Chapter 39

Hemlock-Hardwood Cover Type

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Note- this chapter has not been fully revised since the restructuring of the Wisconsin Silviculture Guide, therefore some subject areas may be missing in the current version of this chapter.

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1 TYPE DESCRIPTION

Three major timber types with basal areas consisting of more than 50 percent hemlock occur in Wisconsin:

- White Pine-Hemlock
- Eastern Hemlock
- Hemlock-Hardwood (or Hemlock-Yellow Birch)

This chapter contains guidelines for hemlock and yellow birch.

1.1 Stand Composition and Associated Species

Stand Composition

Mainly eastern hemlock (*Tsuga canadensis*), with yellow birch (*Betula allegheniensis*), eastern white pine (*Pinus strobus*), sugar maple (*Acer saccharum*), and in the eastern part of the state, American beech (*Fagus grandifolia*).

Associated Species

Northern red oak (*Quercus rubra*), red maple (*A. rubrum*), basswood (*Tilia americana*), white ash (*Fraxinus americana*), northern white cedar (*Thuja occidentalis*), paper birch (*B. papyrifera*), and balsam fir (*Abies balsamea*).

1.2 Silvical Characteristics*

Table 39.1. Summary of selected silvical characteristics.

Species	Eastern hemlock	Yellow birch
Cones or Flowers	Late April - early June.	First three weeks in May as trees begin to leaf (monoecious).
Seed or Fruit Ripens	Cones reach full size late August to early September.	Winged nutlet in late July or August.
Seed Dispersal	Mid-October extending into early winter.	Mid-October extending into early winter.
Good Seed Years	Two out of three years.	Every one or two years.
Germination	For best germination, stratify 10 weeks at or slightly above freezing temperature. Exposure to light can break partial dormancy in unstratified seeds. Peak germinative activity when held at a constant 59°F for 45-60 days (Ruth, 1974).	Around 60°F. If not sown in autumn, seeds should be stratified in moist sand at 40°F for at least one month before sowing (Brinkman, 1974).
Seed Viability	Despite regular cone production, seed variability is less than 25 percent.	Seed viability averages 27 percent. The range is 6 to 48 percent. Seeds of highest germinative capacity are those that fall first. Seeds can remain viable for two years.

Species	Eastern hemlock	Yellow birch
Seedling Development	Very slow compared to competitors. First year seedlings develop 1 to 1.5 inches in height and 0.5 inch in root depth. New seedlings easily damaged by drying; 60 to 80 percent are damaged within 6 to 8 hours of drying.	Germination in spring after seed dispersal. Large numbers may germinate but roots may be too weak to pierce leaf litter. If seedlings are protected from sun and wind, humus soils or mineral soil become good seed beds. Survival depends on a combination of temperature, moisture and light. Seedlings cannot survive much competition particularly where moisture is limited. Unless seeds germinate on a favorable seed bed, competing vegetation will overtake and smother seedlings.
Shade Tolerance	Hemlock is one of the most tolerant of all tree species. It is capable of surviving with as little as 5 percent sunlight for many years and can respond vigorously after release.	Moderately tolerant, but 1 to 2 year old seedlings appear to be quite tolerant. As the seedlings develop and age, the amount of sunlight needed for optimal development increases.

* Mainly from Fowells (1965).

2 MANAGEMENT GOALS, LANDOWNER OBJECTIVES

The management objective should be determined in relation to other land management objectives using the habitat type as the preferred indicator of site potential. Possible alternatives for hemlock-yellow birch include managing to produce the maximum quantity and quality of pulpwood and sawtimber and managing stands for aesthetic or wildlife values and for "old growth" potential.

3 LANDSCAPE, SITE, AND STAND MANAGEMENT CONSIDERATIONS

3.2 Site and Stand Considerations

3.2.1 Soils

The soil criteria for hemlock varies but typically soils are moist and well-drained. Preferred soil types include upland sandy loams, loamy sands, loams, and silt loams. Preferred soil types for yellow birch are loams and shallow silt loams.

The primary landforms associated with the above soils and habitat types include end moraines, ground moraines, drumlins, outwash, and lacustrine deposits.

