SHELTERWOOD
THEME AND VARIATION

The Shelterwood system is a proven method for regenerating even-aged stands of tolerant and mid-tolerant species. It is used in many hardwood and softwood forest types. By harvesting 1/2 to 3/4 of the existing stand, enough daylight and disturbance creates opportunities for new seedlings to become established under partial shade. The remaining overstory is allowed to grow for 5 to15 years while the understory gets established. When the overstory is removed, the young forest is released to full sunlight for rapid growth. The first cut looks like a very heavy thinning, and the second cut looks like a clear-cut, but the new forest is already present, so we call it an overstory removal. It creates a new stand of one age.

Traditional shelterwood systems are impractical in many instances, particularly when the stand is not truly even-aged, or at rotation age, some species are mature and a significant component is immature. A "proper" shelterwood, in most cases, sacrifices many trees that have not met their full potential for diameter or grade increase. Also, some landowners do not want to see the final overstory removed in one cut. My experience has led me to understand the extended shelterwood concept. Past light and moderate cutting has generally not produced adequate regeneration. Various heavy-cutting systems, not strictly according to the textbooks, generally have good regeneration. Also, we see many high-quality sawlogs and veneer produced from trees that were severely released when 4- to 8-inch dbh with a significant clear bole. How can we describe and replicate these successes of the past?

As practicing foresters, we have to make up our minds to regenerate the stand when it is appropriate. Small group selection is a preferred technique for some philosophies, but the failure in practice leads us to reevaluate it. With excessive deer browse in many areas, small group selection is merely a short-term dinner bell. We are left with beech, striped maple, hophornbeam, and black birch if we are lucky. Extended shelterwood creates extra regeneration to feed deer and moose and hopefully enough to establish a new forest. It allows a longer establishment period, and the potential for a second establishment cut if the first one fails.

Extended (or delayed) shelterwood is when the overstory is retained for more than 20 years for additional growth. In the extreme, it becomes a two-aged system where overstory trees are retained for 40–50 years while the understory has grown to half of its rotation age. Final removal of the overstory creates a new age class, and the "understory" becomes the overstory. While this has been practiced in northeastern and other forests by many foresters and by accident, there is little discussion of this technique in the literature.

Extended shelterwood and its variations are well-suited to stands with variable soils, previous patchy harvesting or high-grading, post pasture stands with a range of ages, mixes of species with different shade tolerance or longevity, or any stand with a low proportion of acceptable immature growing stock. It also works with a wide range of product diameter objectives, or mixed landowner objectives for timber growth, wildlife habitat, and recreational or aesthetic goals. It creates stands with a complex structure that provide a range of habitats. It is well-suited to growing long-lived shade-tolerant species from the intermediate crown position, especially sugar maple. It can also be used for mid-tolerant species if they are not suppressed and have enough vigor for the extended growth period.

Three Types of Extended Shelterwood

I would propose three types of extended shelterwood: regular, group, and irregular. Regular extended shelterwood (see both Figures 1 and 4) would probably be the least common in real-life practice. Initial establishment harvesting would leave 30–50 square feet (C-line or below) of basal area of immature, acceptable growing stock well dispersed through the area, like a normal shelterwood. If the average diameter is 10 inches, that leaves 60–100 trees per acre. Sixteen years of growth at 8 rings per inch gives an average diameter of 14 inches and BA of 60–100, too much shade for effective regeneration, but the overstory is still not fully mature. A partial overstory removal would be required to maintain the vigor of the understory and ensure survival of mid-tolerant species. Harvesting half the overstory allows for another period of growth before the final overstory removal. If the initial cut leaves 20–30 BA of 4- to 8-inch trees, then the periods between overstory harvests are lengthened, and there is the chance to establish shade-intolerant regeneration like paper birch.

FOR REGENERATION CUTS, we need the daylight more than the shade or seedsource from the overstory. As time goes on, the overstory expands to shade the new growth.

Group shelterwood is similar to group selection in uneven-aged management, but can be done when the structure of acceptable growing stock is not suited to uneven-aged stocking. One half to 3/4 of the stand can be harvested in groups, leaving groups with immature growing stock, perhaps thinning in these groups as needed. These can be harvested when they

Fig. 1. A good example of "regular" extended shelterwood, with even distribution of residual stems.

Fig. 2. After 15 years, part of the overstory has been removed to release the new growth, before being shaded by the overstory.

Fig. 3. After 25 years, it is apparent that less overstory would be better if a partial removal is not planned.

reach maturity, on a flexible basis. Overall, this is more comparable to progressive strip (or patch) clear-cutting. No attempt is made to establish an uneven-aged structure, but the next stand will have patches of 2 or 3 distinct age classes. This creates quite a bit of edge habitat for wildlife, and can also establish species of a full range of shade tolerance.

Irregular extended shelterwood is probably most common in practice. (Figures 2 and 3) The stands we are discussing are by nature irregular, and a flexible method is needed. Mature trees tend to run in groups, as well as low-quality and immature acceptable growing stock trees. Some of this is caused by the patchy nature of previous harvests, some by the soils themselves, or other factors like natural mortality. The basic idea is to harvest, to below the C-line, all the mature and low-quality trees to leave irregular stocking of trees with good potential for value growth. This will tend to be an irregular practice. Overall basal area might range from 20 to 50 square feet, with AGS diameters from 4 to 14 inches. Some patches are cut, and a small portion may be fully stocked. Scattered individual trees or areas of low stocking will predominate. Regeneration will vary with the available light, seed source, scarification and soils. Overstory growth rates, stocking, and tree sizes will depend on many factors, and will determine the timing of the next harvest. Generally, 15–25 years will create conditions that warrant at least partial overstory removal to maintain the growth of the understory, and provide a commercial volume.

Not Without Problems

There are some problems with these systems. Smaller-diameter crop trees, especially of mid-tolerant species, are prone to epicormic sprouting. Leaving groups of these trees can reduce this risk, or leave trees with larger crowns or better shade tolerance. Overstory removal cuts can take a heavy toll of damage on the understory, and there are often two overstory cuts with extended shelterwood. Careful logging adds expense. Skilled hand felling and skidder layout can be successful, but mechanized harvesting clearly has an advantage. Some could use these residual density numbers to justify high-grading. It is essential that nearly every tree left be acceptable growing stock, as the low stocking and long reentry time will allow substantial growth on whatever is left. This space would be better used by the regeneration than any poor quality trees. Heavier cutting allows for more efficient removal of lower-value trees, and often reduces the size and value of the marginally profitable tree. This adds efficiency to conventional crews but again is well-suited to mechanical harvesting.

These extended shelterwood systems provide a tool for irregular stands that do not fit well into the normal silvicultural guide. Stands that are mature or low quality, but have an immature or acceptable component, are particularly well-suited. Stands that might otherwise be clear-cut have another option to maintain some growing stock. Initial harvests are efficient and provide a high flow of present income. This efficiency improves the economics of removing high proportions of low-value wood. Individual tree growth and health are excellent. Extending the shelterwood overstory can make even-aged management more attractive to small woodlot owners. It provides a more continuous forest cover than regular shelterwood, though not as much as uneven-aged management. It has better regeneration success in areas of high deer browse pressure. It maintains complex stand structure, and provides a range of wildlife habitats, and it is an excellent tool for previously high-graded stands. ■

Fig. 4. Initial extended shelterwood cut. Remove mature and low quality to a basal area of 50 sq. ft. or less.

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