Appendix C – Harvest Cutting Methods

Table of Contents

List of Tables

Appendix C – Harvest Cutting Methods

Appendix C describes the harvest cutting methods used under the final Forest Plan (herein referred to as Forest Plan) and provides rationale for why these methods are considered appropriate.

Introduction

The National Forest Management Act of 1976 (Section 6 (g) (3), (e) (IV) and (f) (i) and the resulting regulations (36 CFR 219.15, 1982) require that vegetation management practices be chosen that are appropriate to meet the objectives and requirements of the land and resource management plan.

The Ottawa National Forest (the Ottawa) recognizes 33 different forest survey types. The principal references for these types are Silvics of Forest Trees of the United States (USDA Forest Service 1990a), Agriculture Handbook 654 (USDA Forest Service 1990b), and the manager's guides for individual tree species and collective forest types. The manager's guides describe silvicultural characteristics by type and management practices appropriate for various management objectives. They also provide guidance on other resource considerations, such as soils, water, recreation, wildlife, and insect and disease management.

Silvicultural Systems and Regeneration Harvest Methods

The principal objective in harvesting timber is to regenerate a stand to meet a number of resource management objectives, such as desired conditions for visual management, species composition, wildlife habitat, restoration of ecological processes, timber product mix and integrated pest management. Achieving the management objectives is foremost in selecting the harvest method. Although there are many harvest methods used in managing forest lands, there are only two silvicultural systems, uneven-aged and even-aged management.

Within the even-aged category, there are three silvicultural harvest methods recognized by the Society of American Foresters: clearcutting, shelterwood, and seed tree. The uneven-aged category consists of the selection method. Principal variations of uneven-aged harvest methods are individual tree and group selection.

Uneven-aged System

A stand is considered uneven-aged if three or more age classes are represented within the stand (Smith 1986). With an uneven-aged system, a portion of each age class in each stand must be harvested on a routine cutting cycle such as 10 to 20 years. An area may be directly impacted by harvesting equipment periodically after the trees in a stand reach commercial size.

Individual tree selection is the recommended cutting method in northern hardwoods (USDA Forest Service 1975). Under the Forest Plan, the individual tree selection method would be the predominant uneven-aged harvest method. However, in some cases, the group selection may be used to more effectively meet the management objectives on a particular site.

Individual Tree Selection Method

Individual tree selection entails the periodic removal of individual trees. Initial cutting is often referred to as an "improvement cut" which is designed to move an even-aged stand toward an uneven-aged condition. The goal of the selection method is to maintain a given number of trees per acre in several diameter classes. This practice should not be confused with "high grading" where only large trees are cut. In order for the practice to work, some trees must be cut or killed within most, or all, diameter classes to maintain the desired distribution of diameter classes in the residual stand. This method favors shade-tolerant tree species. Shade tolerance is a term that refers to the ability of a tree to survive and grow in shaded conditions. The primary species in this area that are shade tolerant are sugar maple, hemlock, and balsam fir.

The individual tree selection method meets the needs of most high-forest, cavity-dwelling, closed canopy wildlife species. This method is least beneficial for wildlife species that use openings, edges and low browse.

The visual resource is minimally affected by harvesting with the individual tree selection method. This method provides for retaining a large-tree character on the landscape.

Group Selection Method

In the group selection method, the management area is treated as a single stand and the volume to be harvested each cutting cycle determines the number of openings to establish.

The objective of this method is to establish desirable regeneration at each harvest cycle, thereby producing an uneven-aged stand. Because the removal of groups would permit more light to reach the forest floor than with individual tree selection, group selection can be used to encourage a higher proportion of shade-intolerant species.

When group selection cuts are made of a maximum size, often considered to be about two acres, they resemble small clearcuts. The aesthetic and wildlife benefits of using group selection depend largely upon group size and spacing.

Group selection harvest systems develop a vegetative condition with an interconnected canopy and many small openings (1/2-acre to 2-acres), simulating a checkerboard pattern within a forested environment. Unbroken stands of timber (20+ acres) would not exist. Wildlife that do well in a forested environment with many small openings and in a variety of age classes would do well in the habitat provided by group selection harvest (i.e., white-crowned sparrow, barred owl, and American redstart).

