

Basics of Pine Management

Information for woodland owners that are considering pine management*

by Billy Thomas and Jeff Stringer

Kentucky is considered a hardwood state with 85 percent of the woodlands dominated by pure hardwood forest types. Fourteen percent of the woodland area is covered by either oak-pine forests (nine percent) or pure pine forests (five percent). Although pine trees, also called softwoods or conifers, occupy a relatively small percentage of land area, they are nonetheless important components of Kentucky's woodlands and can benefit from management. This article provides an overview of pine establishment and management for Kentucky woodland owners. Typically, pine can provide more frequent income opportunities than hardwoods. Also, pine can provide some benefits for wildlife, such as planted stands that provide early successional habitat and winter cover and other benefits for wildlife that cannot be satisfied entirely by hardwood forests.

The majority of pines occur on marginal sites that are better suited for pine (both ecologically and economically) than hardwoods. Generally, these sites are low in nutrients required for hardwood growth, and, although a number of hardwoods will survive on these sites, they are not as prosperous, will not grow as fast, and will not produce the quality hardwood sawtimber that brings the most income. Pine can produce a product on these marginal soils and provide other benefits in a shorter time period than hardwoods. On low-productivity upland sites, particularly those with shallow soils and south- to west-facing slopes, landowners might consider favoring pine or a pine/hardwood mix over only hardwood species.

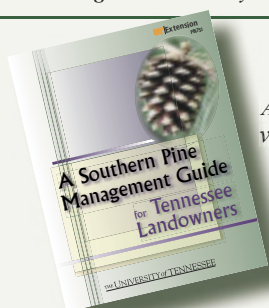
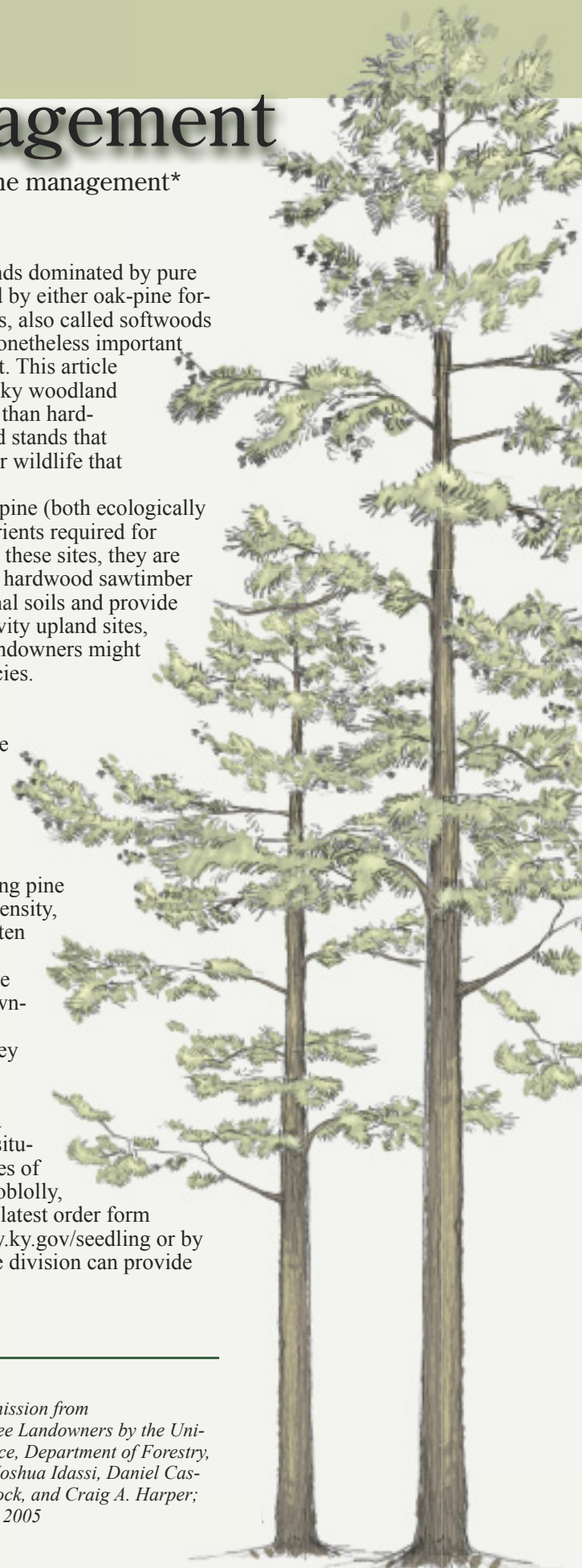
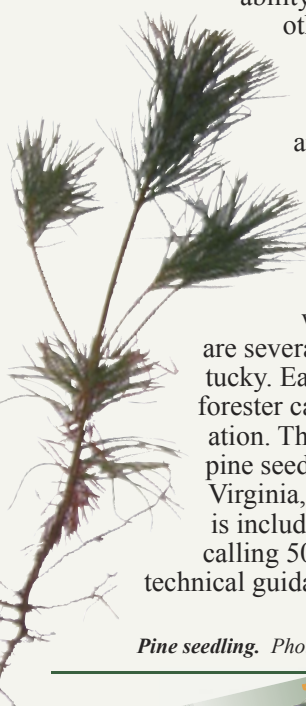
Planting Pine