3.2.2 Site Quality

3.2.2.1 Range of Habitat Types

Habitat Type	Soil Nutrient Regime
TMC (Tsuga/Maianthemum-Coptis)	medium
ATM (Acer-Tsuga/Maianthemum)	|
ATD (Acer-Tsuga/Dryopteris)	|
AFD (Acer-Fagus/Dryopteris)	|
AViO (Acer/Viola-Osmorhiza)	|
AH (Acer/Hydrophyllum)	rich

Hemlock does not constitute 50 percent of basal area on AOCa or AH but they are included here for comparison. Yellow birch is a constant companion of hemlock on all habitat types because the two species, despite their significantly different shade tolerance, have very similar germination requirements.

5 SILVICULTURAL SYSTEMS

The even-age (shelterwood) system can be successfully employed in managing hemlock and yellow birch. However, difficulties in securing regeneration of both species are a possible limitation of the uneven-aged selection system.

5.1 Seedling / Sapling Stands

The early growth of eastern hemlock is very slow, especially where overstory suppression occurs. Established sapling stands should be released to full sunlight to stimulate growth. Allow saplings to then develop naturally.

For increased diameter growth and crown development on yellow birch, do an early crown release prior to 16 years of age. In relatively pure stands of yellow birch, 100 released crop trees per acre -- well-spaced (21 ft. apart) -- will produce 75 final harvest trees per acre, each more than 18 inches DBH. Crown release by cutting all trees whose crowns are within 10 ft. of the crop trees.

5.2 Intermediate Treatments

5.2.2 Thinning

Pole Timber Stands

Growth of eastern hemlock during the pole stage also tends to be slow due to overstory suppression of faster growing species and crowding. Although pole stands can be suppressed for many years, good stem form and live crown ratio are retained. Suppressed and crowded pole stands should be released or thinned to maintain vigor. Thin from above those trees that suppress hemlock. Selectively thin from below those low vigor trees exhibiting seams, rot, many dead branches, or butt log injury. These external defects indicate internal decay and shake which are common in hemlock.

For commercial thinnings in stands of hemlock and hemlock-yellow birch, refer to Figure 39.1. This stocking chart for even-age management identifies two levels of management relating to the proportion of the hemlock component.

The lower B'-level of residual stocking applies to stands with 20 to 49 percent hemlock. The upper B-level applies to stands with more than 50 percent hemlock. Growing space requirements for stands that are predominantly hemlock are not as great as those for stands that are predominantly hardwood mixtures; consequently residual basal area levels are higher.

Sawtimber Stands

To maintain vigor and prevent overcrowding, thin to the appropriate stocking levels as indicated in Figure 39.1 (even-age stocking curves), selectively removing low-vigor trees from below to favor hemlock. In heavily stocked stands (200 sq. ft. or more per acre) not more than one-third of the total basal area should be removed at one time. In even-age management, these thinnings can be conducted before rotation age.

Favor yellow birch crop trees with a crown release. Cut all trees within 10 ft. of the crop tree crown. A crown release can double the diameter of pole-sized yellow birch in 10 years.

5.3 Natural Regeneration Methods

5.3.1 Even-Age Regeneration Methods

Even-age management is the preferred system of managing eastern hemlock. Generally, the economic rotation age is 150 years and the biological rotation age is 320 years.

Even-age management is also the preferred system of managing yellow birch. Where yellow birch is present, favor yellow birch dominants and co-dominants. Approximate rotation ages for yellow birch are similar to hemlock on most sites.

The stocking chart for yellow birch can be found in Chapter 40 (Figure 40.9).

5.3.1.1 Shelterwood

The shelterwood system is the best method of regenerating hemlock and yellow birch at rotation age, because it can provide the warm, moist environment required by hemlock-yellow birch silvics to obtain seed germination and prevent seedling desiccation. The shelterwood system can be implemented with the following sequence:

1. Thin the stand from below to 70 to 80 percent crown closure. Favor the best dominant hemlock and yellow birch trees for high shade and superior genetic seed source potential. Discriminate against tolerant, less desirable hardwood species, i.e., sugar maple or red maple. Avoid making large openings in the canopy.
2. Shallow scarification of at least 50 percent of the ground area, after leaf fall and before cutting, thoroughly mixing humus and mineral soil, provides an optimal seed bed.
3. Kill or remove advance hardwood (i.e., sugar maple, red maple) reproduction by mechanical or chemical means.

