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Harvesting and Reproduction Methods for Ohio Forests

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Nearly eight million acres of Ohio are forested. These forests provide a variety of benefits including timber, pulpwood, and veneer products; wildlife habitat; a high-quality water supply; recreational experiences; aesthetics; and others.

The mix of benefits and products produced by a particular forest depends on the characteristics of the forest and how it has been managed. Ohio's forests are diverse. They vary in acreage, species composition, age, size structure, and past uses. Ninety-three percent of Ohio's forest land is owned by private individuals or companies, and their goals of ownership and intensity of management vary greatly. Except where strict preservation is the primary ownership objective, the periodic harvest of trees can play an important and often necessary role in accomplishing many ownership objectives.

The theory and practice of controlling the establishment, composition, growth, and quality of forest stands to achieve management objectives is termed silviculture. Various kinds of management practices are used by foresters including timber harvesting, tree planting, prescribed burning, and the use of specific chemicals such as pesticides and fertilizers. Timber harvesting is the most common practice used by land managers to manipulate existing forest stands to meet their objectives.

There are two types of treatments that involve timber harvesting. Intermediate treatments are conducted with the objective of improving the potential of the remaining stand (the residual stand) to meet ownership objectives. If, for example, objectives include the production of high-value timber products, some of the poorer, less desirable trees may be harvested to improve the stand's overall species composition and quality. If, on the other hand, wildlife habitat were an important objective, an intermediate treatment might consist of removing competing trees in the vicinity of good mast-producing trees to allow them to expand their crowns, thereby increasing the amount of mast produced.

In contrast to intermediate treatments, the primary objective of harvesting in a mature stand is to regenerate or reproduce a new forest stand. Depending on the regeneration method used, large or small openings may be created in the stand. If the stand is regenerated using one to three harvests spaced over a short period of time, the new stand will consist of one age class of trees. Such a stand is even-aged. If the stand is regenerated using a series of harvests spaced over many years, the new stand will consist of trees of many age classes. Such a stand is uneven-aged. The remainder of this article discusses regeneration methods commonly used in Ohio.

Choosing a Regeneration/Harvest Method

Selection, clearcutting, and shelterwood (occasionally) are the regeneration methods commonly used in Ohio. All three methods are not equally applicable to every forest. The appropriateness of a particular regeneration method depends on the forest ownership objectives and the characteristics of the forest, particularly its species composition, age structure, and overall quality.

It is essential that ownership objectives be identified before considering whether trees are to be harvested, and if so, by which method. Ownership objectives define the goals of management — the type of forest that will best satisfy the owner's desires. Each regeneration method produces a forest with distinctly different characteristics — different in species composition, age and size structure, appearance, etc. If, for example, grouse habitat was an important management objective, small clearcuts or large group selection openings might be needed to create required habitat. If, on the other hand, periodic income were an important ownership objective for an uneven-aged maple-beech woodland, individual-tree selection or small group selection might be the appropriate method.

From an ecological perspective, the predominant tree species present or desired in a forest is a major factor in the choice of method. Tree species differ in their ability to establish and grow successfully in different environments. Some species, such as sugar maple and beech, will reproduce and grow in almost complete shade under a dense forest canopy. Such species are termed shade-tolerants because of their ability to establish and grow in the shade of larger trees. Other species, such as yellow-poplar and aspens, are shade intolerants, requiring essentially full sunlight to survive and continue growing. Still other species, including many of the oaks, are intermediate in shade tolerance, establishing and growing in partially shaded conditions. Shade tolerance ratings of a number of common Ohio tree species are presented in Table 1.

The different regeneration methods create distinctly different environments that best fit the environmental requirements of different tree species. Clearcutting will be needed to create the open conditions required for species like yellow-poplar and aspens that require full sunlight. Species that thrive in essentially full shade, like sugar maple and American beech, may be managed utilizing any of the regeneration methods. Other factors such as the stand age structure, economic criteria, or aesthetic considerations will determine the choice. Species with intermediate light requirements, such as white ash or northern red oak, will commonly be managed using group selection, shelterwood, or clearcutting. Again, other considerations will determine the choice among the alternatives.

Uneven-aged forests can be maintained by either single-tree or group selection. Even-aged stands can be maintained with clearcutting or shelterwood, but can only be converted to an uneven-aged structure with some difficulty and perhaps economic loss. Ownership goals partially determine the desirability of such a conversion.

The overall quality of the trees in a forest may also influence the regeneration method chosen. Some ownership objectives, such as the desire for an undisturbed woodland for recreational activities, may be satisfied by a forest containing essentially any species of tree in almost any condition. Most ownership objectives, however, will be enhanced by the presence of healthy, vigorous, high-quality trees of particular species that result from properly applying any one of the three main regeneration methods. When a forest consists mostly of less-desirable species or trees of low vigor or poor quality, harvests may need to be prescribed that reduce the amount of less-desirable species, while creating conditions essential for the establishment and growth of more desirable species.

Figure 1. A clearcut two years after harvest.