This method has not been practiced on the Ottawa in the past and would be used only on a very limited basis under the Forest Plan. Regeneration of mid-tolerant species can be accomplished more efficiently with the shelterwood method (discussed in the Even-aged System section). Also, the group selection method is more difficult to regulate and site preparation for increasing mid-tolerant species would be uneconomical due to the very small size of regeneration groups. Therefore, in most cases, management objectives can be achieved more efficiently by use of the individual tree selection method than the group selection method.

Even-aged System

The intent of an even-aged management system is to maintain stands of manageable size and of the same age or age class. A stand is considered even-aged if the difference in age between the oldest and youngest trees of the managed stand does not exceed 20 percent of the length of rotation. This is 16 years for an 80-year rotation and 24 years for a 120-year rotation. With any of these systems, the size, shape, timing, and dispersion of harvest units is done to achieve the multiple use management objectives for the area.

The rotation age under an even-aged management system is the number of years between establishment of a stand of timber and when it is considered ready for final harvesting and regeneration. During a rotation, there may be one or more periodic thinnings prior to the next regeneration harvest. Thus, as within even-aged systems the area may be directly impacted by harvesting equipment periodically after the trees in the stand reach commercial size.

Commercial thinnings are conducted periodically, usually at 10-20 year intervals, to maintain the density and composition of trees at a level which helps meet a variety of management objectives.

Some of the more obvious objectives of thinnings are to improve the growth rate of residual trees and provide for the periodic removal of a portion of the timber volume.

Some of the more subtle objectives of thinnings may include:

- Improving diversity of habitat for a variety of wildlife species that prefer the conditions provided through even-aged management through thinning.
- Improving the composition of the stand to favor a more desirable mix of tree species.
- Improving the quality of the trees upon which growth occurs thus improving the dollar value growth in the stand.
- Harvesting trees that have a high risk of mortality, thus utilizing wood volume which would otherwise be lost to mortality.
- Harvesting insect or disease infected trees to help reduce the spread of a particular insect or disease problem.
- Maintaining a more vigorous and healthy stand of trees, thus reducing the risk of insect or disease attacks.
- Improve the diameter growth of residual trees resulting in a stand of larger diameter trees in a shorter period of time.
- Opening up the canopy of the stand to allow more sunlight to reach the ground, and stimulating more plant growth to occur on the forest floor.

Thinning can alter the dynamics of a stand in several ways to help achieve more desirable conditions for a variety of resource uses.

Even-aged management offers many opportunities for a wide range of vegetative diversity. Even-aged management can provide a wide range of vegetative cover type composition in terms of species mixtures and also in terms of age classes, ranging from old mature forest to open conditions.

Three regeneration harvest methods may be used in an even-aged silvicultural system; clearcutting, shelterwood, and seed tree (Smith 1986). Under the Forest Plan, the clearcutting and shelterwood methods will be featured. However, the seed tree method may have limited application in situations where it best meets site-specific management objectives.

Clearcut Method

With the exception of trees left for wildlife or visual purposes, all merchantable trees on an area are harvested at one time in clearcutting. Unmerchantable trees are often also felled to eliminate competition with the regeneration. Regeneration of tree species develops from natural seeding and/or sprouting, root suckering, or artificial seeding or planting in clearcut areas. This regeneration method favors the establishment and development of shade-intolerant species, such as aspen and jack pine.

Clearcutting is a method that can provide for a disturbance of a site that is needed to return the vegetation to an earlier successional stage. In a natural condition, this disturbance would be caused by wildfire, insects, diseases, or windthrow. Without human-caused or natural disturbances, the forest tends to move toward a condition dominated by late successional vegetation that is shade tolerant, such as sugar maple or sugar maple/hemlock.

To obtain desirable natural regeneration of types such as aspen or jack pine, clearcutting is the most effective method.

Clearcutting favors species of wildlife that utilize open and young growth habitat conditions or are well adapted to early successional vegetative types, such as the five-lined skink, woodcock, white-tailed deer, snowshoe hare, and ruffed grouse. Some predators such as Northern goshawks, wolves, fishers, and lynx can be key beneficiaries of certain prey species that thrive in early successional vegetative types. Some of these same prey species are also highly desired by hunters.

Shelterwood Method

In the shelterwood method, the mature stand is removed in a series of two or three cuts. The early cuts are designed to improve vigor and seed production of the remaining trees while preparing the site for new seedlings (seed cut). Mechanical ground scarification and site preparation (felling of sub-merchantable sized stems) are common, associated silvicultural practices especially when regenerating mid-tolerant species. The final harvest is made when a sufficient amount of desirable reproduction has become established and before the regeneration has reached 20 percent of its rotation age (Smith 1986). This method provides a partial cover of either large or small trees. When the shelter becomes a hindrance to the growth of the seedlings, rather than a benefit, it is necessary to remove the remainder of the mature stand (removal cut).

