Introduction

Old-growth forest was once the predominant natural condition across southern New England before European settlement; however, it is now one of the rarest habitats in our region, constituting less than one-tenth of 1 percent (< 0.1%) of our forests. While much of the attention around old growth has been focused on protecting "true" old growth, of which there is very little in our region, little attention has been paid to **creating old-growth characteristics** in the woodlots and landscapes of New England.

Although new old-growth forests cannot be created, the opportunity exists to restore old-growth characteristics in our current forests. Since almost two-thirds of the forests in southern New England are owned by families and individuals, the greatest opportunities for creating old-growth characteristics will be on these private lands. This pamphlet will introduce you to some of the habitat features of old-growth forests, outline management options and resources for restoring these features to your woodlands, and discuss opportunities to realize both economic and ecological benefits from your forest.

What is old growth?

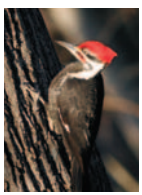
old growth: forests that were never directly impacted by humans. This is a very rare condition in southern New England due to the historic prevalence of agriculture, logging, and other land uses. These forests often contain a well-developed structure, including large trees, multiple-aged trees, and abundant downed wood (see Old-Growth Structure, page 5).

second growth: forests that established and grew following human land use, such as agriculture or logging. Most of the forests currently found in our region are best described as second-growth and often consist predominantly of even-sized and even-aged trees.

Why is old growth important?

Our current forests are much different than the forests our native plants and wildlife adapted to over thousands of years. While there are no "charismatic" old-growth dependent wildlife species in southern New England such as the spotted owl of the Pacific Northwest, some plants, lichens, and mosses are dependent on old-growth characteristics that are currently lacking or less abundant in our second-growth forests. Also, many species, particularly native birds including some woodpeckers, warblers, and thrushes, have been shown to reach greater abundance in forests with old-growth characteristics such as large trees with cavities. These dense populations are crucial for populating or re-populating other areas and are therefore central to the long-term viability of our native species.

Furthermore, it is estimated that we have only documented approximately 10 percent of the species found on Earth. **Creating the structure and composition found in old-growth forests helps us "keep every cog and wheel"** and undoubtedly conserves crucial habitats for insects, fungi, and other organisms yet to be documented. **Therefore, restoring these once common habitats is of central importance to conserving the full suite of our region's native plants and animals.**



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Pileated Woodpecker

Old-Growth Structure

Although much of southern New England is forested, the woods you see today are much different from the vast expanses of old growth that covered the landscape upon the arrival of the first European colonists. **Characteristics that are generally more abundant in old-growth forests include the following:**

A diversity of tree ages and sizes, including very large trees (25 to 30 inches in diameter)

Snags—large standing dead trees

Large downed logs

Gaps in the forest canopy

Restoration of Old-Growth Structures

Old-growth structure can be restored to your woods either through passive or active management.

Old-growth structure: large standing dead tree

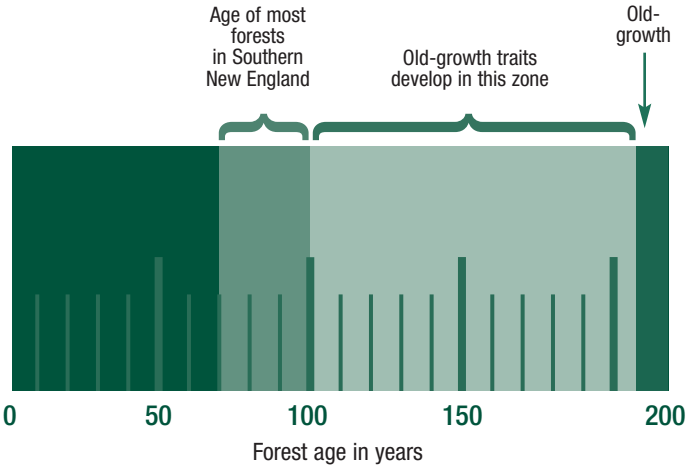
Passive Management. This approach involves letting nature take its course and waiting for forest development and natural disturbance to create the structure without any direct human intervention. Disturbance events such as windstorms, ice and snowstorms, and insect outbreaks strongly influence forest structure by creating old-growth characteristics such as gaps in the forest, standing dead trees, pits and mounds from blown over trees, and downed logs on the forest floor (photo, page 15). The structure of a forest changes over time and is determined by the type, frequency, and intensity of natural disturbance. Because no trees are harvested using passive management, this approach will produce the most natural appearance and conditions in your woods in the long run (i.e., no cut stumps or skid trails). Nonetheless, developing old-growth structure using this approach will often take over a century based on tree growth and the types of natural disturbance in southern New England (see Figure A, page 7).