Regeneration Methods

Clearcutting Method

As the name suggests, clearcutting is the removal of all the trees from a forested area at one time, without regard to species, quality, age, or spacing (Figure 1). Clearcutting may be prescribed for a variety of reasons including: (1) to reproduce even-aged stands of intermediate or shade intolerant tree species; (2)

Table 1. Shade Tolerance Ratings of Some Ohio Tree Species.

INTOLERANT	INTERMEDIATE	TOLERANT
black locust	American elm	American beech
bigtooth aspen	black oak	American basswood
black cherry	boxelder	black gum
black walnut	chestnut oak	eastern hemlock
cottonwood	eastern white pine	flowering dogwood
pin oak	green ash	red maple
red pine	hickories	slippery elm
scarlet oak	northern red oak	sugar maple
sycamore	white ash	
sweet gum	white oak	
yellow-poplar		

to create openings and early-successional vegetation for wildlife habitat; (3) to create vistas, campsites, roads, etc.; or (4) to clear the area for tree planting or seeding.

Clearcutting is the most dramatic regeneration method. Some people object to it because temporarily unattractive areas are created. However, the initial visual impact of clearcutting is quickly reduced in Ohio. The rapid establishment and growth of vegetation, including tree seedlings and sprouts, causes the harvested site to take on the appearance of a young forest in a relatively short time. The visual impact of clearcuts can be further lessened by: (1) exercising care in their location; (2) leaving borders of uncut trees as visual buffers where appropriate, (3) planning harvest areas that conform to the natural topography; and (4) designing irregular-shaped areas in a range of sizes, up to some acceptable maximum. Some commonly cited advantages and disadvantages of clearcutting are given in Table 2.

Where necessary to accomplish ownership objectives, clearcutting is an important and valuable regeneration method. As with all harvesting, care must be exercised so that it is properly prescribed and carried out. One form of clearcutting, called commercial clearcutting, is rarely appropriate. In a commercial clearcut, all merchantable trees are cut and removed, while the rest are left standing. Such a cut normally does not create the type of full-sunlight environment desired when a clearcut is prescribed. Further, the trees remaining after a commercial clearcut do not commonly develop into a desirable forest stand. The only situation where a commercial clearcut would commonly be appropriate is where the forest land is being converted to some other land use.

Figure 2. A two-cut shelterwood shortly after the first cut.

Shelterwood Method

The shelterwood method also produces an even-aged stand, but in contrast to clearcutting, this method commonly consists of a series of two or more partial cuts spaced over several years (Figure 2). The major ecological objective of a shelterwood is to create a partially shaded and protected environment in the understory where young trees can become established and grow. This is particularly beneficial for species that initially do not compete well with other trees and shrubs. Once the desired reproduction is well-established, the remaining larger trees are harvested. One advantage of the shelterwood method is that it produces far less negative visual impact than a clearcut because the harvested area always is dominated by trees, while the debris (branches, tops, etc.) generated by the harvest is less visible.

Throughout the United States, two- or three-cut shelterwoods have been used to reproduce a variety of coniferous and hardwood species. In a three-cut system, the first cut removes enough of the stand to stimulate the crowns to increase seed production and hastens the decomposition of soil surface organic matter to form a suitable seedbed. Several years later (commonly five to 20), a second cut removes approximately half of the remaining stand to create conditions suitable for the establishment and early growth of young trees. Finally, several years later when adequate regeneration has become established, the remaining trees are harvested. Some care is necessary during the final harvest to minimize damage to the young, even-aged stand that is developing.

Most shelterwoods in Ohio use a two-cut rather than a three-cut system. In a two-cut system, 40–70 percent of the stand (depending on the species) is removed; several years (perhaps five to 20) pass until adequate reproduction is achieved; and then the remaining trees are harvested.

Although suitable for most Ohio forest types, the shelterwood method is uncommon for several reasons. First, the short-term planning horizons and brief land tenure of many Ohio forest landowners does not lend itself to a harvesting method that extends over several years. Second, use of the shelterwood method requires a market for the relatively small amounts of lower quality trees that are removed in the first cutting — something that has not been common in Ohio. However, with increasing public concern over widespread use of clearcutting, the shelterwood method may become more common in situations where it can successfully achieve landowner objectives. Table 2 summarizes some of the commonly cited advantages and disadvantages of the shelterwood cutting method.

Selection Method

Selection is a regeneration method in which individual trees or small groups of trees are periodically (commonly every 10–15 years) harvested based on their size, species, quality, condition, and spacing. Selection is used to create and maintain an uneven-aged stand. As noted previously, selection can only be used to convert an even-aged stand to an uneven-aged with some difficulty, economic loss, and often with a major change in species composition.

Table 2. Advantages and Disadvantages of Forest Regeneration Methods.

CLEARCUTTING

Advantages

- Provides necessary environmental conditions for shade-intolerant species.
- Usually the most economical method.
- Relatively easy to implement.
- Allows site preparation for seeding or planting.
- New species or genetically improved seed or seedlings may be planted.
- May create needed habitat for many wildlife species (e.g., grouse, deer).

