From Soup to Nuts: A Single Tree Selection Harvest from Conception to Completion

Bradley M. Hutnik[1]

Abstract.—Throughout the range of the northern hardwood cover type, single tree selection is one of the most commonly prescribed natural regeneration systems. Unfortunately, being a common prescription does not necessarily mean that it is commonly implemented properly. This paper provides a case study for single tree selection management as implemented by Wisconsin Department of Natural Resources Foresters in northern Wisconsin. It reviews stand assessment, prescription writing, marking guide development, and timber marking. This case study also examines lessons learned. These lessons learned include a general lack of familiarity with the tenets of single tree selection. They also include a lack of consensus about what acceptable growing stock (AGS) means for saplings and non-sawtimber size class trees.

INTRODUCTION

Single tree selection has the unique distinction of being both one of the most widely prescribed and most misunderstood northern hardwood natural regeneration systems in the Lake States (Pond et al. 2014). As a silvicultural method, it is designed to regenerate and maintain uneven-aged stands by consistently removing trees in all size classes throughout the stand at regular intervals. Single tree selection stands are maintained at each stand entry by establishing or releasing new age classes, tending trees to develop desirable growing stock, and harvesting mature trees to reallocate growing space to new age classes (Nyland et al. 2016). In practice, it is often confused with intermediate thinning or simply the marking of individual trees. While this may seem innocuous, the potential consequences may include stand growth rates which do not meet expectations, diminished yield due to low residual stocking (cutting too heavily), and compromised regeneration due to insufficient disturbance (cutting too lightly) (Pond et al. 2014). More recently, forest managers have begun to explore other silvicultural methods with more ecological precedent and less perceived rigidity (Seymour and Kenefic 1998). Nevertheless, properly applied single tree selection prescriptions and marking guides have utility for many landowners. This paper provides a thorough case study of a single tree selection management and walks through stand assessment, prescription writing, marking guide development, timber marking, and lessons learned along the way.

BACKGROUND

The stand utilized for this case study, HCHLWA 1, is located on the Hay Creek-Hoffman Lake Wildlife Area, Ashland County, Wisconsin. For this stand, the management goal is to maintain a relatively diverse northern hardwood stand with high vertical and horizontal structural diversity for both wildlife habitat and timber production. At project initiation, HCHLWA 1 was dominated by sugar maple (*Acer saccharum*) sawtimber and poletimber, with 76 percent of the stocking in sugar maple (Fig. 1). The forest habitat type classification for this stand is ATM (*Acer-Tsuga/Maianthemum*) / ATD (*Acer-Tsuga/Dryopteris*) (Kotar et al. 2002). The stand quadratic mean diameter was approximately 10 inches diameter at breast height (d.b.h.) with 135 ft^2/acre basal

[1] Silviculturist and Forest Ecologist, Division of Forestry, Wisconsin Department of Natural Resources, 101 S. Webster St., Madison, WI 53707. To contact, call 608-574-5642 or email Bradley.Hutnik@wi.gov.