While passive management means no human intervention, it does not mean "do nothing." Since the time frame for developing old-growth characteristics is beyond your lifetime (see Figure A), engaging in forest and estate planning is critical to achieving old-growth structure in your woods (see Long-Term Forest and Estate Planning, page 14).

Old-growth structure: large downed log

Active Management. The second approach to restoring old-growth structure to your land involves *active management*. **Planned forest management provides the opportunity to accelerate the development of old-growth structure (bigger trees, standing dead trees, various canopy gaps, diversity of tree sizes, downed logs) through carefully planned treatments and allows for simultaneous economic return through timber management.** Forest management provides an opportunity to mimic natural disturbance, increasing the growth of trees and the development of old-growth characteristics. Although it may sound counterintuitive, active management can restore certain old-growth characteristics faster than the passive approach.

Timeline of Old-Growth Structural Development



adapted from Hagan and Whitman (2004)

Figure A In our forests, it takes at least 200 years for the full suite of old-growth structures to develop. Because most of our forests are 70 to 100 years old, very little old-growth structure is currently present in our region. Both passive and active management approaches can ensure the development of these structures. The opportunity exists to shorten the time it takes to create old-growth characteristics by using forest management (see Table 1, page 9).

Patch reserve of legacy trees left after a harvest to develop into old-growth structure

Active Management continued

When planning active management, it is critical to identify and retain legacy trees. *Legacy trees* are in the main canopy and are left to serve as future sources of old-growth structure. Unlike trees that are left following traditional timber harvests to grow larger and be harvested in the future, **legacy trees are never removed from the woods.** Instead, these trees are left to grow larger and die, providing standing dead trees for habitat, and eventually fall over, providing different habitats as a large downed log on the forest floor. Depending on your objectives, individual legacy trees can be dispersed throughout your land or retained in groups to serve as small-patch reserves (see photo above). In the selection of legacy trees, preference should be given to trees in your woods that already contain important habitat features, such as cavities and dens. Likewise, reserving large canopy trees with wide crowns will allow for the rapid development of large diameter trees on your property. Finally, selecting long-lived species for legacy trees, such as sugar maple, beech, and white pine, can ensure that these old-growth characteristics are present on your land for future generations.

The number of legacy trees left will depend on your landowner objectives. If old-growth structure restoration is your primary objective, then leaving between 25 to 50 percent of your canopy trees as legacies will ensure that old-growth structure will develop over time. Leaving fewer trees will take longer for the structure to develop. **However, leaving even just a few legacy trees per acre can provide old-growth characteristics missing from most woodlots.**

Many of the practices used for meeting traditional timber management objectives are also excellent tools for restoring old-growth characteristics; however, it is critical that you match these practices with the types of old-growth characteristics you hope to restore (see Table 1 below).

Table 1 **Old-growth structural characteristics and corresponding management practices for promoting these characteristics.**

Old-Growth Structural Characteristic	Management Practice
Increase the diversity of tree sizes and ages	Harvest single trees or small groups of trees, creating gaps up to 1/4 acre; repeat to create multi-aged stands
Increase the number of snags—large standing dead trees	Girdle (i.e., cut several rings of bark/cambium around the stem to deliberately kill the tree) selected medium- to large-sized trees, including cull trees
Increase number and volume of downed logs	Fell and leave on the ground selected medium- to large-sized trees, including cull trees, which can improve growth of residual trees
Provide for future snags and downed logs	Reserve permanent "legacy trees" within harvested areas (photo, pg. 8)
Increase number of large living trees	Thin woods by removing competing, low-quality trees adjacent to largest, most vigorous trees

Adapted from William Keeton (2005)

The Gradient of Old-Growth Restoration Practices

There is no one specific "old-growth condition" to aim for as an objective and therefore no one way to create it. **Instead, it is more valuable to consider increasing the amount of old-growth characteristics in your woods in a way that matches your objectives.** While applying the entire set of old-growth restoration practices to your property may be the quickest and most effective way to restore old-growth structure to your land, this approach may also interfere with other management goals, such as timber

