CHAPTER 47

BOTTOMLAND HARDWOOD TYPE

TYPE DESCRIPTION

A. Stand Composition

The bottomland hardwood type is associated with flood plains and stream/river bottoms, primarily in the southern two-thirds of Wisconsin. When the bottomland hardwood community is found further north, it can be regionally significant and may provide important habitat for uncommon or rare species.

The major commercial tree species are **eastern cottonwood** (*Populus deltoides*), **green ash** (*Fraxinus pennsylvanica*), **river birch** (*Betula nigra*), **swamp white oak** (*Quercus bicolor*), and **silver maple** (*Acer saccharinum*). Unfortunately, Dutch elm disease has precluded management of **American elm** (*Ulmus americana*).

Cottonwood is commonly found along streams and bottomlands in the southern two-thirds of Wisconsin. An excellent pioneer of recently disturbed sites, cottonwood requires a continuous supply of moisture throughout the growing season. Cottonwood grows best on medium textured soils with good internal drainage; growth is poor on excessively wet sites and areas of impeded drainage.

Green ash is usually confined to bottomland sites. However, it will grow well when planted on moist upland sites. In Wisconsin, it is most commonly found on wet, rich alluvial soils in the southern half of the state.

River birch occurs at the northern edge of its range in southwestern Wisconsin. It extends north along the Wisconsin River to Stevens Point and the Mississippi River to Lake Pepin. It prefers deep rich alluvial soils that are sometimes flooded for weeks at a time.

Swamp white oak commonly occurs on wet sites characterized by hardpan or areas subject to flooding. In Wisconsin, it is most commonly found as a component of bottomland hardwoods.

Silver maple is characteristically a bottomland species, common within alluvial flood plains. It occurs on all major soil types, but is more common on medium to fine textured soils.

American elm was an important component of bottomland forests, but Dutch elm disease has killed most large elm. Elm seedlings and saplings may be locally abundant but are not generally favored by foresters due to continuing disease problems.

C. B. Associated Species

Other tree species that commonly occur with bottomland hardwoods include: hackberry (*Celtis occidentals*), bur oak (*Quercus macrocarpa*), black willow (*Salix nigra*), basswood (*Tilia americana*), black ash (*Fraxinus nigra*), red maple (*Acer rubrum*), and red oak (*Quercus rubra*).

C. Soil Preference

Bottomland hardwood forests are intricate and variable ecosystems due to species richness, flooding, ice movement, internal drainage patterns and the pattern of deposition and development of soils is complex. Being associated with waterways that periodically flood, the soils are stratified. Typical soil profiles have horizons of distinctly different textural classes deposited by the stream. Soil textures are often a mixture of organic material, sands, silts, and clays developing complex microsites. The interaction of these variables precludes the development of any single regeneration prescription which will function adequately on most bottomland sites.

SILVICULTURAL CHARACTERISTICS

Many bottomland hardwoods share some adaptive characteristics such as seed production at an early age, frequent and abundant seed crops, immediate germination to take advantage of favorable spring moisture conditions.