Whether to plant or not is the question when it comes to raising pine. The answer will depend on a variety of factors including objectives, soil productivity, current tree species on the site, nearby seed sources, availability of time and resources for planting, and a host of other considerations.

Pines can readily regenerate naturally from seed if exposed to mineral soils and full sunlight. Planting pine provides more control over growing space, stand density, and arrangement than natural regeneration, which often leads to stands that are too sparse or too dense. In turn, this leads either to incomplete use of the site or added expense later to thin the stand. Landowners should discuss their situation with a professional forester so that they can get the results they want in the fastest and most economical way. There

are several pine species to choose from for planting in Kentucky. Each species has advantages and disadvantages, and a forester can help decide which species is best in a particular situation. The Kentucky Division of Forestry sells several species of pine seedlings, for \$25 to \$30 per 100, including shortleaf, loblolly, Virginia, white, and other conifers such as baldcypress. The latest order form is included in this issue and can be obtained at www.forestry.ky.gov/seedling or by calling 502.564.4496. In addition to selling the seedlings, the division can provide technical guidance and lend tree planting equipment.

Pine seedling. Photo courtesy: Charlie Saunders, Kentucky Division of Forestry



* Compiled and adapted with permission from *A Southern Pine Management Guide for Tennessee Landowners* by the University of Tennessee Cooperative Extension Service, Department of Forestry, Fisheries and Wildlife. Wayne K. Clatterback, Joshua Idassi, Daniel Cassidy, Ron Hay, David Mercker, Fitzroy D. Bullock, and Craig A. Harper; edited by Daniel Cassidy, 2005

Natural Regeneration Methods for Pine

When it comes to naturally regenerating pine, there are a few options to choose from including clearcutting, seed-tree, and shelterwood techniques. An important key to successful regeneration of pine is to control the amount of sunlight available to the developing seedlings. Mature trees are cut to make room for a new developing age class.

Clearcutting: Clearcutting is commonly used to regenerate pine in the South. Clearcutting removes all of the mature trees in the stand to provide full sunlight over the entire stand, creating an environment that will allow young pines to grow well. Artificial regeneration of pine allows the potential use of genetically improved stock and planting at precise spacings such that each seedling has the full complement of resources to grow well. Species that naturally regenerate in clearcut stands are pioneer species, like the pines. Complete or silvicultural clearcuts are those that remove all of the trees down to 1 to 2 inches in diameter. However, most clearcuts are commercial clearcuts where trees are left that are too small or poorly formed to meet local merchantability. In some cases, this could mean leaving trees less than 6 to 8 inches in diameter. These trees are usually of undesirable form and/or species, and they never constitute desirable growing stock for the next stand. If there is a significant number of these trees, they will interfere with the regenerating trees, and they are normally removed as a part of site preparation treatments. It is not recommended that hardwood stands, particularly those on medium and high quality sites, be clearcut and converted to pine. Clearcutting should be reserved for use in existing pine stands where the majority of trees are mature or of low vigor and at risk. Regardless, careful attention to timber harvesting BMP's is required during clearcutting.

