WHITE PINE MANAGEMENT—A QUICK REVIEW
Ken Lancaster, USDA Forest Service, originally published in 1984, NA-FR-27[1]

Introduction

White pine has played a most important role in the economy of the northeast since early times. But its importance may diminish in the future as volumes available for its traditional uses decline.

A scan of the timber survey of the northeastern states indicates white pine drain equals or exceeds growth, and that the inventory is declining rapidly or is projected to decline within this century. This is due, in part, to the heavy demand for white pine that has been consistently high over the years, but more so due to the loss of white pine sites to hardwood species.

Forestry, for the most part, has played a minor role to alleviate the supply problems of white pine. White pine management seems to end when the last log is harvested. Foresters have concentrated their efforts in thinning stands with not enough concern given to regenerating the species. It would appear foresters have fallen victim to the adage that white pine cannot succeed itself.

It is the intent of this discussion to encourage foresters to become more active in white pine management and to emphasize that with the application of management practices, white pine can be regenerated successfully. White pine is the fastest growing softwood in the northeast and even with its insect and disease problems can exceed the growth of red pine—and the hardwoods.

Growth and Development

The best seedbed condition of white pine is exposed mineral soil protected from full sunlight. Thus to regenerate white pine, a disturbance of the forest floor is necessary to break up and mix the accumulated litter with mineral soil. A 15 to 20 year cutting cycle, with logging confined to snowless months, usually results in enough scarification to ensure good establishment of pine.

An inherent weakness that places white pine at a disadvantage in competing with hardwoods is the slow height growth of seedlings during the first 5 years. White pine will rarely exceed a height of more than a foot 5 years after establishment. After this initial slow height growth period, the species begins to grow rapidly and is maximized at 50% full sunlight and more. Hardwoods on the other hand have their maximum height growth during the first 10 to 20 years and can quickly overtop the pine.

White pine is recorded as intermediate in tolerance and can persist for years in the understory. The species will respond to overhead release after 30 to 50 years of suppression. The rate of response is dependent on crown size. A seedling or sapling with a full, healthy crown of needles and a crown of 50% or more of total height, will respond almost immediately to release. (Maintain residual at B-level).

[1] Retyped with minimal editing by Karen Bennett, UNH Cooperative Extension. Every effort was made to adhere to the original. 2015.

Smaller crowned, sparsely needled trees will go through a period of crown development before responding to the release. Up to 5 years might be required before an increase in height growth is evident of these poorly developed understory trees.

Although white pines can be grown on nearly every soil within its range, it can be managed most effectively and economically on those soils having a high proportion of sand. In comparing red and white pines, red pine is best suited on courser sandy soils while white pine is best for finer sands and loams. White pine is less drought-resistant than red pine, but tolerates wetter soils. Red pine is not suited to poorly drained soils, while white pine grows exceptionally well in such sites.

Forestry Practices

Regeneration

Forestry practices designed to regenerate white pine naturally are rarely applied because of the problems associated with the aggressive hardwoods. Site conditions developed for white pine establishments are also well-suited for hardwood encroachment. This is particularly so in older stands of pine ready for regeneration. In most of these situations, the hardwoods are already established while white pine may or may not be present. Thus, the first cut of a shelterwood designed to establish white pine is doomed to failure if the white pine is not established, but the hardwoods are and no attempt is made to control hardwoods.

Failure is also assured when both hardwoods and white pine are established in the understory, and no effort is made to remove the hardwoods before or after the first cut of the shelterwood cut. Hardwood control is an essential measure in regenerating white pine in pure or nearly pure stands.

The guide to success in regenerating white pine can be summarized as follows:

1. Pick the right pine site—leave the hardwood sites (site index 60+) to the hardwoods. Controlling hardwoods on these better sites is a costly venture.
2. Start the regeneration measures early in the life of the stand. Optimum seed-bearing age begins at age 50. This is a good time to begin regeneration measures.
3. In the thinning operations from age 50 and on, strive for maximum site disturbance by confining the operation to snowless months. Although this is not possible in all instances, an effort should be made to have at least one thinning conducted during the snowless months long before the stand is mature and ready to be regenerated.
4. Remove the understory and overstory hardwoods in all the thinning operations from age 50 on. Firewood is a good outlet for this material.
5. If at all possible, pick a time for the thinning operation that coincides with a good white pine seed year.