4. Directly seed one-half pound of hemlock seeds per acre. Seeding can be done in early winter to prevent rodent damage and to promote natural seed stratification.
5. When hemlock-yellow birch reproduction is established (3 to 5 ft. tall) partially or completely remove the overstory. Winter logging is preferred to provide protection for hemlock and yellow birch seedlings.
6. Hemlock reaches the western limit of its natural range in Wisconsin; consequently we should expect a certain percentage of regeneration failures when weather conditions are not favorable for seedling germination and establishment. Occasional dry years are normal in a continental climate.

8 APPENDICES

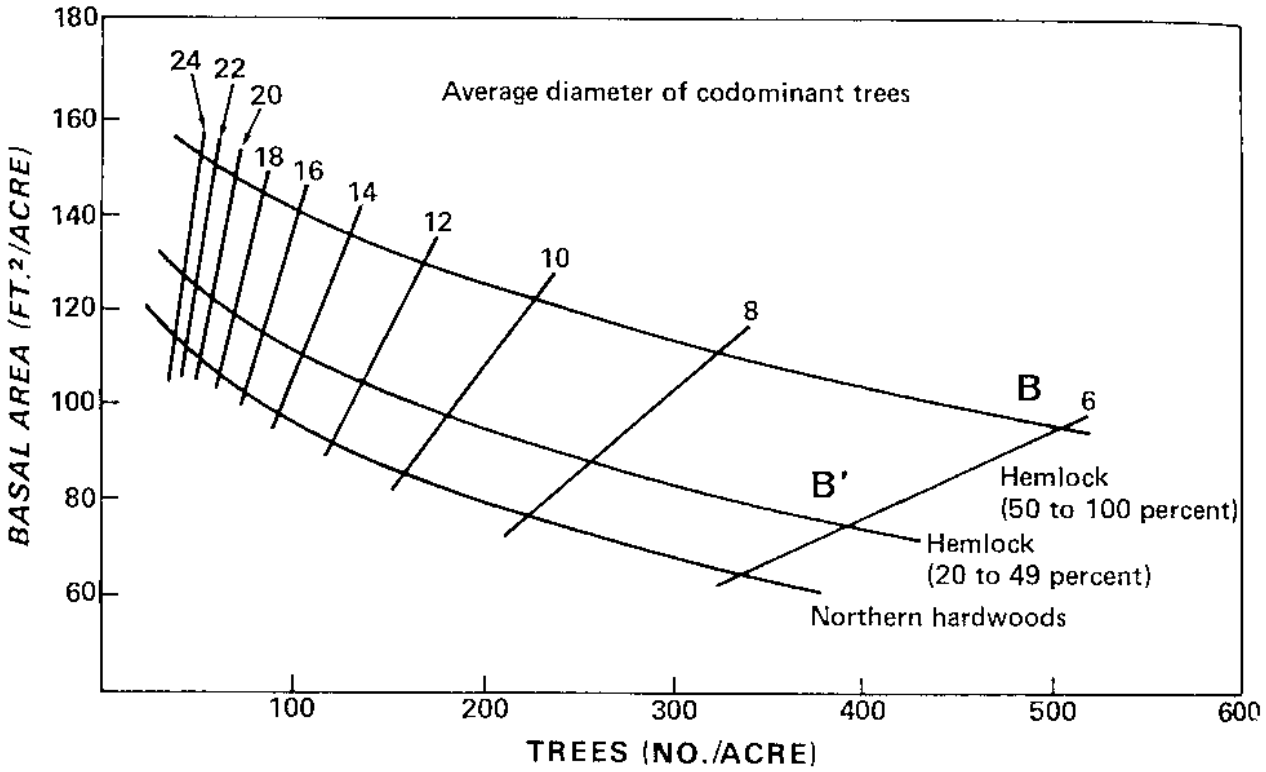

Figure 39.1. Residual stocking levels (B and B'-levels) for even-aged hemlock stands based on number of trees, mean stand diameter, and basal area per acre (Tubbs, 1977).