The Gradient of Old-Growth Restoration Practices continued

production and the realization of an economic return. **It is important to recognize that a gradient of old-growth restoration practices is available that you may apply to your land.**

This gradient ranges from doing a single practice, such as retaining a few legacy trees or felling low-quality canopy trees, to employing combinations of practices (see Figure B below). **Choosing the level of restoration intensity that is consistent with your other management goals is critical.** If you are only interested in applying a single practice, the designation of legacy trees on your property will provide for the greatest number of old-growth characteristics (e.g., large old trees, future snags, and logs).

Old-Growth Restoration Gradient

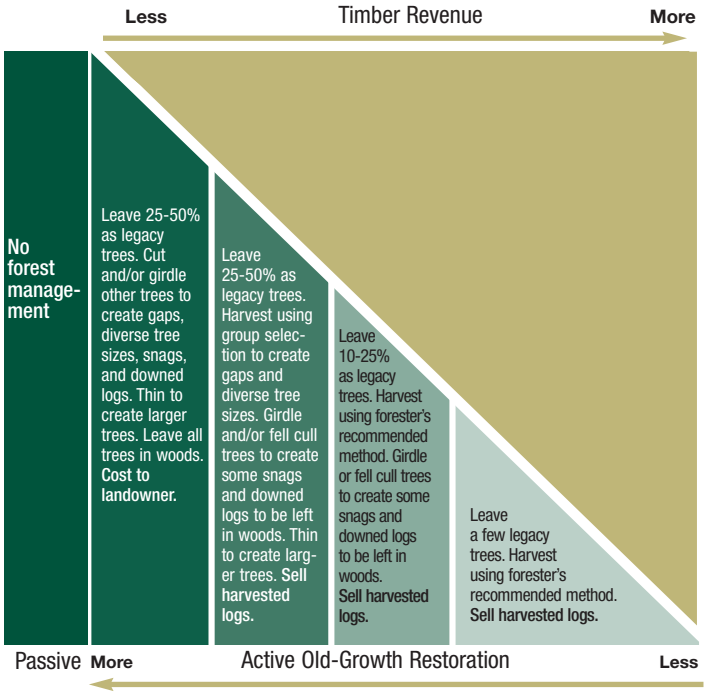


Figure B A gradient in opportunities exists in the level of old-growth restoration practices that you might apply to your land. Multiple combinations of practices can be used to restore old-growth structure to your land, and even low levels of restoration practices can be used in areas primarily focused on maximizing timber revenue. Central to all these practices is the use of long-term planning and forest protection.

Combining Old-Growth Restoration Practices

Figure C-a Woodlot before old-growth restoration practices

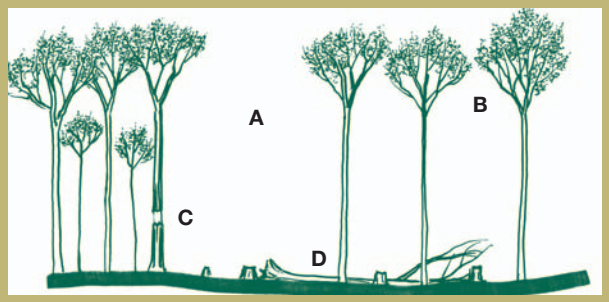


Figure C-b Immediately following a harvest using old-growth restoration practices. (A) Trees are cut and removed to create a 1/4-acre gap. (B) Full crowned canopy trees are thinned around to increase their size. (C) Poor quality tree girdled to create standing dead tree. (D) Tree felled to the ground and left in the woods to provide large downed logs.

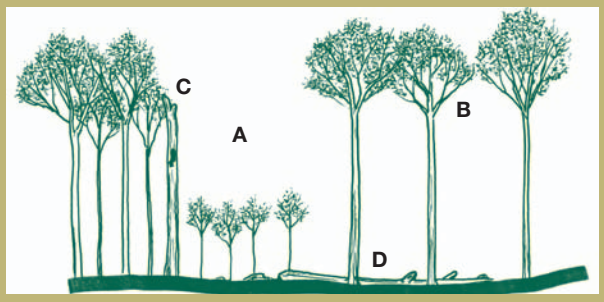


Figure C-c 15 years after harvest. (A) 1/4-acre gap is regenerated, diversifying tree sizes and ages. (B) Thinned trees grow larger. (C) Girdled tree is now a snag. (D) Large downed log shows sign of decay.

