Selective Harvesting
Part II: Elements of a Successful Harvest

by Jeff Stringer

Note: Part I of "Selective Harvesting" focused on problems associated with high-grading, an unsustainable selective harvesting technique that, when repeated, leads to long-term loss of timber value. Part II provides information on how to correctly implement a selective harvest to ensure the sustainability of timber production.

A selective harvest can be used to improve a number of non-timber attributes important to many woodland owners. While this article focuses on timber production, many of the concepts can be used to assist in developing a selective harvest for other objectives.

Good stewardship requires the use of practices that enhance the future value of the woodlands and provide for sustainability of woodland resources. Simply put, sustainability means that woodlands are cared for and managed in a way that does not degrade woodland resources and does not result in a loss of future use. Managing in a manner that provides for sustainability is critically important for woodland owners who actively manage, particularly if timber harvesting is being planned.

A selective harvest is one way to ensure that timber growth and production can be sustained and that the woods are not exploited. However, a selective harvest can just as easily ruin a woodland resource as it can help one. An unplanned selective harvest can result in the loss of both short- and long-term timber value and productivity.

Determining a Good Selective Harvest

While every woodland is different, there are two key issues that determine whether a selective harvest is helpful or harmful. To ensure sustainability, a majority of trees left after a selective harvest must have enough vigor to respond to the growing space provided by the harvest. Further, selective harvesting in mature woodlands often creates areas that are relatively open and stimulates natural regeneration. Selective harvests should be planned to provide for appropriate regeneration. These concerns can be posed as questions that, when answered, will indicate whether a selective timber harvest is good or bad.

• *Are the trees left after a selective harvest, healthy, vigorous, and capable of increasing in value?*

A selective harvest, by definition, removes some trees but leaves a number of others to continue to grow. These residual trees are often smaller than the trees that were removed, but if they possess good vigor, they will be able to respond positively to the harvest. If they also are of the proper species, have straight trunks, and are not wounded during the logging, they potentially can provide good future timber value.

There is a relationship between age and vigor, and indicators of both are well known. These indicators can be used to assess the condition of residual trees left by a selective harvest. Unfortunately, many believe that smaller trees are also young. However, in mature woodlands, this is often not the case (see Figure 1). In planning a selective harvest, it is critical to properly identify which trees are truly young and

An example of a good tree (left) to leave during a selective harvest. Note the well developed balanced crown compared to the spindly unbalanced crown tree on the right. *Photo courtesy: Jeff Stringer*

vigorous and are of the proper species and possess good form. Then they must be protected from damage during the harvest. If a selective harvest has already been completed, assessing residual tree vigor, species, form, and damage allows one to determine whether a selective harvest was helpful or harmful to the production of timber.

• *Are the woods regenerating properly?*
Ultimately, in most woodlands dominated by hardwood species, adequate natural regeneration is required to ensure long-term timber production. It is possible to evaluate the regeneration potential of a woodland before or directly after a selective harvest. If the regenerative potential is found to be poor before a harvest, the harvest should be delayed or designed in a manner to help regeneration. If this is not done and the selective harvest is conducted, regeneration could be negatively affected, and timber production could be harmed for a significantly long time.

Using a Sustainability Index to Assess Woodlands

Answering yes to the first question means that at least in the short term (10 to 20 years), the woods will produce timber resulting in short-term sustainability. If the answer is no, then there will be little or no timber production possible in the next 10 to 20 years and possibly for much longer. If the second question is answered yes, then the stage is set for the production of valuable timber over the long haul (+ 40 years). If the answer is no, then long-term timber production is in jeopardy. Table 1 provides a simple explanation of how these two questions can be used to gauge the success of a selective harvest.

Table 1. Short- and Long-Term Sustainability Index

Healthy Residual Trees	Proper Regeneration	Viable Timber Production		Sustainability Index
		Short-Term	Long-Term	
Yes	Yes	Yes	Yes	Good
Yes	No	Yes	No	Short-term
No	Yes	No	Yes	Long-term
No	No	No	No	Poor

Characteristics of Healthy and Potentially Valuable Residual Trees

Tree diameter is often mistakenly equated with tree age. It is thought that small trees are young, and large trees are old. While this is intuitive, in many woods, it is also incorrect. Many of our woodlands were established due to agricultural abandonment or intensive harvesting that caused large numbers of trees to become established at the same time. These woods are considered even-aged, meaning that the majority of the trees, especially overstory trees, are close to the same age. These woods may contain trees of the same species that range significantly in diameter. Many of the large overstory trees are large because they were the first to sprout, or they were faster growing at the very start of their development. Because of this head start, they were able to gain a competitive advantage over other trees and outgrew them. In these cases, small diameter trees are so because of the competition from the faster-growing trees of the same age. Many sawtimber-sized overstory hardwood trees are between 70 and 100 years old and average between 18 and 24 inches in diameter. In the same woods, there will be 6- to 16-inch trees that will be in the same age range or slightly younger.