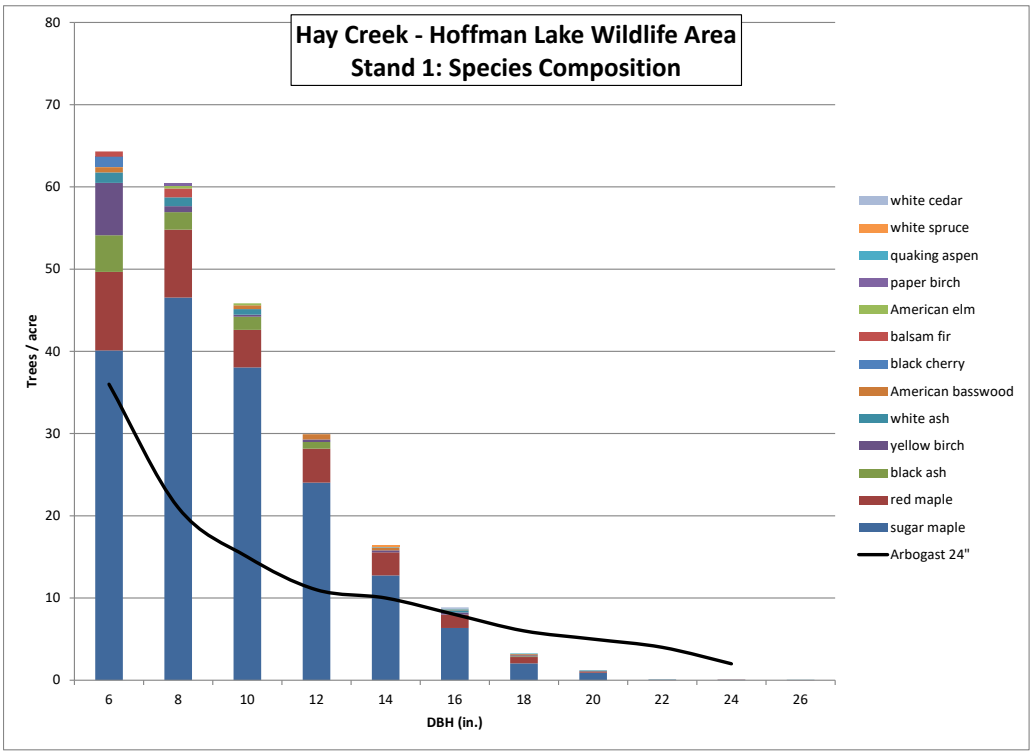

Figure 1. — HCHLWA 1 overstory species composition and diameter distribution.

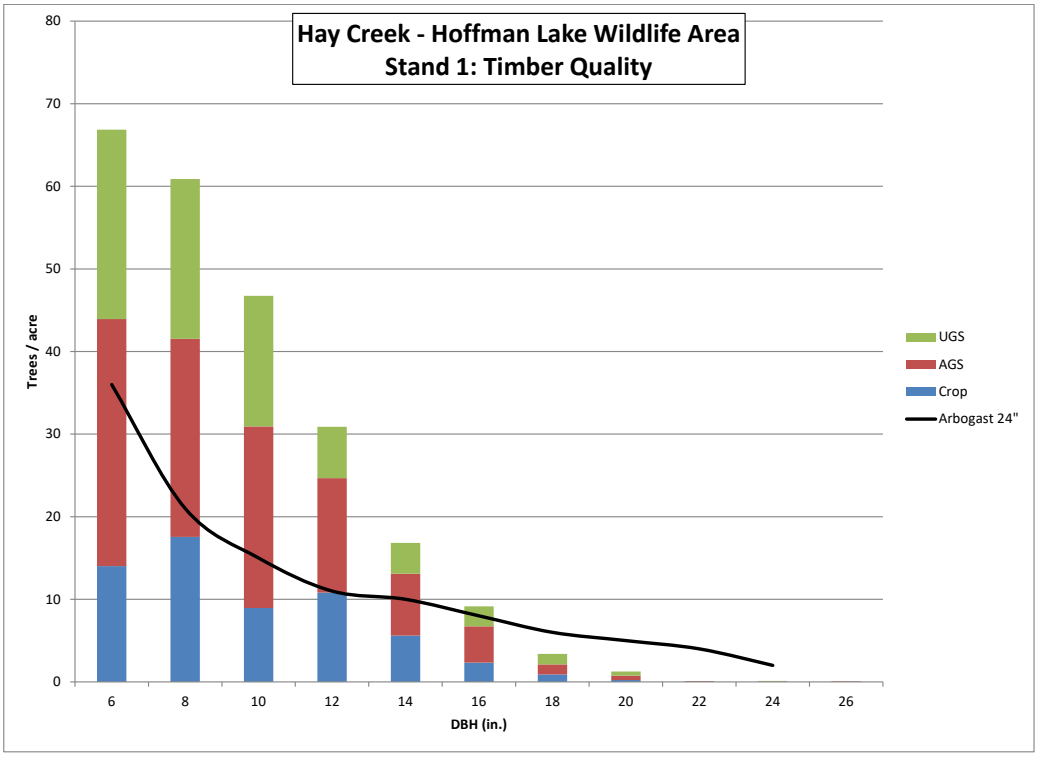

Figure 2. — HCHLWA 1 overstory growing-stock status and diameter distribution.

area. Age class diversity however was assumed to be absent. The understory was open, with sugar maple seedlings mostly less than 1 foot in height. However, where gaps occurred in the stand, sugar maple saplings were present. Overall, tree quality and potential were good with 67 percent of pole timber, 79 percent of small sawtimber, and 69 percent of large sawtimber meeting an acceptable growing-stock (AGS) status. (Fig. 2).

