Managing for Quality Hardwoods and Multiple Age Classes

Tom Parkin[1]

OVERVIEW

A selection system was applied to an uneven-aged stand consisting of mature northern hardwoods. Through group and individual selection on a 10- to 20-year cutting cycle, red maple[2] and sugar maple were drastically decreased in basal area to promote the growth of quality crop trees and allow greater structural diversity in the stand.

SILVICULTURE OBJECTIVE

In northern hardwood stands, Aitkin County (Minnesota) would like to increase the species diversity, reduce the abundance of sugar maple, and promote the growth of quality hardwoods, such as American basswood, northern red oak, and paper birch.

Through individual or group selection harvesting, Aitkin County would also like to maintain uneven-aged stand character with three or more age classes. The current northern hardwoods cover type will be maintained after the treatment. Promoting a multi-aged stand maximizes forest regeneration and stand quality. The stand will be tended using variable density thinning to mimic the horizontal structural diversity found in an unmanaged stand, as well as to promote the dominance of northern red oak and paper birch. In addition, snags, den trees, mast trees, and vertical stratification should be retained to provide wildlife habitat.

SILVICULTURAL PRESCRIPTION

Apply group and individual selection cuts to maintain an uneven-aged system to promote three or more age classes and release crop trees. The creation of varying gap sizes allows for regeneration of shade tolerant and intolerant species and further promote multiple age classes. With harvests occurring on cycles between 10 and 20 years, one-third of the stand basal area should be removed with each cutting cycle. Individual trees selected for harvest are marked based on risk, defect, vigor, crown competition with dominant crop trees, or release of advanced regeneration. Areas selected for group harvest are chosen based on forest inventory data and were designed to leave 20 merchantable trees per acre. Best management practices are to be followed by retaining snags, slash, and residual trees. Leaving coarse woody debris and residual trees not only increases the structural diversity of the stand, it also provides wildlife habitat and protects water resources that could be affected by harvest operations. Basal area should be primarily removed from red maple and sugar maple to decrease the abundance of these species in the stand. Black ash, paper birch, American basswood, and northern red oak must also be reduced in basal area, but at a smaller magnitude than red maple and sugar maple. The paper birch and northern red oak present are quality but represent a limited portion of the stand. In addition, advanced northern red oak regeneration is present. Therefore, group selection harvests should be used to maintain northern red oak and paper birch throughout the stand.

[1] Senior Forester, Aitkin County Land Department, 502 Minnesota Avenue N., Aitkin, MN 56431. To contact, call 218-927-7364 or email tom.parkin@co.aitkin.mn.us.

[2] Scientific names of trees mentioned in this paper are listed in Table 1.