Figure 1. Stump of a 5 inch diameter white oak that is 82 years old. *Photo courtesy: Jeff Stringer*

Figure 1 shows the stump of a 5-inch white oak tree that is 82 years old. This white oak tree was growing among 20-inch overstory trees that were 90 years old. Most individuals would look at a 5-inch diameter oak and guess that the tree would be 15 to 25 years old. Based on this assumption, many believe that leaving small-diameter trees during a selective harvest equates to leaving young trees with a lifetime of growth ahead of them. This is unfortunately incorrect and shows the importance of proper aging of trees in developing a good selective harvest.

Oftentimes, these older, smaller trees possess little vigor. Generally, healthy vigorous trees can be identified by their crowns. Healthy trees, especially those that are young, will have crowns that still have a main leader, are well balanced (crowns that are protruding from the main stem on three or four sides) and have at least 35 to 40 percent of their total height in crown. For example, look at small diameter oak trees in a mature woodland, and you will notice that many of their crowns are flat topped and sparse. This is an indicator of low vigor and often of old age. When released through a harvest,

these trees can remain for many years without growing. In some cases, they will die back.

Residual trees should be of a commercial species, have straight trunks, and have not been wounded during logging. A small branch knocked off is not a problem, but if there are wounds on the base of the tree from skidding or if the top is knocked out, there may be severe damage to future value. Figure 2 shows a residual tree wounded during a selective harvest that was conducted 15 years ago. At that time, the tree was relatively small with a significant potential to grow into a veneer tree. However, skidding was not planned, and many of the smaller residual trees, including the one shown, had the bark knocked off near the ground by contact from logs being dragged behind the skidder. The wounding was significant, and the damage to the butts of the residual trees caused open wounds that have not healed, resulting in significant loss in value.

Figure 2. Internal rot created by skidding damage that occurred during a selective harvest 15 years ago.
Photo courtesy: Steve Gray

Maintaining Adequate Regeneration

To maintain long-term sustainability, analysis of the regenerative potential is necessary, and selective harvests in mature woodlands should be designed to provide for proper regeneration.

At some point, a woodland must regenerate new trees of the appropriate species if long-term timber value is to be maintained. Further regenerating a diverse species mix is also preferable and can help hardwood forests maintain value over the long term. A woodland should be analyzed to determine its regenerative potential, and plans should be undertaken to ensure that a variety of commercial species can regenerate. For example, oaks can maintain good regeneration on poor-quality sites (dry uplands), but on medium- and high-quality sites, oaks cannot develop adequate amounts of small seedlings and saplings in the understory due to the deep shade that persists on these sites. Without the presence of these before a harvest, oaks will not regenerate. It also takes considerable planning to select and protect small diameter maples and other species that can grow successfully in the shade of the understory. While these species may regenerate easily under a mature overstory, keeping the sapling and pole-sized trees intact during a selective harvest can be a challenge. Other species such as yellow-poplar and black walnut need full sunlight, and open areas must be established for these species to regenerate. If the selective harvest does not take into consideration the regeneration needs of the overstory species present, regeneration could be less than adequate and, in some instances, non-existent.

Also, a management plan must take into account invasive species and make sure that the harvest is designed to avoid problems with the establishment of these species and minimize or eliminate their presence.

How to Ensure Sustainability

Understanding the basic principles of how woodlands regenerate and what characteristics constitute vigorous, high-quality trees is the key to assessing whether a selective harvest will improve a woodland or degrade it. Foresters can identify young, potentially high-value trees and develop an improvement harvest to protect them and encourage their growth while removing larger valuable timber as well as low-quality trees that are hindering their development.

Contracts should require a logger to protect residual trees from harm. Research has shown that damage to residual trees can be held below 10 percent and further damage reduced by avoiding harvesting in March and April, the time of year when bark is easily stripped from trees. Foresters may also recommend the use of designated skidding areas to avoid unwanted damage to residual trees or regeneration.

Foresters can also mark a selective harvest to encourage regeneration. In some cases, group openings can be made to promote species that require sunlight. In other instances, larger open areas could be prescribed to remove degraded overstory trees. Partial shade can be left in some areas to encourage oaks if there are some oak seedlings and saplings present. Foresters might recommend postponing harvesting in some portions of the woodlands to avoid a problem with exotic invasives or give that area time to develop its regeneration capacity.

Significant planning is required to develop a successful selective harvest. A landowner should consider consulting a professional forester to design a successful improvement harvest that provides for adequate regeneration of our many hardwood species. Often, their experience and expertise can make the difference between a sustainable or unsustainable harvest.

About the Author:
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