Table 1. — HCHLWA 1 single tree selection marking guide worksheet

			Current Stand		Residual Target						
	DBH	BA/tree	Total trees	Total BA	Target Trees	Target BA	Tree Difference	BA Difference	Tree Cut %	Harvest Ratio	Harvest BA
Poles	6	0.2	45.00	7.00	36.00	5.8	9	1.20			
	8	0.3	32.00	10.00	21.00	6.3	11	3.70			
	10	0.5	49.00	24.00	15.00	7.3	34	16.70			
Sm. Saw timber		Class Total	126.00	41.00	72.00	19.4	54	21.60	42.86%	1 out of 3	15 BA
	12	0.8	31.00	23.00	11.00	7.9	20	15.10			
	14	1.0	19.00	19.00	10.00	9.9	9	9.10			
Lg. Sawtimber		Class Total	50.00	42.00	21.00	17.8	29	24.20	58.00%	1 out of 2	20 BA
	16	1.3	12.00	16.00	8.00	10.5	4	5.50			
	18	1.7	5.00	8.00	6.00	10	-1	-2.00			
	20	2.1	1.00	2.00	5.00	10.3	-4	-8.30			
	22	2.3	0.00	0.00	4.00	10.1	-4	-10.10			
	24	3.0	0.00	0.00	2.00	6	-2	-6.00			
The Great Beyond		Class Total	18.00	26.00	25.00	46.9	-7	-20.90	-38.89%	High Risk	<5 BA
	26	3.6	0.00	0.00	0.00	0	0	0.00			
	28	4.1	0.00	0.00	0.00	0	0	0.00			
	30	4.7	0.00	0.00	0.00	0	0	0.00			
	>30	5.0	0.00	0.00	0.00	0	0	0.00			
			0.00	0.00	0.00	0	0	0.00	0.00%	High Risk	<5 BA
			194.00	109	118.00	84.1	76	24.90			

STAND ASSESSMENT

To determine if single tree selection was a suitable alternative for stand management, managers assessed stand history, site potential and operability, stand stocking and quality, stand age/structure, and regeneration as well as deer herbivory and interfering vegetation utilizing the "Checklist for Evaluating Northern Hardwood Stand Management Options[2]", a tool designed to help foresters identify the full suite of management options prior to developing a silvicultural prescription. Unlike a dichotomous key, the checklist format recognizes many "right answers," or ways to achieve a desired future condition. In application, it relies on local knowledge and professional judgement to choose the best alternatives. This assessment concluded that single tree selection was a plausible management alternative.

PRESCRIPTION AND MARKING GUIDE

Having identified single tree selection as the preferred option, the managers utilized a worksheet to identify and quantify target and actual stand conditions. In this case study, the comparison utilized four diameter size classes (Table 1). The target condition was identified using the BDq method. The target condition was:

- Residual basal area (B): 84 ft^2/acre
- Maximum diameter (D): 24 inches d.b.h.
- q factor: Arbogast Curve, which consists of multiple q factors (Arbogast 1957).
- Stand re-entry: approximately 15 years

[2] Wisconsin Department of Natural Resources (WDNR), in press, State of Wisconsin Silviculture Handbook (2431.5).

Based on the comparison of target and actual stand conditions, the percentage of trees to be marked, the ratio of trees to be removed vs. retained, and the basal area to be removed in each size class were identified. These marking considerations, along with other marking guide elements such as leave tree priority and additional gap placement criteria were included in contract marking specifications. Contract marking and volume estimation bids varied widely, perhaps reflecting a local lack of familiarity with single tree selection marking. Bids ranged from a high of $27,756 to the winning bid of $12,893.

In November 2017, HCHLWA 1 was let out for timber sale bids. The harvest volume was estimated as 1870 cords of mixed species pulp, 21 MBF (thousand board feet) of sugar maple sawtimber, and 7 MBF mixed species sawtimber. The winning bid is estimated to be $71,685. Note that this sale was on a scale basis so the actual value will reflect the recorded, not estimated, sale volume.

LESSONS LEARNED

There were several notable findings in this case study. First, most foresters associated with this study had not worked with single tree selection harvests using the BDq method. This is by no means a recent development (Filip 1977). As such, there were many questions at each step. Marking contractors were initially hesitant to employ the marking guide as it was more intensive than the single tree selection prescriptions they had used in the past. However, as they became more familiar with the marking guide, they employed it successfully. They became less worried about the multiple size class targets and complexity and started viewing them as "areas of marking emphasis."

In addition, foresters were not used to inventorying stands to support single tree selection prescription development prior to stand marking. In addition, there were concerns that this system was not economically viable. Presale inventory does add to workloads and could be a factor in determining where or how many single tree selection harvests are employed. At least for this sale, economic viability concerns were unfounded.

Finally, a factor which garnered much discussion related to single tree selection applicability was the use of AGS trees in smaller size classes as a surrogate for true age class diversity. Foresters in the Lake States are familiar with prescriptions designed to aid in the conversion of northern hardwood stands from an even-aged to an uneven-aged condition (WDNR 2017). These even-aged to uneven-aged conversion prescriptions generally stipulate thinning from below in concert with installation of gaps. This is supported by recent work that has shown smaller diameter trees in even-aged stands do not reflect the same growth dynamics as similar trees in uneven-aged stands (Bassil et al. 2019). However, the lack of stand age data across multiple size classes hinders use of this information. Development of acceptable and unacceptable growing-stock status definitions for advance regeneration which incorporate age indicators and compliment overstory age and quality assessment may be a way forward.

ACKNOWLEDGMENTS

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