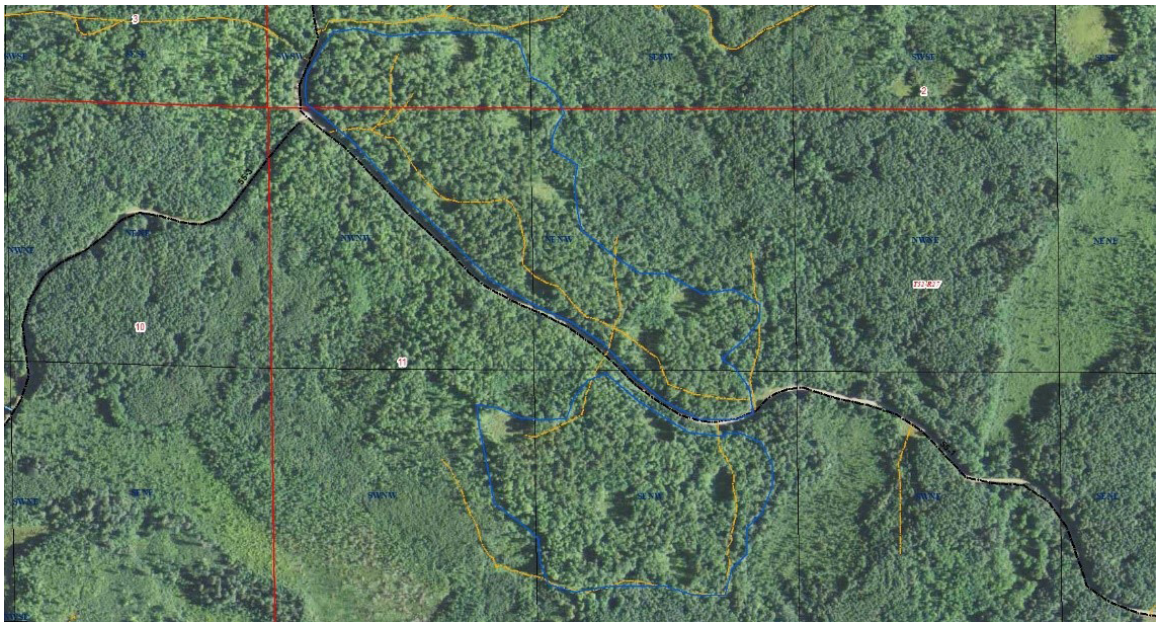

Figure 1.–Aerial view of harvest-created canopy gaps and residual stands after harvest.

TREATMENT

During the winter of 2010–2011, using group selection harvesting, trees were removed from 10 "holes," or gaps, that ranged from a 0.5 acre to 1 acre (Fig. 1). These holes together added up to about 23 percent of the stand. During this time, individual selection cutting also occurred throughout the stand. White pine (*Pinus strobus*) stumps were found throughout the stand from previous logging operations, so it would be beneficial to plant white pine saplings in shaded portions of the stand to restore their presence.

Minnesota's forest management guidelines (FMGs) were applied and included snags, slash, and residual trees being left throughout the stand to maintain structural diversity and sufficient wildlife habitat. Adequate access was left to allow for planting and bud capping (browse protection) in the future.

Total basal area was reduced from 128 ft^2/acre to 85 ft^2/acre, leaving 66.4 percent residual basal area, consistent with the prescription to remove about one-third of the basal area in each treatment. The species that experienced the greatest decrease in basal area were red maple and sugar maple, from 11 ft^2/acre to 5 ft^2/acre and 25 ft^2/acre to 12 ft^2/acre, respectively. In addition, the basal area for basswood was reduced from 76 ft^2/acre to 59 ft^2/acre. A total of 457 cords were extracted during the harvest. Mixed hardwood made up a large portion of that with 389 cords removed. The stand will be reassessed in 10 years to determine the need for variable density thinning, as well as to monitor the status of stand growth, health, and wildlife use.

Table 1.—Average regeneration 2 years (2013) and 5 years (2016) after cutting

Species	Scientific name	2-year regeneration trees/acre	5-year regeneration trees/acre
Northern red oak	*Quercus rubra*	406	864
Sugar maple	*Acer saccharum*	1560	2822
Paper birch	*Betula papyrifera*	84	312
Basswood	*Tilia americana*	34	312
Aspen	*Populus* spp.	425	218
Ash	*Fraxinus* spp.	17	17
Red maple	*Acer rubrum*	50	0

POST-TREATMENT ASSESSMENT

Regeneration was assessed 2 and 5 years after harvest (Table 1).

SUMMARY

A selection system was applied to 65 acres of an uneven-aged stand of mature northern hardwoods in Aitkin County, Minnesota. The management goals involve maintaining a multi-aged system for structural diversity and promoting the growth of quality crop trees. Harvests are to occur on cutting cycles of 10 to 20 years, with the stand harvested using both single tree and group selection. Harvests are to be focused on decreasing the basal area of red maple and sugar maple throughout the stand. Between cutting cycles, variable density thinning is recommended to maintain the growth of northern red oak and paper birch.

Maintaining a multi-aged hardwood stand promotes ecological resilience against climate change and protects wildlife habitat, while also generating revenue from harvesting quality crop trees. Climate change is introducing new pathogens, diseases, migrating species, and shifting habitat ranges. By promoting multiple species in multiple age classes, the impacts of these shifting variables on an ecosystem can be reduced. Multi-aged silviculture systems deal with the uncertainty of climate change by providing a short- and long-term strategy that allows for gradual adaptive adjustments to the changing environment. Multi-aged systems help to sustain ecological integrity, which leads to accommodating change rather than resisting it, as that can bring about a rapid transition that leaves the ecosystem unable to returned to desired conditions. The additional management to remove unhealthy trees and maintain a desirable density will help to increase the viability of the residual trees as well.

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