E3202 Bulletin 13 • New • November 2014

MICHIGAN STATE UNIVERSITY | Extension

Forest Types of Michigan

Silvicultural Systems

MSU Forestry Extension Team

Silviculture is the art and science of controlling the establishment, growth, composition, health and quality of forests and woodlands to meet the diverse needs and values of landowners and society on a sustainable basis. It's also the heart of forest management. A silvicultural system is a planned series of treatments for tending, harvesting and reestablishing a forest stand.[1] "Forest management" is a broader term that includes biological, social and economic factors. For the forest owner, the terms may be interchangeable when a forest management plan is developed.

White ash in a managed woodland

For Michigan forest types, three major silvicultural systems are employed: selection, shelterwood and clearcut. Each system has a number of variations to accommodate the constraints of a particular woodland, the desires of an owner and market conditions in a particular region.

Foresters will sometimes use terms that forest owners may not fully understand or apply them in unusual ways. When working with a forester, be sure to ask questions and obtain explanations. The forester will expect this and will be happy to provide clarification. The book "The Forests of Michigan" offers a good chapter on silvicultural background.[2]

A reasonable silvicultural system will simultaneously meet at least two of the four goals in Table 1.

Various forest types will respond differently to each silvicultural system. Each system will be appropriate for certain forest types and not so much for others (Table 2). A forest type is a distinct association of tree species, distributed across a wide geographical range. For example, "northern hardwoods" is a common forest type. Thousands of northern hardwood stands occur throughout the range of the northern hardwood forest type. Ecological characteristics, along with

Table 1. Silvicultural Goals and Systems

Silvicultural Goals
1. Provide for forest regeneration.
2. Forest products for the good of the owner and society.
3. Improve the quality and health of the forest.
4. Satisfy the desires of the forest owner
Silvicultural Systems
1. Selection System
2. Shelterwood System
3. Clearcutting System

the socioeconomic environment and forest owner wishes, will determine the best fit of a silvicultural system. Consequently, there is a lot of wiggle room to define what is best for any particular forest type and forest stand.

Selection System

This is perhaps the most commonly applied silvicultural system in Michigan. Individual trees are marked for removal in a commercial harvest. The remaining trees will benefit from the reduced crowding, and the overall quality of the stand will increase. The increase in light to the forest floor will encourage tree regeneration.

Two common variations of the selection system exist: single-tree selection and group selection.

Trees marked for harvest may be distributed evenly throughout the stand. This results in a uniform density of trees. This is the classic version of the selection system. Single-tree selection tends to create an ecological environment that favors sugar maple or other shade-tolerant species and enhances the quality of sawtimber. Good quality sugar maple sawtimber typically has the highest monetary value of all Michigan species.[3]

Group selection removes both single trees and groups of trees and results in a more variable stand density. The gaps created by harvesting groups of trees encourage tree species diversity. Gaps are often created around or next to certain tree species, such as white pine, hemlock or yellow birch, to favor regeneration of those species. Group selection resembles natural disturbance of these forest types.

A variant of the selection system is called “crop tree selection” — harvest is designed to maximize growth on preferred trees within a stand. It is often applied to even-aged pole-sized stands in which all trees are approximately the same size. Certain crop trees are identified on the basis of their species, quality and spacing. Important crown competitors are removed to provide growing space for the designated crop trees.

Selecting trees for removal generally follows a priority list (Table 3). Priorities might vary with the particular stand and specific desired outcomes. The eventual outcome produces an all-aged or multi-aged stand structure of increased quality and health.

Table 2. Some examples of applying different sivicultural systems

Selection System	Shelterwood System	Clearcutting System
Northern hardwoods, high quality	Oak	Aspen
Spruce-fir	Paper Birch	Oak
Black ash on good sites	White pine	Pines (white, red, jack)
Lowland hardwoods on good sites	Spruce-fir	Spruces (white, black)
	Northern hardwoods	Low quality hardwoods

Table 3. Sample Marking Removal Order

1. High risk trees
2. Highly defective trees
3. Trees with poor form
4. Crown position/favor crop trees
5. Tree diameter

The selection system will achieve marvelous results under the right circumstances, but forest owners should be aware of similar practices incorrectly called "selective cutting." The practice of "high-grading" removes the high monetary value trees and leaves the rest without regard for future stand conditions. This is generally regarded as poor forestry because repeated applications inevitably lead to poor quality stands. Another example is diameter-limit cutting, in which all trees above a certain diameter are cut. This is another form of high-grading that also leads to poor quality stands. Partial cutting is sometimes done in inappropriate forest types, such as aspen, where it leads to degradation of stand quality and results in poor regeneration.