Seed-Tree Regeneration: Seed-tree is an even-aged regeneration method that uses natural regeneration to establish the new age class of pines. The seed-tree regeneration method is a modified clearcut, in that some trees are left on the site to provide seed (seed trees), but essentially the site is as fully exposed as that of a clearcut. The same types of plants and animals that colonize a clearcut also find the seed-tree environment inviting. The seed-tree regeneration method is often used with pines, especially those native to the Southeast. All seed trees must be windfirm; that is, they must be able to stand for several years by themselves without the support of an adjacent canopy. The seeds should be readily dispersed by wind currents, carrying laterally for some distance. Seed trees are removed after the new pine seedlings are reestablished. However, the seed-tree regeneration method is rarely used because most landowners would prefer to recover full economic potential from their stands rather than leave large, high-value trees at risk for several years.

Shelterwood Regeneration: Shelterwood is another regeneration technique useful in pines. This requires harvesting about one-half of the existing overstory and removing any unwanted understory trees. The overstory trees that are left will provide partial shade on the ground, thus sheltering the new age class from full sunlight. If they are pine, they provide for more even seed dissemination. Eventually, the overstory is removed once the newly developed seedlings are well established. This method is recommended for regenerating eastern white pine, a more shade-tolerant pine species; it can also be used with species that are somewhat tolerant of shade. The partial shade allows these species to have a growth advantage over competing species that must have full sunlight to grow quickly. For the pines that are more shade-intolerant than eastern white pine, the overstory "shelter" must be removed within three or four years. With eastern white pine, the overstory can be left on for a longer period of time (10 to 15 years). The basic premise of the shelterwood method is that regeneration is established under the protection of the upper canopy while the amount of understory exposure (most importantly, sunlight) is regulated through two partial overstory

Softwoods and Hardwoods

Tree species are often classified as either softwoods or hardwoods. The names can be somewhat misleading in that they have nothing to do with the "hardness" of the wood. Rather, the terms refer to flowering or broadleaf trees (hardwoods) and coniferous or needled trees (softwoods). Softwoods, or conifers, are usually evergreen, having leaves that are needles or scalelike. Hardwoods dominate Kentucky's land coverage and its species diversity (~120 hardwoods compared to eight softwoods).



A clearcut can be used to establish a new pine forest. The area on the left side of the image was treated with herbicides to control hardwood competition. The untreated area on the right shows hardwood sprouts that will compete with pine seedlings. Photo courtesy: Jeff Stringer

removal cuts. Gradually, the regeneration is released from the influence of the upper canopies. As it forms an overstory canopy of its own, it becomes the dominant canopy on the site.

Site Preparation Treatments

To produce conditions that are necessary to effectively and efficiently regenerate pine species, silvicultural techniques classified as site preparation are often applied in conjunction with a regeneration harvest prior to or directly after the establishment of seedlings. Foresters use site preparation treatments to control competition on the site, prepare the site for planting by removing brush and litter, and prepare the soil for seedling establishment (natural or artificial). There are three ways to implement site preparation treatments: chemical, mechanical, and burning. All three can be used effectively in any combination given the economic constraints of the landowner. Cost-share programs may also be available to help offset the costs of these early operations.

