFOs in this study (Table 1). However, our results show that there is interest among landowners in implementing more intensive methods, especially when financial benefits were considered. Aesthetic concerns did not result in significantly negative results for the likelihood of FFOs to implement clearcut or shelterwood, which also means there is an opening for forestry professionals to introduce these methods in their work with landowners.

Past research has shown that landowners who receive assistance are more likely to engage in forest management activities (Kilgore et al. 2015). In this study, landowners with management plans written by a professional forester were 2.6 times more likely to use single-tree selection. This suggests that future use of a single-tree selection system among FFOs may be influenced by prescriptions written by consulting foresters which, in turn, reflect a regional norm regarding the use of a selection system to manage northern hardwoods.

The Upper Peninsula has some history with cooperative ecosystem management (Beyer et al. 1997) that could prove relevant given the results of this study. Cooperative management of forests across land ownership types and boundaries would give FFOs in the WUP greater access to professional expertise and management options. Implementing alternatives to single-tree selection on a landscape scale would prove less challenging with a cooperative agreement in place. The results of this study could help inform such efforts and guide management decisions across ownership types.

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