Selection system silviculture requires a great deal of knowledge and experience. Working with a consulting forester is highly recommended (see MSU Extension bulletin E-3188).

Shelterwood System

This even-aged system involves the harvest of all mature trees in a two- or three-stage process over several years. Additionally, some stands might be commercially thinned one or more times before they reach maturity. If regeneration is not occurring, then some of the canopy trees are harvested to increase the amount of light to the forest floor and encourage regeneration. A ground treatment might be required to expose mineral soil or remove undesirable competing vegetation. The next cut — or the first cut, if regeneration is already present — removes most of the overstory and provides light to increase the growth rates on understory regeneration. Partial shade modifies the microenvironment to avoid excessive heat and dry conditions. Remaining mature trees are those that are not likely to be blown down by wind events

Oak Shelterwood

(windfirm) and of good quality that will rapidly increase in size and monetary value. When the next generation of trees reaches an appropriate size, maybe 6 to 8 feet high, then the residual overstory is removed.

In Michigan, shelterwood silviculture is most often applied to oak stands but can be applicable to other forest types, such as mixed upland hardwoods.

Clearcutting System

Clearcutting is the complete or nearly complete removal of a mature stand and is a legitimate system when appropriately applied. Forest types that require full sunlight and warm soil temperatures for regeneration and subsequent growth require this sort of disturbance. In nature, catastrophic events such as wildfire and windstorms provide the necessary ecological regeneration conditions. Classic example forest types are aspen and jack pine.

Seed-tree silviculture is a variation of clearcutting. A small number of trees can be left on-site to provide seed. This is sometimes done with white pine, red pine or oak. Leaving a few trees may also provide visual benefits and habitat for certain species of wildlife, such as raptor roosts and snags for cavity nesters. Residual trees must be windfirm and have the ability to adjust to rapidly increased exposure to the sun.

Silvicultural clearcutting harvests trees at the right time, before overmaturity, to guarantee the optimum amount of vigorous regeneration. The new stand is even-aged and requires few additional practices until the next harvest. The key to the appropriate application of clearcutting is proper timing to produce the next forest stand.

Wildlife Impacts

Most forest owners rank wildlife values much higher than either timber or revenue.[4] Forest management is a valuable tool to achieve wildlife habitat goals. Some habitat management practices are difficult to employ without forest management. For example, aspen thickets for woodcock and ruffed grouse require clearcutting aspen at the right time and in a manner that will attract logging contractors. As another example, birdwatchers will see more of certain migratory bird species if the woods have a good understory of shrubs and young trees. This condition is best met through forest management and commercial harvest.

It is important to note that any forestry practice, even a poorly applied one, will benefit some wildlife species and discriminate against others. The complete lack of forest management will also have winners and losers. Habitat conditions change over time, with or without management, and these changes will affect wildlife use. Often when landowners say “wildlife,” they mean “game species” — more specifically, white-tailed deer. There are nearly 600 species of vertebrates in Michigan, however, and most of them depend on forests for at least part of their habitat requirements. Specific forest conditions are far from equal in meeting the needs of various wildlife species.

See the Michigan Society of American Foresters’ publication, Forest Management Guidelines for Michigan, on their website: ***http://michigansaf.org***.

---

[1] Definitions from Helms, John A. 1998. The Dictionary of Forestry. The Society of American Foresters.

[2] Dickmann, D.I., and L.A. Leefers. 2003. The Forests of Michigan. Ann Arbor: University of Michigan Press.

[3] Recent historical values from DNR stumpage reports and TimberMart North reports.

[4] Butler, B. 2006. Family Forest Owners of the United States. USDA Forest Service General Technical Report NRS-27.