Cutting Methods in Northern Hardwoods

"Ecology and Silviculture of Northern Lake States Forests"

A research work unit of the USDA Forest Service North Central Research Station

1831 Hwy 169 E.
Grand Rapids, MN 55744

218-326-7100

For more information, contact Christel Kern (218-326-7133) or Brian Palik (218-326-7116)

Study Briefing

Established 1952, Argonne Experimental Forest, Wisconsin

Purpose: In 1952, the North Central Research Station installed a "cutting methods" experiment in second-growth, northern hardwoods on the Argonne Experimental Forest in northern Wisconsin, USA. The study contrasts a range of silvicultural treatments (both even-age and uneven-age management) for their efficacy at meeting timber production and regeneration objectives. The forest is dominated by sugar maple (averaging 63% of overstory basal area), with lesser amounts (4-9% basal area each) of white ash (*Fraxinus americana* L.), yellow birch (*Betula alleghaniensis* Britton), basswood (*Tilia americana* L.), hemlock (*Tsuga canadensis* L.), and red maple (*Acer rubrum* L.) The site supports potential for quality northern hardwoods with site indices of 65 for sugar maple and yellow birch and 70 for basswood (50 year base). Soils are predominantly sandy loams of the Argonne-Sarwet series, while the habitat type is largely *Acer/Osmorhiza-Caulophylum*. At the time of study establishment, the forest was approximately 50 years old.

Study Design:
The experiment uses a randomized block design, consisting of three blocks and six treatments assigned randomly within each block. Treated stands are one hectare in size.

Control treatment, 2004

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Even-age treatments include i) diameter-limit cutting and ii) shelterwood. The diameter limit treatment removed all trees greater than 20 cm diameter at 30 cm stem height. Residual basal area averaged 5.3 (2.2 (sd)) m^2/ha in 1952. The shelterwood treatment was cut to 60% crown cover or about 9.2 m^2/ha in 1957. The shelterwood overstory was removed in 1964.

Shelterwood, 2004

Diameter Limit, 2004

Uneven-age treatments included three levels of individual tree selection: i) light (20.6 m^2/ha residual basal area), ii) medium (17.2 m^2/ha residual basal area) and iii) heavy (13.8 m^2/ha residual basal area). These treatments removed trees larger than 4.6 inches in diameter and were applied six times (1952, 1962, 1972, 1982, 1992, and 2002). The amount of basal area removed from the uneven-age treatments are listed in Table 1. Marking in the selection treatments followed the BDq method, where B is residual basal area, D is maximum diameter (61 cm) and *q* (1.3) is the diminution quotient, a value that reflects the ratio of the number of trees in diameter class *a*, to the number in diameter class *a+1*.

Light selection

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Medium Selection

Heavy Selection

Research History:

The trees were measured at ten year intervals but have been measured annually for the past decade. In 1990, a herbaceous survey was conducted.

This study is used annually for silvicultural trainings.

Publications:

Niese, J.N. and Strong, T.F. 1992 Economic and tree diversity trade-offs in managed northern hardwoods. Canadian Journal of Forest Research 22: 1807-1813.

Strong, T.F., Erdmann, G.G., and Niese, J.N. 1995. Forty years of alternative management practices in second-growth, pole-size northern hardwoods. I. Tree quality development. Canadian Journal of Forest Research 25: 1173-1179.

Niese, J.N., Strong, T.F., and Erdmann, G.G. 1995. Forestry years of alternative management practices in second growth, pole-size northern hardwoods. II. Economic evaluation. Canadian Journal of Forest Research 25: 1180-1188.

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Rollinger, J.L. and Strong, T.F. 1996. Carbon storage in managed forests of the northern Great Lake States. USDA For. Serv. Gen. Tech. Rep. NE-214. pp. 203-207.

Strong, T.F. 1997. Harvesting intensity influences the carbon distribution in a northern hardwood ecosystem. USDA Forest Service Res. Pap. NC-329, 7p.

Strong, T.F. 1999. Productivity of even-aged, second-growth northern hardwoods brought under uneven-aged management. In: Conf. Proc. Of Improving Forest Productivity for Timber…. A key to Sustainability. Duluth, MN. Dec. 1-3, 1998. 7p.

You can also look up these additional reports in the Knowledge Store (http://ncrs.fs.fed.us/pubs/) :

- General Technical Report NC-39.
- Research Paper NC-139
- Northern Hardwood Notes
- General Technical Report NC-39
- Research Paper NC-54

Investigators:

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