CENTRAL HARDWOOD NOTES

Silvicultural Systems For Harvesting Mixed Hardwood Stands

Mixed stands that include oaks, yellow-poplar, black cherry, maples, white ash, basswood, birches, American beech, and other species are commonly found in the central hardwood forest. Depending on site quality and past stand treatment, overstory composition may range from nearly pure stands of oak or yellow-poplar to mixtures of 20 or more species.

Is There Enough Natural Reproduction?

In mixed hardwood stands, there are several sources of reproduction (see Note 3.01 Principles *of* Natural Regeneration) that collectively provide the potential to produce as many as 250,000 woody stems per acre. This is certainly a lot of reproduction. But sheer numbers are not enough; the species available and size of stems as related to competition are also important (see Note 3.02 *Assessing Regeneration Potential).*

A key point in using different silvicultural systems to harvest forest stands is the amount of light reaching the forest floor. Available light is related to intensity of cut. Species such as yellow-poplar and black cherry grow fast when exposed to adequate light. Conversely these shade intolerant species die in dense shade. Shade tolerant species such as beech and sugar maple can survive for many years under dense shade and will respond when given light and room to grow. So, to reproduce the mixed hardwoods you must control the establishment and development of shade intolerant and/or shade tolerant species. You can control species composition to some extent by using different cutting practices. Another key is the site quality which is an expression of geologic, climatic, and topographic characteristics of a stand.

Silvicultural Systems-What Are Your Options?

You have several silvicultural options in establishing and developing reproduction in mixed hardwood stands. In fact, the greater the number of species in the mixture the better your chances to regenerate desirable species. Almost any type of harvest practice used in mixed hardwood stands will regenerate some commercial species. The trick is to reproduce the species you want along with the others that will be favored by the harvest cutting practices you choose.

Silvical characteristics, available light, and site quality are the key factors that determine what tree species will succeed on your sites. Sometimes factors such as deer can have a major negative influence on reproduction and the choice of harvest methods to use.

Even-Age Method!+ Three Choices

Even-age methods reproduce a greater variety of species and a higher ratio of intolerant to tolerant species than uneven-age practices. Species that are intolerant to intermediate in shade tolerance are usually fast-growing, high-value species such as black cherry, black walnut, red oak, and white ash. Other fast growing species include yellow-poplar and basswood.

In stands where even-age silviculture is practiced, reproduction cuts are made at the end of each rotation. There are three regeneration cutting practices to consider in even-age management.

1. *Clearcutting*

- Clearcutting is done in mature and overmature stands where tree growth rates are slowing down and the current stand needs to be replaced with a new vigorous stand.
- Due to past stand treatment, clearcutting is also done in stands that are so badly degraded there is a need to start over.
- There is no optimum stand size. The stand should generally be confined to a single site quality and tree size class. A minimum of about 1/2 acre is needed to establish and develop most shade intolerant species.
- Normally all trees 2.0 inches d.b.h. and above are felled (see Note 3.04 *Treatments to Encourage Natural Reproduction).*
- Adequate advance regeneration must be present or species should have potential for seed being "stored" in the forest floor such as yellow-poplar (table 1).
- Both shade intolerant and shade tolerant species are reproduced but often intolerants dominate.
- Well-planned clearcuts in a forest provide variety in tree species and wildlife. Where clearcutting is done periodically on a large property, stands of different ages will contribute to diverse habitat and foster a variety of wildlife species.
- Clearcutting has more immediate impact on the forest than any other cutting practice. The greatest impact is the visual appearance of the cut area. Clearcuts do not look good for a few years after cutting.

Table 1 .-*Summary of several reproductive characteristics of 14 hardwood species (adapted from Kelly 1988)*

Species	Seedling shade tolerance	Minimum size acceptable advance growth	Seed dormancy
		Feet	*Years*
PIONEER SPECIES			
Yellow-poplar	Intolerant	—	> 3
Sweet birch	Tolerant	—	Several
Black locust	Intolerant	—	Several
MODERATE SHADE TOLERANCE			
Black cherry	Intolerant	0.5	> 3
Red maple	Tolerant	2.0	None[2]
White ash	Intermediate	2.0	> 3
Basswood	Tolerant	2.0	> 3
Red oak	Intermediate	4.5	Overwinter
White oak	Intermediate	4.5	None
Hickories	Intermediate		Overwinter[1]
Black walnut	Intolerant	—	
EXTREME SHADE TOLERANCE			
Sugar maple	Very tolerant	2.0'	Overwinter[3]
American beech	Very tolerant	2.0'	Overwinter
Eastern hemlock	Vet-v tolerant	2.0'	Overwinter

[1] Ideally should be sapling size (1 .O to 4.9 inches d.b.h.) to reach overstory in new stand.