Disadvantages

- Usually considered to be aesthetically less desirable.
- Greater risk of soil erosion and stream sedimentation if done improperly.
- Regeneration of some desirable species may be uncertain.
- May lead to invasion of undesirable vegetation.

SHELTERWOOD

Advantages

- Reproduction of desirable species may be more certain than with clearcutting.
- Slash disposal less of a problem than with clearcutting.
- May be more effective with heavy-seeded species such as oaks.
- Less invasion of undesirable vegetation than with clearcutting.
- Opportunity for genetic improvement in the regenerated stand.

Disadvantages

- Requires a market for small and low-quality trees.
- Remaining trees must be wind-firm.
- Requires more technical skills of forester and logger than clearcutting.
- Removal cutting damages some young trees.
- Epicormic branching on trees in final harvest may result in decreased quality.

SELECTION

Advantages

- Maintains continuous forest cover on land.
- Usually perceived as having less visual impact.
- Forest usually less susceptible to wind, insect, and disease damage.
- Reproduction not exposed to heavy competition from herbs and shrubs.
- Shorter harvest intervals mean more frequent income for landowner.
- Easier to alter harvest intervals in response to market conditions.
- Can combine intermediate and regeneration harvests into one treatment.
- Long-term management favors shade-tolerant species.
- Some form of natural reproduction will occur.
- Beneficial to some forms of wildlife.

Disadvantages

- Takes more skill to implement than other regeneration methods.
- More expensive in terms of inventory, marking, and harvesting.
- Trees harvested are variable in size.
- Some damage to residual trees may result.
- Some residual trees may develop epicormic branching.
- Long-term management for intermediate and shade-intolerant species requires group selection.
- May be detrimental to some wildlife species requiring openings and early successional vegetation.

Figure 3. A single tree selection cutting.

Figure 4. A group selection cutting.

When individual trees are selected for harvest (individual-tree selection), they are replaced either by new seedlings or by small trees already present (Figure 3). Individual-tree selection is best suited for shade-tolerant species such as sugar maple and American beech. When small groups of trees are selected for harvest at the same time (group selection), a larger opening is created (Figure 4). Depending on the size of the opening, group selection areas may favor the successful reproduction of intermediate or shade-intolerant tree species.

Aesthetically, selection has the least visual impact of any regeneration method. Periodically, a number of trees are selected for harvest approximately equal in volume to the growth of the stand since the last harvest. The openings created by the removal of individual trees or small groups are small and scattered throughout the forest. The overall integrity and appearance of the forest is only slightly modified, and after a few years much of the residue from the harvest will have decomposed.

Selection can also be economically attractive to many private woodland owners with small acreage. Most uneven-aged forests managed with selection can be economically harvested every 10–15 years. There are many advantages and some disadvantages to the selection method (Table 2).

Two important cautions must be kept in mind when using the selection method. First, extreme care must be exercised in selecting the logging company to perform the harvest. One of the strong advantages of the selection method is that a forest remains after the harvest. It is important that the harvest be carried out by a professional logger with the skills to minimize damage to the trees that remain.

The second caution involves the need to work with a professional forester to determine the need for and extent of a selection harvest. Two all-too-common and undesirable cutting practices occasionally encountered in Ohio are high-grading and diameter-limit cutting. In high-grading, all of the trees with any economic value are removed from the stand. In diameter-limit cutting, all of the trees above a certain diameter, usually specified at stump height, are cut. While both high-grading and diameter-limit cutting are often promoted as acceptable forms of "selective harvesting," both cutting methods as commonly applied ignore the sound ecological principles on which the selection method is based. Both practices will generally leave a forest composed of poor-quality, low-vigor trees with very little value or limited ability to meet most landowner objectives.

An Important Concern

Protecting the soil and water resources is an important concern during forest regeneration activities. The removal of trees typically requires the use of heavy equipment that disturbs the porous organic layer of the forest floor. The mineral soil is then exposed to the erosive forces of raindrops and surface runoff. Soil may move downslope off the area and become sediment in streams, rivers, and lakes. The implementation of best management practices (BMPs) can substantially reduce soil erosion and its negative effects. BMPs include such activities and considerations as the proper location and construction of skid trails and logging roads; preservation of forested buffer strips along streams; diversion of runoff into the forest from roads and trails; and seeding of landings, roads, and trails upon completion of the harvest. Landowners should discuss best management practices with their professional forester and with the logger who will perform the harvest. To promote discussion with the logging operator and to avoid future disagreements, the best management practices to be utilized during the harvest should be specified in the timber sale contract.

Conclusion

Forests can provide many benefits on a sustained basis, and many of these benefits can be created and enhanced by properly harvesting trees. A close working relationship between the

woodland owner, a professionally trained forester, and the logger is critical. Personal assistance in planning for the regeneration of a stand can be obtained from many sources, including an ODNR Division of Forestry Service Forester, a self-employed consulting forester who will not only plan but also supervise a timber harvest, or a forester employed by a forest products company.

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