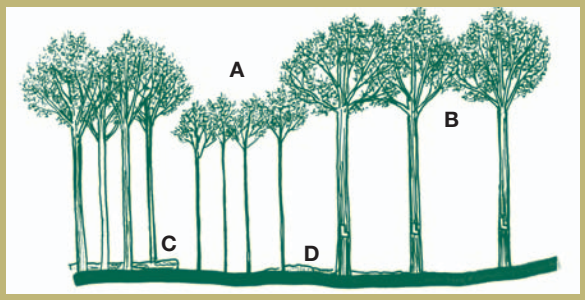


Figure C-d 30 years after harvest. (A) Gap is now sapling and pole-sized trees. (B) Thinned trees, designated with "L" for legacy tree, are large with big crowns. (C) Snag has fallen to the ground and now provides a new large downed log. (D) Large down log is well decomposed.

Siting Old-Growth Restoration Areas

You may choose to implement old-growth management and restoration, whether it is passive or active, to all of your woods or only a portion of it. **When considering where on your land to develop old-growth structure, it is most effective to identify and enhance old-growth structural characteristics already present in your woods.** These areas might include large amounts of downed logs due to a windstorm or a group of large trees containing woodpecker cavities (see photo below). Establishing a patch reserve around these existing old-growth structural characteristics will enhance their value as old-growth habitat by providing contiguous forest around them that will be dedicated to developing additional old-growth characteristics. **A patch reserve is an area of your woods with legacy trees, dedicated to developing old-growth structure** (see photo, page 8)**.** In addition, designating patch reserves in an area with high environmental variation (e.g., topography, moisture, soil productivity) will help restore the natural variation in forest types once found across the landscape.

When considering where on your land to develop old-growth structure, it is most effective to identify and enhance old-growth structural characteristics already present in your woods.

Large trees containing woodpecker cavities

Restoration of old-growth characteristics can occur most rapidly in high site quality areas. For example, this white pine is growing on a productive site in Cummington, MA and has reached old-growth dimensions despite being only 100 years old.

Another consideration in siting your old-growth efforts is directing them to areas of your land in which management for old-growth features would be most efficient. These areas would include those of the highest site quality in which the restoration of structures, such as large living and dead trees, would occur most rapidly. **Site quality** is the productive capacity of a site as determined by the amount of available water and nutrients. High-productivity sites will grow big trees faster than low-productivity sites. **Old-growth structure (big trees, large standing dead trees, and large downed logs) will develop faster on high-productivity sites** (See photo, above). Remember, however, that these areas also represent the best areas for timber management. Should you choose to dedicate a high-productivity site to developing old growth characteristics, it is important to recognize the loss of future timber revenue. It is important for you, as a landowner, to work with a professional forester to understand your options and balance your objectives. **To find a Massachusetts licensed forester working in your town, see www.masswoods.net.**

An additional, important consideration in planning for old-growth restoration is how your land fits into the surrounding landscape. Like most management objectives, an excellent way to increase the functioning of the areas containing old-growth restoration treatments is to implement these strategies in landscapes where other landowners, both public and private, are doing similar management. Consider coordinating your management activities with adjacent landowners to increase the size and effectiveness of these areas in serving as old-growth habitats on the landscape. For information on landscape-level old-growth restoration planning, visit **www.wildlandsandwoodlands.org**.

Suggested Reading and References

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Acknowledgments

Several individuals have provided extensive feedback and suggestions on drafts of this pamphlet. We thank them for their efforts: David Kittredge (UMass), Andy Finton (TNC), David Foster (Harvard Forest), David Orwig (Harvard Forest), Scott Jackson (UMass), and Laura Marx (TNC).

This pamphlet was made possible through the generosity of the Massachusetts Chapter of The Nature Conservancy.

Photo credits: Anthony D'Amato, Susan Campbell, John Burk

Design: Penny Michalak (designmz.com)

Co-author, Tony D'Amato, standing next to a 300 year old hemlock on Mount Everett, Mount Washington, MA