Chemical Site Preparation: Site preparation that uses the systematic application of herbicides is classified as chemical site preparation. The goal of the process is to control dense or unwanted vegetation that might interfere with the survival and development of seedlings. The application of the herbicide can also inhibit hardwood sprout competition. Many pines are shade-intolerant and flourish when direct sunlight is available. The removal of overtopping vegetation increases the survival of planted seedlings. After commercial clearcutting, if enough trees are left, it is recommended that these be deadened using herbicides. The herbicides used are based on the species present. The techniques used to apply the herbicides can vary widely. In some instances, herbicides are applied over the entire stand with a helicopter or ground equipment that is designed for this purpose. However, many times the trees are treated by hand, using techniques such as hack and squirt, cut stump, or basal bark. Foresters should be consulted to help determine the most effective herbicide and techniques.

Mechanical Site Preparation: Mechanical site preparation works toward removing unwanted vegetation or breaking down logging slash and debris. These techniques use heavy tractors and bulldozers to pile, rake, shear, chop,

or disk the woody debris and vegetation. Removing this material provides a clean planting site, reduces standing competition, and often tills or mixes the soil and the organic material to enrich the soils, increasing the likelihood for pine tree growth. Just as many herbicides can be used in chemical applications, there

are many mechanical techniques available, ranging from simply knocking over stand vegetation to pushing the debris into organized piles or windrows. Mechanical preparation is often used in conjunction with fire, burning the debris once it has been piled together.

Site Preparation by Prescribed Fire: Prescribed fire reduces the levels of slash, debris, and litter while releasing nutrients back into the soil. A properly timed fire will kill vegetation that initially invades a harvested stand and will also increase the ease of planting seedlings. Controlled fire should be used only under ideal conditions. If the site is too wet, the application will be useless. If the site is too dry or wind and weather conditions are not ideal, the fire can burn too hot and create potential short-term nutrient and erosion problems in the area to be planted.



Prescribed fire can be a useful tool in controlling unwanted vegetation. Photo courtesy: Terry Price, Georgia Forestry Commission, www.forestryimages.org

Smoke management should be a priority when applying fire. Considering the liability and safety issues surrounding the application of fire, landowners should always work with a professional forester and double check to ensure that all the proper permits and regulations have been filed and followed.

Thinning Pine Stands

Thinning is a technique that is used to adjust the density of forests or plantations. Thinning is required in most pine stands to ensure that an adequate number of valuable trees are established to quickly and fully occupy the site. This is needed to ensure that competing species do not overrun the regenerating trees. As these stands age, they will become crowded, growth will start to slow dramatically, and slower growing trees will start to die. This mortality is an inescapable function of nature. As pine stands grow, individual trees compete for light, soil moisture, nutrients, and space. Many trees are crowded by faster-growing neighbors and will eventually die. Thousands of pine seedlings populate a naturally seeded acre. In a plantation, usually 500 to 800 seedlings are planted. However, at maturity only 50 to 100 large-diameter, sawtimber pine trees, greater than 20 inches, remain. More than 90 percent of the trees die. By actively managing pine stands through thinning, this mortality can be reduced by allowing selected trees to take advantage of additional space, sunlight, and nutrients.

The fundamental results from thinning are the improvement of stand health and growth and a reduction in the rotation length. Thinning is a forestry technique that mimics this natural process of mortality under the guidance of a trained professional. By applying cuts to immature stands, material that might otherwise die before rotation age can be used, and growth can be concentrated on fewer, more desirable stems left in the stand. As trees grow and mature, their crowns will begin to compete for available sunlight. Eventually, this crown competition will result in a forest with a closed canopy, where sunlight does not reach



A drum chopper can be used to help breakdown logging slash and debris.

Photo courtesy: USDA Forest Service - Rocky Mountain Region Archive, USDA Forest Service, www.forestryimages.org

the forest floor. This indicates that the tree crowns no longer have space to grow and expand. A thinning should be applied.

Trees to remove will depend on the landowner's objectives. For timber production, undesirable species, poorly formed trees, and slow-growing individuals are removed. Some of the poorly formed or cull trees may be left to provide wildlife habitat. How much to thin will depend on objectives as well, but it must be enough trees for loggers to make a profit. A common mistake in thinning is to leave too many trees. Approximately 50 percent of the trees are harvested during a thinning. Several thinnings may take place before the stand reaches maturity.