Species	Eastern cottonwood	Green ash	River birch	Swamp white oak	Silver maple
Flowers	Dioecious April-May	Dioecious April-May before leaf buds enlarge.	Monoecious April-May	Monoecious May-June	Monoecious Feb.-May; susceptible to frost damage.
Fruit Ripens	May-June	Sept.-Oct. of same year.	May-June	In Sept. and Oct. of the same year.	April-mid June
Seed Dispersal	June to July as seed ripens; seed may be transported miles by wind and water.	In fall and continues through winter. Seed is dispersed by wind. Seed may germinate 1st spring or lie dormant several years.	May-June; Disseminates seed in late spring when water levels recede. Alluvial soil provide excellent seed beds.	Dispersal by gravity, mammals, and moving water.	Seed fall 10-20 days after ripening. Dispersal mainly by wind, occasionally water
Good Seed Years	Annually; poor seed crops rare. Seed production begins at 10 years of age. Optimum seed bearing age is 30 to 40 years of age.	Annual crops common after trees reach 3 to 4 inches DBH. Seed production begins at an early age.	Almost every year.	Every 3 to 5 years with light crops intervening. Minimum seed bearing age is 20 years; optimum age is 75 to 200 years.	Seed production begins as early as 11 years of age. Prolific seeder with good seed crops almost every year.
Germination	Short period of viability, 2 to 3 weeks. Moist exposed mineral soil needed for germination.	Seed may germinate the spring after seed fall or lay dormant for several years.	Shortly after dispersal. Moist mineral soil or freshly exposed soil required.	In autumn shortly after seed fall. Root development continues until temperatures are too low for growth.	Most successful on seedbed of moist mineral soil with considerable organic matter.
Seedling Development	Seedlings exceptionally delicate; susceptible to hard rains, high temperature, and damping-off fungi in first three weeks.	Juvenile growth is rapid. Good competitor against weed species. Strong apical dominance.	Juvenile growth may average 6 to 12 inches in the first year. Germination and growth is inhibited by even moderate shade.	Establishment and early growth is favored on better drained lowland soils.	Saturated soil will often stunt growth. Seedlings cannot compete with overtopping weeds and may die after first year.

Vegetative Reproduction	Propagation by cuttings is usual method of artificial regeneration. Will sprout from low cut stumps less than 25 yrs. old.	Sapling and pole size stumps sprout readily. Stump sprouting of larger size classes is not reliable.	Sapling and pole size stumps sprout. Sprouting of larger size classes is not reliable.	Will stump sprout, with best sprouting on stumps less than 10 inches in diameter.	Prolific sprouting from root collars and lower stems. Best sprouts are from stumps up to 12 inches in diameter.
Growth	Grows rapidly. On better sites may grow 2/3 to 1 inch in diameter and 4 to 5 ft. in height per year up to 25 to 30 years of age.	Reaches average diameter of 18 to 24 in. and height of 50 to 60 ft. Sawlogs usually of lesser quality than white ash.	Average diameter of 12 to 24 inches and heights of 50 to 80 ft.	Relatively long lived, up to 300 years. Average diameters 24 to 36 inches; average heights 60 to 70 ft. with occasional trees to 100 ft.	May live 130 years or more. Have reached diameters of 36 to 48 inches and heights of 90 to 120 ft. Growth most rapid during first 50 years.
Shade Tolerance	Intolerant; must outgrow its competition to survive.	Intolerant to moderately tolerant. Seedlings can survive for 15 years or more in the understory.	Relatively intolerant pioneer species. Often invades fresh alluvial soils.	Intermediate tolerance. Seedlings can be established under moderate shade.	Moderately tolerant to very intolerant depending on site quality. Intolerant on poor sites.

MANAGEMENT ALTERNATIVES

Management objectives should be identified within an ecosystem framework, giving consideration to a variety of objectives within the local and regional landscape. Site index, soils, and vegetation can be used as indicators of site potential. The bottomland hardwood community has important functions and attributes including: flood control, protection of water quality by absorption and filtering of chemical and sediment run-off, timber production, travel corridors for otherwise isolated populations of plants and animals, habitat for a variety of species, including some sensitive, endangered, or rare species, and recreation and aesthetics.

Management alternatives include but are not limited to:

1) Maintaining the forest type. Stand composition and structure may be managed to meet specific objectives within ecological and economic limitations.

2) Allow natural conversion to other species.

3) Reforestation or conversion of severely disturbed stands (e.g., stand that are heavily dominated by reed canary grass or box elder)

SILVICULTURAL SYSTEM

Uneven-age or even-aged management systems may apply depending upon the species composition of the stand, management objectives of the landowner, and regeneration strategies to be implemented. A brief discussion of uneven-aged and even-aged systems are discussed.