These measures should be continued up to the final cut of the shelter trees. Planting should be considered towards the end of the rotation in the scattered areas not stocked with pine.

Seedling and sapling stands (1-inch to 5-inches DBH[2])

Thinning of these young stands is not recommended for stagnation never occurs. The major concern is the release of the white pine in the understory of a hardwood stand. In many instances seedlings under a heavy overstory of hardwoods need to be partially released at intervals to maintain thrifty crown development. Something close to 50% full sunlight should be strived for in the application of the release measure. Heavily stocked, small pockets of pine can be completely released, coupled with the repeated release of pine from the hardwood competition around the pocket margins where the tendency is for the hardwoods to encroach upon the pine.

White pine saplings, growing in the understory of hardwoods on a pineland site (hardwood site index 59 or less) are usually not completely released until they average about 20 feet as a means of protecting the pine from weevil. Experience has taught us, however, that this need not be a hard and fast rule. In areas where there are a sufficient number of stems, 800 or more per acre, 4.5 feet in height or taller, complete removal has resulted in excellent stands of pine. If there are enough pine saplings on the site, evenly distributed, so that early crown-closure is assured, then a complete release will produce a stand of acceptable quality and volume, with and without the weevil.

Poles and sawtimber stands (6-inches DBH and larger)

Prescription guidelines for managing poletimber and sawtimber stands are well-established in the silvicultural guide[3]. Specifically, thinning is recommended where stocking is at or above the halfway mark between A and B levels of the stocking chart. Not clearly defined in the publication, is when a stand should be thinned for the first time.

Recent unpublished data from the University of New Hampshire indicate that the first thinning can be delayed until the stand has a mean stand diameter of 7 to 8 inches DBH. It has been found that for stands averaging 8 inches or more, volume per acre response is at a higher rate than younger stands. Stands less than 6 inches mean stand diameter actually sustain a per acre growth loss due to the thinning.

This would indicate that foresters need not be too hasty in initiating the first thinning of a pure stand of white pine. Delaying the first entry until the stands average 7 to 8 inches DBH appears to be the best strategy.

Applying the shelterwood cutting system

The shelterwood system is the best method available to the land manager regenerating white pine at rotation age. It is most effective because the system compensates for the slow seedling growth of pine in the critical first 5 years.

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[2] DBH—diameter at breast height. The diameter of the tree measured 4 ½ feet above the ground

[3] Lancaster, Kenneth F.; Leak, William B.; A silvicultural guide for white pine in the northeast. 1978. Gen. Tech. Rep. NE-41. Broomall, PA: U. S. Department of Agriculture, Forest Service, Northeastern Forest Experiment Station. 13 p.

Based on our many field observations, foresters are not capitalizing on this most important advantage. In too many cases, the first cut of a two-cut shelterwood ends up in a series of patch and group openings with some clustering of residuals. Patch or group cut arrangements in mature stands of white pine favor and encourage hardwood regeneration, and to a limited extent white pine, but the conditions are more favorable for hardwoods.

Based on our many different ways the shelterwood system is being applied throughout the northeast, it would indicate that a more precise description of the system is appropriate, particularly as it relates to regenerating white pine.

Normally, a two-step shelterwood cut, completed over a period of 10 to 20 years, will ensure adequate regeneration of white pine. The first cut should be fairly light, removing not more than 30 to 40% of the basal area, including both softwood and hardwood stems. Trees should be removed mostly from the co-dominant and lower crown classes. The best trees should be left, and they should be well-distributed over the entire area.

Avoid making large openings in the canopy—larger than one-half tree height.

If after a period of 10 years advanced regeneration of white pine is satisfactory, i.e., 80 % or more of 1/500 acre quadrats (5.26 foot radius) are stocked with white pine, remove the overstory trees.