The lower B'-level of residual stocking applies to stands with 20 to 49 percent hemlock. The upper B-level applies to stands with more than 50 percent hemlock. Growing space requirements for stands that are predominantly hemlock are not as great as for stands that are predominantly hardwood mixtures so residual basal area levels are higher.

Table 39.2. Residual stand structure for hemlock designed for 130 sq. ft. of residual basal area, up through the 18-inch DBH class.

DBH class (inches)	Trees per acre (number)	Basal area per acre (sq. ft.)	Percentage distribution
6	58	11	
8	44	15	
10	34	19	
Subtotal:	**136**	**45**	**35 percent**
12	26	21	
14	20	21	
16	15	22	
18	12	21	
Subtotal:	**73**	**85**	**65 percent**
Total:	**209**	**130**	**100 percent**

Table 39.3. Residual stand structure for hemlock, for fully regulated uneven-aged stands, with residual basal area 130 square feet per acre (trees ≥5" dbh) and maximum diameter class 30 inches, for 2 inch diameter classes and q-factor 1.3

DBH class (inches)	No. of Trees per acre	No. of Trees by size class	Basal Area (sq. feet / acre)	Basal Area by size class
6	33	58	6	15
8	25		9	
10	19	54	11	47
12	15		12	
14	11		12	
16	9		12	
18	7	19	12	44
20	5		11	
22	4		11	
24	3		10	
26	2	5	9	24
28	2		8	
30	1		7	
Total (per acre)	136		130	

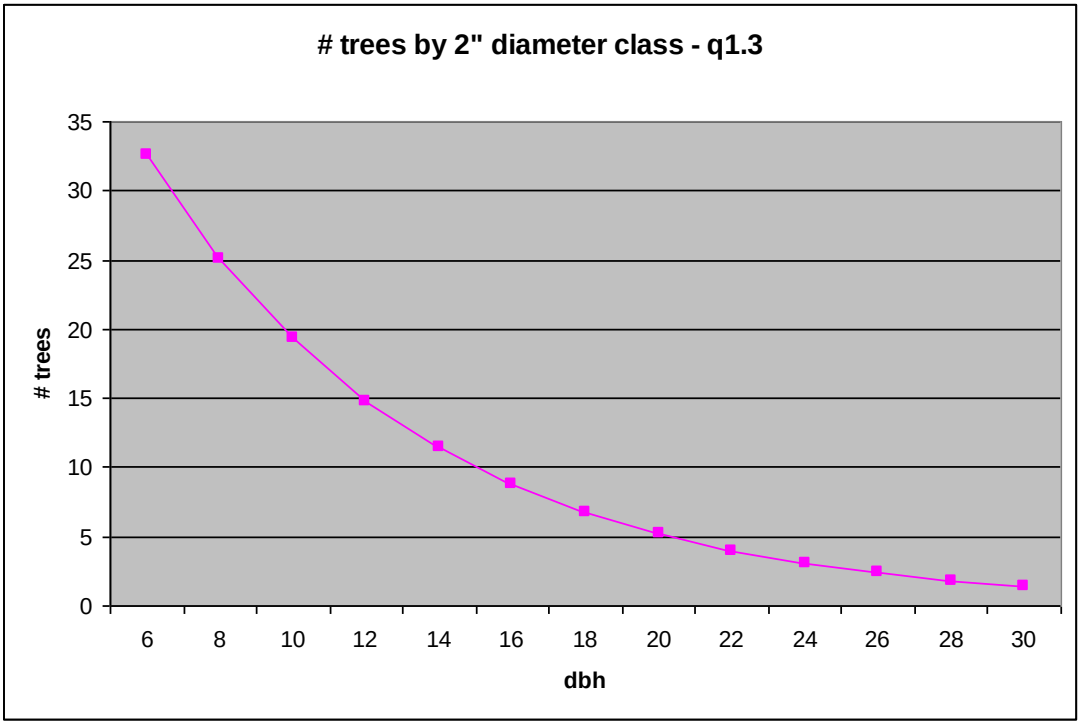

Figure 39.2. Maximum diameter class 30 inches, for 2-inch diameter classes and q-factor 1.3.

9 REFERENCES

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