[2] Majority germinate soon after falling, but some may remain dormant 1 year.

[3] Majority germinate the first spring after falling, but some may remain dormant 1 to 2 years.

2. shelterwood

- This method involves removing overstory trees in two or more cuttings within a period of about 20 years.
- In a mixed hardwood shelterwood, 20 to 30 percent of the basal area is generally removed at the first cut. Additional light cuts may be needed at 5- to 10-year intervals. When desirable advance reproduction is well established, the remaining overstory trees are removed in one final cut.
- Shelterwood is used to establish regeneration of desirable species where advanced regeneration is lacking.
- Shelterwood has the potential to reproduce heavy seeded, intermediate shade tolerant species such as oaks on good sites. However, this method has not consistently yielded good results and is still under study.
- Shelter-wood and clearcuts off en yield similar reproduction results in mixed hardwood stands.
- The residual trees left in a shelterwood cut can benefit from the increased growing space. Growth and value added to the residual trees may be worth more in the future than if the present stand were clearcut.

3. Seed Tree

A few seed trees per acre are left to reproduce the harvested stand. The seed tree method is seldom used or needed in mixed hardwoods. In most instances, regeneration comprising the new stand is already established or will become established in the first growing season after cutting regardless of the presence or absence of seed trees. Also, where seed trees are left in the stand, wind throw, sun scald, and loss of bole quality are problems. For some species, lumber values will decrease drastically by the time seed trees are harvested.

Uneven-Age Management-Two Choices

In uneven-age methods, both reproduction cutting and thinning are done together each time the stand is entered for harvesting. The stand is thinned to achieve a reasonably balanced distribution of size classes and openings in the overstory are small. So, shade tolerant species such as sugar maple, American beech, and red maple commonly dominate the reproduction. Noncommercial tolerant species such as dogwood, sourwood, and striped maple can also dominate the understory. These species create major problems to landowners interested in reproducing commercial timber species using uneven-age methods. There are two methods to consider in uneven-age management.

1. Single-Tree Selection

This method results in the least disturbance of the forest canopy. Usually one or two species dominate the reproduction and eventually a hardwood stand containing mixtures of tolerant and intolerant species will be replaced by a few tolerant commercial species such as sugar maple, American beech, or red maple.

- A high portion of shade tolerant tree and shrub species will be produced.
- In the future, wildlife habitat will be influenced by changes in tree species.
- Single-tree selection is commonly used where visual quality is a strong concern or recreational values are high.

2. Group Selection

Small, scattered clearcut openings in mixed hardwood stands can provide a mixture of desirable tolerant and intolerant species. Small openings, often 1/2 acre or less are made each time the stand is entered for harvesting. Also trees between the openings can be cut to achieve the chosen size class distribution to develop an uneven-aged stand.

- Select openings by looking for the more mature trees in the stand.
- Openings should be about 1/2-acre to establish and develop shade intolerant reproduction.
- Small openings don't detract from the esthetic quality of a stand.
- Wildlife habitat and diversity are good.
- Quality of trees bordering these small openings can be reduced by epicormic branching.
- If deer populations are high, reproduction in small openings may be browsed severely, even eliminated.
- Group selection is well suited to small woodlots where occasional cuts are desired.

Because mixed hardwoods generally contain a number of desirable species, these stands are often highly productive. While mixed species and the wide variation in silvical characteristics allow flexibility in applying silvicultural systems, management decisions are more complicated. Even-age management is often recommended to maintain mixed hardwoods of several species. Through this practice, both intolerant and tolerant species can be grown together. Because there are so many forest stands, site conditions, and management objectives there is no single silvicultural system that is best for managing mixed hardwood stands.

Reference

Kelty, Matthew J. 1988. Sources of hardwood regeneration and factors that influence them. In: Guidelines for regenerating Appalachian hardwood stands: Proceedings, Society of American Foresters;1 988 May 24-26; Morgantown, WV. SAF Publ. 88-03. Morgantown, WV: West Virginia University Books: 17-30.

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