The shelterwood method is most appropriate for species or sites where the shelter of a partial overstory is needed for reproduction, or to give desirable regeneration an advantage over less desirable species.

The shelterwood method provides conditions favorable to regeneration of a wide variety of hardwood and conifer tree species, such as yellow birch, eastern hemlock, paper birch, white

pine, red oak, and white ash to name only a few. The individual species favored depends on several physical and biological factors, such as seed source, soil-site conditions, seedbed conditions, amount of shade, soil temperature, and other microclimatic conditions at the forest floor.

Therefore, shelterwood cutting favors wildlife species that utilize a variety of age classes and tree species mixture, such as wood pewee, purple finch, Cooper's hawk, and woodcock.

Seed-Tree Method

This method involves harvesting all but a few well-distributed trees of the desired species to provide seed for natural regeneration. After adequate regeneration has been established, the seed trees are normally harvested. This method is suited to situations where a seed source is needed along with full sunlight. This method would be utilized on a limited basis under the Forest Plan.

Selection of Harvest Method

Some forest types can be regenerated by more than one silvicultural system and/or harvest method, but other types cannot. Since a management area typically contains several forest types and forest type diversity is desirable within a management area, more than one silvicultural system or harvest method may be used within a management area. The amount of each harvest cutting method will vary by management area.

Table C-1 shows the harvest cutting methods by desired forest type that are considered appropriate for use on the Ottawa. The harvest cutting methods are expressed in terms of the desired forest type that is to be regenerated by one of the appropriate harvest cutting methods. The desired forest type that is regenerated may be regenerated from the same type or converted from a different type.

Table C-1. Harvest Cutting Methods for Regeneration by Desired Forest Type

Desired Forest Type [1]	Clearcutting [2 3 4]	Shelterwood [2]	Selection
Aspen	X		
Paper birch		X	
Northern hardwoods		X	X
Hemlock		X	X
Lowland hardwoods		X	X
Jack pine	X		
Red Pine	X	X	
White Pine		X	
White spruce-fir	X	X	X
Balsam fir	X	X	X
Lowland Conifer	X	X	
Non-forest openings and uses	X		

[1]The desired forest type is the type to be regenerated through maintenance of an existing type or converted from another forest type. For example: conversion of hardwood to aspen utilizes harvest-cutting methods for aspen (clearcutting)

[2]Clearcut and Shelterwood may include intermediate cuts during the rotation of the stand.

[3]Clearcutting may be used to convert a forest type where clearcutting is not indicated, to one where clearcutting is indicated. For example, the northern hardwoods type may be clearcut to convert to aspen, jack pine, red pine, white spruce-fir, or balsam fir types.

[4]Includes strip, patch, and stand clearcutting.

Harvest Method by Management Prescription

Management Prescriptions 1.1a, 4.1a, and 4.2a

These management prescriptions emphasize shade-intolerant tree species and cover types in meeting the management objectives and providing the desired mix of outputs and services from the management area.

Therefore, these management prescriptions will have relatively high amounts of clearcutting, moderate amounts of shelterwood cutting, and rather low amounts of selection cutting.

Management Prescriptions 2.1, 2.2, 6.1, and 6.2

These prescriptions emphasize dispersed recreation and higher visual quality objectives. Shade-tolerant hardwood species and forest types are emphasized in meeting the management objectives and providing the desired mix of outputs and services from the management area. Therefore, these management prescriptions will have relatively high amounts of selection harvest and moderate to low amounts of shelterwood cutting and clearcutting.

Management Prescriptions 3.1a

These prescriptions emphasize a variety of vegetative conditions, including a variety of tree species and forest types of different ages.

A wide range of harvest cutting methods will be used to meet the management objectives and provide the desired mix of outputs and services from the management area. Therefore, these management areas would have moderate amounts of clearcutting, shelterwood cutting, and selection cutting.

Management Prescriptions 5.1, 5.2, 5.3, 7.1, 8.1, 8.2, 8.3, 9.2, and 9.3

These prescriptions will include very little or no timber harvesting. Minor amounts of timber harvesting may occur in management prescriptions 7.1, 8.1, 8.2 and 8.3 to meet specific management objectives to enhance recreational values.