Generally, these silviculture guidelines will require site-specific refinement, but they can help prevent or correct some silvicultural disasters. Following are some precautions:

- If the understory is dominated by reed canary grass, cattails or sedges, regenerating the stand will be difficult if not impossible.

- Wind throw can result from partial cuts in stands growing on wet mineral soils, organic soils and sites exposed to periodic winds.

    - Ice flow on river systems can shear or scour established seedlings removing existing reproduction.

    - Deer may concentrate in these stands during winter. Advanced reproduction may be severely browsed in deer yarding areas. Other damage may result from rabbits and beaver.

- Changes in the drainage pattern, culverts, ditches, tiles, compacted skid roads, construction of dams, or removal of dams, can alter the amount and rate of water flowing through the system. Mortality and drastic stand conversion may result from a small change in water table or flow.

Given the almost infinite variability of bottomland hardwood site conditions, as well as the species mix and silvicultural characteristics, selection of the most appropriate silvicultural system should be left to the judgement and experience of the local forest manager.

A. Group selection and irregular shelterwood systems

Technically speaking, group selection is an uneven-aged system that regenerates small groups of even aged trees and results in a stand with many groups of different aged trees. An irregular shelterwood is a system that regenerates patches of even-aged trees resulting in a stand of multiple even-aged patches. Removal of the overstory occurs at irregular times depending upon the regeneration and response of the water table. Integrating group selection and irregular shelterwood into a patchwork application, may provide a feasible management approach. These approaches can be applied to a stand depending on the variability of species, age classes, and sensitive sites sometimes found in bottomland hardwoods.

Under both systems the stand is entered every 5 to 20 years. At each entry canopy gaps of various sizes will be created to establish seedlings or increase the light levels to established seedlings. With the irregular shelterwood method the overstory is slowly removed in 2 to 4 cuts. Maintaining a partial canopy of trees to control both light levels and water table are important aspects of these two systems. Green ash and swamp white oak may be favored in this system because they are somewhat shade tolerant and do not require bare mineral soil for seed germination.

B. Shelterwood

A closed canopy prior to the initial shelterwood cut can benefit the early establishment of intolerant bottomland species, especially silver maple. Under the heavy canopy, the seedbed is maintained relatively free of herbaceous vegetation and 1 to 2 year old silver maple seedlings will often be found. Without additional light these young seedlings do not grow or persist. The goal is to manage the overstory to permit sufficient light, 1/3 - 1/2 full light intensity, for the seedlings to grow without stimulating strong herbaceous competition.

Once established the seedlings should be released before they are 15 feet tall to prevent excessive damage from overstory removal.

C. Clearcut

A common error has been to conclude that since many of the bottomland tree species are shade intolerant, harvesting systems which create large openings will lead to the establishment of the desired intolerant species. Additional light may stimulate an herbaceous ground cover which retards seedling establishment and survival. Without advanced reproduction the composition of the new stand will depend on the sprouting ability of the species harvested, the seeding characteristics of the tree species, and environmental factors.

The following factors should be considered if a clearcut is being prescribed:

1) The river system deposits a layer a fresh silt each year. This provides an ideal seed bed for most of the bottomland hardwood species.

2) Seedlings are established or enough small diameter stumps are present to produce sprouts (sprout origin trees are not as desirable).

3) Cull and non-commercial trees are cut or killed so they do not impede the reproduction.

4) Deer population is low or controlled to prevent overbrowsing of the reproduction.

5) Water table will not rise after logging and there is little danger the site will convert to cattails, reed canary grass, or woody shrubs.

MANAGEMENT RECOMMENDATIONS

Disturbance and successional patterns are difficult to predict on bottomland sites. Research on bottomland hardwoods is limited. Of the published information, much is based on work done in the south and may be of limited value in Wisconsin. Each site and stand is different, therefore specific recommendations are not possible, but certain generalizations can be made from past studies and observations.