If after a period of 10 years regeneration is lacking or less than 80% of the quadrats are stocked with white pine, then there are two choices:

1. If the crown canopy has not been closed or the stand has not recovered from the previous cut, then prepare the site for seed by breaking up the accumulated litter in those areas not stocked and remove the advanced regeneration of hardwoods. Wait another 5 or 10 years.
2. If the crown canopy has closed during the 10-year period, conduct another light cut by removing no more than 30% of the basal area following the same guidelines of the first cut; i.e., leaving a residual stand evenly distributed with no large openings in the crown. Evaluate the regeneration situation in 10 years.

Essentially, in the installation of the shelterwood system, keep the crown canopy of the shelter trees rather tight to create conditions more favorable for white pine establishment rather than the broad leaf species.

<u>Pruning</u>

Because of the persistence of branches and degrade associated with weevil damage, pruning can be an important cultural practice in white pine management. Pruning is done to develop quality and improve the value of a standing tree.

There is a wealth of research on the subject which indicates that pruning is a good investment. In one study, white pine pruned 20 years ago was cut and sawn and compared to those trees not pruned from the same lot, pruned trees yielded an internal rate of return of over 17% over unpruned trees.

Thinning and pruning should go hand-in-hand for rapid growth of the selected crop trees and early healing of wounds.

A common mistake in selecting crop trees to prune is to select smaller trees because they are usually the straightest with smaller branches. These trees for the most part are the slow-growing, small-crowned trees that respond slowly and will never be dominant crop trees. In choosing crop trees, pick the dominant, larger crowned trees—these are the fast growers.

Reforestation

In planting white pine in open areas, spacing should be as a maximum at 6 feet x 6 feet. Close spacing will not protect the pine from insect damage, but it will help the development of broad irregular crowns. Close spacing is the most promising solution to the white pine weevil problems. 5 feet x 5 feet spacing should even be considered.

Insect and Disease Problems of White Pine

White pine blister rust, transmitted to pine by the spores from infected gooseberry and currant bushes, is a disease that is no longer a major problem in the northeast. This would indicate that the control efforts over the last 30 years have been effective; for infections over the past decade or two, have declined significantly.

White pine weevil is the major pest of white pine because of crooked and multiple stems resulting from the larval feeding and killing of the leading shoot.

Things known about the weevil are:

1. Prefers a thick stemmed leader over a thin leader. Leaders 4mm (.156 inch) in diameter or less are usually rejected by the insect.
2. Temperature and feeding are interrelated. Feeding and ovipositing are at a reduced level under shaded conditions.
3. We cannot economically control the weevil by the application of insecticides; therefore our only choice is to control weevil damage through stand manipulation, especially during the critical years—the first 20 years of establishment.

The most critical time in the development of open-grown white pine is during the initial period when the crowns have no side competition and have not yet closed. This is commonly referred to as the weevil stage of white pine. These are the difficult times when the damaging effects of the weevil are most devastating and most noticeable.

Once crown-closure occurs weevilling continues, but the impact of the insect is less spectacular because of the compaction of the crowns caused by the side competitors. In this situation, weevilling of the terminal leader will cause a leader to shift to the strongest lateral that is usually thin-stemmed, pliable and at an acute angle to the vertical stem which results in a main stem with a short crook. This defect is corrected, for the most part, as the diameter of the stem increases to merchantable size.

A total release of saplings from overhead competition creates an open-grown situation. Such a measure should be encouraged on those areas where early crown-closure is assured. This early release is the best way to get white pine into rapid production and to condition the stand to withstand the damaging effects of the weevil.

Where the stocking of white pine is insufficient to insure early crown-closure, hardwoods should be thinned at 5-year intervals. The entire overstory can be completely removed when the pines reach 20 feet in height.

Summary

The silvicultural guide, that includes the stocking chart, should be used in the management of white pine. The strong pinelands should be selected as the best sites for white pine management. Most important—the residual stocking after a thinning should not be below the B-level to maximize carrying capacity of the site and to reduce the problems of hardwood invasion.

The initial thinning of essentially pure stands of white pine can be delayed until the stems average 6 to 8 inches DBH. Regenerating white pines is started early in the management process. Start site preparation measures for early establishment of pine seedlings when the stand is about 50 years old.

White pine saplings in the understory of a hardwood stand should be completely released if there are enough of them to insure early crown-closure. Delaying the complete release until the pine is 20 feet tall should only apply to those areas of pine where early crown-closure cannot be attained.