Management prescriptions 9.2 and 9.3 could include minor amounts of timber harvesting for salvage purposes.

Management prescriptions 5.1, 5.2, and 5.3 will not include any timber harvest.

Selection Factors

The silvicultural system and harvest cutting methods were chosen to achieve a desired mix of conditions within each management area and across the Ottawa, in a manner that best meets the Forestwide management objectives and responds to the public issues, management concerns, resource opportunities, and to contribute to maximizing net public benefit. (See Chapters 2 and 3 of this document).

The mix of harvest methods estimated for the first decade of the Forest Plan is shown in Appendix E, *Proposed and Probable Practices, Goods Produced and Other Information*. These are estimates only, actual amounts of all harvest types may vary so long as the ASQ is not exceeded.

The rationale for selection of a harvest method is based on a variety of factors, some of which are site-specific in nature, as well as the overall direction for the management area.

The harvest cutting method is based upon the forest type that is to be regenerated and how that regeneration is to be accomplished (natural or artificial). The determination of the desired forest type to be regenerated requires management considerations such as:

- Vegetative composition objectives for the management area
- Existing vegetative conditions
- Spatial distribution of types within the management area
- Potential soil-site productivity for suitable vegetative types based on ecological classification system (ELTP) information
- Relative cost and benefits of alternative regeneration options

- Ability to manage and protect the regenerated stand
- Need for intra-stand diversity
- Desired recreation setting (ROS class) objectives
- Desired mix of timber products
- Presence of riparian areas
- Visual quality objectives
- Potential insect, disease, and other risk factors

The optimum mix of harvest methods proposed is based on the objective of maximizing net public benefits from the entire Ottawa as a unit, as opposed to site-by-site analysis.

As part of the overall Forest Plan objectives, clearcutting was determined as being the optimum harvest cutting method to achieve some of those objectives.

The appropriate silvicultural system and harvest cutting method will be determined at the project level considering the site-specific conditions, along with the objectives for the management area.

Clearcutting Rationale

Clearcutting was considered an appropriate harvest cutting method to regenerate several forest types as shown in Table C-1.

Clearcutting was determined to be the optimum method for regenerating (including conversion to) the following desired forest types given the considerations as listed under "selection factors" described earlier in this appendix.

Aspen

Clearcutting may be determined to be the optimum method for regeneration of aspen at the project level because:

- Aspen is a very shade-intolerant tree species (USDA Forest Service 1977c).
- Early successional species, such as raspberries, blackberries, grasses, and strawberries, or community types, including temporary openings, can be maintained within the management area as well as aspen regeneration.
- Clearcutting provides habitat conditions for wildlife species that utilize early successional habitat.
- Clearcutting stimulates root suckering and increases stocking and early growth of aspen.
- This method can increase visual variety through the design, timing, size, and location of clearcut.
- This method allows other types, including hardwoods, balsam fir, and jack pine to be naturally converted to aspen.
- Motorized access needs are minimized, reducing conflicts with dispersed recreation activities, and favoring wildlife species requiring remoteness. Most stands are accessed only once every 40 to 60 years.

- Costs are lower and revenues higher because there is usually only one timber sale for the stand, volumes per acre are higher, and harvest operations are more efficient.

Jack Pine

Clearcutting may be determined to be the optimum method for regeneration of jack pine at the project level because:

- Jack pine is a shade-intolerant tree species (USDA Forest Service 1977a).
- Early successional species, such as blueberries and grasses, or community types, including temporary openings, can be maintained within the management area as well as jack pine regeneration.
- Clearcutting provides habitat conditions for wildlife species that utilize young conifer habitat.
- Serotinous cones require high temperatures to open. These high temperatures can be achieved through the use of fire or cone bearing slash lying on the ground in full sunlight.
- Site preparation for seeding, planting, or natural regeneration including prescribed burning is accomplished more efficiently.
- Clearcutting reduces risk from windthrow and insect infestations.
- This method can increase visual variety through the design, timing, size, and location of the clearcuts.
- This method allows other types, including hardwoods, aspen, red pine, white pine or balsam fir, to be converted to jack pine.
- Genetically improved jack pine stock can be introduced through artificial reforestation.
- Costs are lower and revenues higher because there is usually only one timber sale for the stand, volumes per acre are higher, and harvest operations are more efficient.
- Motorized access needs are minimized, reducing conflicts with dispersed recreation activities, and favoring wildlife species requiring remoteness. Most stands are accessed only once every 40 to 60 years.