Some bottomland sites are very productive with growth rates of 200-800 bd.ft./ac./yr. Unfortunately past cutting practices have high graded many bottomland hardwood stands leaving an accumulation of poor quality trees. Dutch elm disease has also greatly impacted many bottomland stands. Stand history should be investigated before concluding that a site has low growth potential.

Shade intolerant trees often form even aged stands. However, many bottomland stands have more than one age class because of past cutting, loss of the elm component, wind damage, and beaver damage.

Cutting trees will temporarily decrease the amount of evapo-transpiration and may raise the water table. One large maple tree will transpire 150 gallons of water/day during the summer. Forested sites have been converted to cattails, reed canary grass, or woody shrubs as a result of the water table rising following heavy cuts or blow downs. Consider this impact when designing the management system.

Due to the proximity of bottomland hardwood sites to waterways and the wetness associated with these sites, consultation of Wisconsin's Forestry Best Management Practices for Water Quality is recommended.

A. Seedling-sapling stands (0-5")

Partial overhead shade will reduce the survival and growth rates of shade intolerant seedlings. To maintain the desired intolerant seedlings, established seedlings should be released to full sunlight to stimulate growth and survival.

B. Pole stands (5-11")

Good sites, site index 70 or better for featured tree species, may benefit from intermediate stand treatments. Green ash, swamp white oak and silver maple respond well to thinning. Use even-aged stocking charts (see northern hardwood or red maple stocking charts in Chapters 40 and 51) to determine thinning levels. In general, no more than one-third of the basal area should be removed at any one time. If thinning can not be done commercially in pole sized stands, crop tree release can be used to increase the growth and vigor of the potential crop trees.

C. Sawtimber stands (>11")

On good sites, thin stands younger than the desired rotation age or diameter to the B-level or above. Initiate thinning before the A-level is reached. Thinning intervals may vary based on management objectives, site quality, species mix, merchantability and access. Ten to twenty years is common. Stop thinning at approximately three-fourths of the desired rotation age to reduce understory competition at the time of the regeneration harvest.

Rotation age will vary by species mix, stand origin, site quality and management objectives. There is some flexibility in rotation age, however many of species are not long lived, the majority being less than 130 years. Use short rotations, 50-60 years, for stump origin and low quality stands. Green ash can be grown to 18 inches DBH in 80 to 100 years on good sites. Silver maple can be grown to 24 inches DBH or more in 80-110 years on good sites. Swamp white oak is longer lived with trees reaching 300 years on good sites.

D. Regeneration techniques

There are three sources of reproduction in bottomland forests:

1. Advanced reproduction (over 18 inches tall is the most dependable)

2. Sprouts from stumps of cut trees under 12-inch DBH (green ash stump sprout origin trees are susceptible to early decay and silver maple sprouts more frequently on wetter sites).

3. New seedlings that become established after the harvest.

If adequate desirable advanced reproduction greater than 24 inches tall is present, many different harvest systems could succeed. The goal would be to release the seedlings in one or more cuts. However if advanced reproduction is not present bottomland hardwood stands can prove a challenge to regenerate. Depending on site conditions, species composition, and management objective, select the appropriate silvicultural system.

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WISCONSIN DEPARTMENT OF NATURAL RESOURCES
NOTICE OF FINAL GUIDANCE & CERTIFICATION

Pursuant to ch. 227, Wis. Stats., the Wisconsin Department of Natural Resources has finalized and hereby certifies the following guidance document.

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DNR CERTIFICATION

I have reviewed this guidance document or proposed guidance document and I certify that it complies with sections 227.10 and 227.11 of the Wisconsin Statutes. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is not explicitly required or explicitly permitted by a statute or a rule that has been lawfully promulgated. I further certify that the guidance document or proposed guidance document contains no standard, requirement, or threshold that is more restrictive than a standard, requirement, or threshold contained in the Wisconsin Statutes.

Carmen Hardin — March 27, 2020

Signature — Date