Red Pine

Clearcutting may be determined to be the optimum method for regeneration of red pine at the project level because:

- Red pine is a shade-intolerant tree species (USDA Forest Service 1977b).
- Early successional species, such as raspberries, blackberries, blueberries and grasses, or community types, including temporary openings, can be maintained within the management area as well as red pine regeneration.
- Clearcutting provides habitat conditions for wildlife species that utilize young conifer habitat.
- Artificial regeneration (planting) is required. Seed production is too irregular to depend on natural regeneration (occurs at intervals of 10 years or more)
- Site preparation for planting, planting of stock and release can be accomplished in a more efficient manner.

- Genetically improved red pine stock or stock from known seed sources can be utilized.
- Clearcutting minimizes risk from *sirococcus* shoot blight.
- Clearcutting can increase visual variety through design, timing, size, and location of clearcuts.
- This method allows other types, including hardwoods, aspen, balsam fir, and jack pine, to be converted (planted) to red pine.

White Spruce-Balsam Fir

Several harvest cutting methods are appropriate for regeneration of white spruce, spruce-fir, or balsam fir forest types. Clearcutting is the optimum method for regeneration of these types in some situations and shelterwood is appropriate in other situations. Depending on stand conditions, either clearcutting or shelterwood cutting is recommended for reproducing balsam fir in even-aged stands (USDA Forest Service 1986b).

In situations where the desired condition is one of these forest types, and advanced regeneration is not present in adequate numbers, and artificial regeneration is not desired, or where frost damage to regenerated spruce is likely, the shelterwood method would be used where feasible. Stands that are over-mature or high-risk, have high windthrow hazard, or have inadequate volume per acre to support two or more cuts, are not shelterwood opportunities. These stands would be regenerated by clearcutting to convert to aspen or artificially regenerated to conifers.

Where use of the shelterwood method is not necessary to regenerate the type, or where shelterwood opportunities are not realistic, clearcutting may be determined to be the optimum method for regeneration of white spruce-balsam fir at the project level because:

- Natural regeneration of white spruce is often unreliable (USDA Forest Service 2004p).
- Over-mature and spruce budworm-damaged stands can be salvaged.
- Stands can be sold commercially as a clearcut that would not sell as a shelterwood because of low volume or value per acre (primarily balsam fir).
- Clearcutting allows more efficient site preparation and planting for white spruce.
- Genetically improved white spruce planting stock can be introduced.
- Clearcutting reduces risk of windthrow and spruce budworm damage is reduced.
- Clearcutting can increase visual variety through design, timing, size, and location of clearcuts.
- This method allows other types, including hardwoods, aspen, and white pine to be converted naturally or artificially to spruce-fir.
- Costs are lower and revenues higher because there is usually only one timber sale for the stand, volumes per acre are higher, and harvest operations are more efficient.
- Clearcutting provides habitat conditions for wildlife species that utilize young conifer habitat.

Lowland Conifer

Several harvest-cutting methods are appropriate for regeneration of lowland conifers, including clearcutting. The amount of lowland conifer regeneration harvest in the Forest Plan is very minor compared to other forest types.

In situations where the desired condition is lowland conifer and advanced regeneration is not present in adequate numbers, shelterwood, strip clearcutting, or patch clearcutting should be used where feasible. Stands that have high windthrow hazard or have inadequate volume per acre to support two or more cuts are not shelterwood opportunities. These stands should be regenerated by clearcutting to regenerate lowland conifers.

Where the shelterwood method is not necessary to regenerate the type, or where shelterwood opportunities are not realistic, clearcutting may be determined to be the optimum method for regeneration of lowland conifer at the project level because:

- Clearcutting is the preferred method to regenerate black spruce. (USDA Forest Service 1971).
- Strip clearcutting is the best way to obtain even-aged stands of northern white cedar (USDA Forest Service 1976).
- Clearcutting reduces risk of windthrow in mature and over-mature stands.
- Slash disposal such as full tree logging, broadcast burning or piling and bunching to prepare (expose) a seedbed is accomplished more efficiently.
- Clearcutting provides habitat conditions for wildlife species that utilize young lowland conifers.
- Costs are lower and revenues higher because there is usually only one timber sale for the stand volumes per acre are higher, and harvest operations are more efficient.
- Clearcutting can increase visual variety through design, timing, size, and location of clearcuts.
- Clearcutting provides a variety of age/size classes of lowland conifer vegetation.

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