Depending on when the stand is thinned, the cut can be deemed either a pre-commercial or commercial thin. Pre-commercial thins are generally required in stands that are naturally regenerated, where thousands of seedlings per acre are established. The goal of a pre-commercial thin is to reduce stocking to

400 to 600 seedlings per acre. There is no merchantable material removed during this thinning; thus, it occurs at an expense. However, the removal of the excess trees will prevent tree stagnation and improve stand growth and development. To minimize cost, pre-commercial thinnings should be conducted before the stand is four years old. Mowing strips across the stand, leaving seedlings in 1- to 2-foot-



Row thinning can generate revenue and increase the growing space for the remaining trees.

Photo courtesy: James H. Miller, USDA Forest Service, www.forestryimages.org

wide rows, will quickly reduce the total number of seedlings. Row width is dependent on seedling density. Commercial thinnings occur typically when the stand is 12 to 18 years of age and can provide some intermediate return on long-term forest investments. In plantations, this can be accomplished using a row thinning where whole rows of pines are commercially harvested. Another option is to use selection thinning, typically called a release treatment, which requires a more acute eye. Release requires that good individual trees (crop trees) be located and that poorly formed and less valuable trees competing with the crop trees be removed. Release favors only the best trees by removing the inferior individuals and producing a consistent spacing around the crop trees. This allows the favored crop trees to use the additional growing space and to mature into the desired size.

Pure and Mixed Pine/Hardwood Stands

Pine management in the South is often done with one species in a plantation or a naturally regenerated area. However, there are opportunities to develop mixed stands of pine and hardwood species. In areas where strong markets exist for pine pulpwood, poles, sawlogs, and other products, pine plantations with one species can make sense. Where markets are weaker or where non-timber objectives are important, a mixed stand can be developed. This is normally accomplished by changing the intensity of operations to allow for more natural hardwood development to occur among the regenerating pine seedlings. For example, during clearcutting, more hardwoods are left, seed-tree cuts leave fewer seed trees, or plantations are established with fewer pines per acre. Site preparation treatments can also be limited or planned to allow for more hardwood sprouting and growth. All of these options will result in fewer pine trees per acre and a higher percentage of hardwoods.

Pine Markets in Kentucky

If pine is being managed for timber products, it is important to understand where pine markets exist and whether they will be available in the future. There are markets for pine in the form of sawlogs, peeler logs, logs for cabins, chip logs, posts and pulpwood. However, pine markets in Kentucky are not as widespread as those for hardwood trees, so woodland owners are encouraged to consult with a professional forester for marketing guidance. To make sound management choices, landowners need to know what their timber investment choices are and the return they are expecting. Sometimes overlooked are recreation, hunting, and other non-timber opportunities associated with the investment. Risk is also unique with timber investments, for there is a real risk of a complete and unexpected loss in the value of the investment due to fire or insect damage.

Summary

Working with pines can provide landowners with an additional opportunity to achieve their management objectives. They must decide how to regenerate pines, either naturally or artificially, and what species are most appropriate for a soil type and ownership objective. They also need to consider how much site preparation is required to establish the correct number of pines per acre and when and how to initiate thinnings or release. This article describes the management opportunities with the goal of encouraging proactive management of pines where applicable. If you are serious about pine management, consult *A Southern Pine Management Guide for Tennessee Landowners* by the University of Tennessee available at www.utextension.utk.edu/publications/pbfiles/PB1751.pdf, although this publication was developed for a Tennessee audience, a state where more intensive pine management is common, many of the concepts and details on pine management will apply in Kentucky.

About the Authors:

Billy Thomas is an Extension Forester with the University of Kentucky Department of Forestry. He works primarily on non-industrial private forest issues and is the associate editor for the *Kentucky Woodlands Magazine*.

Cooperative Extension Service, Department of Forestry, University of Kentucky, 213 Thomas Poe Cooper Building, Lexington, KY 40546; E-mail: billy.thomas@uky.edu, Phone: 859.257.9153; Fax: 859.323.1031

Jeff Stringer, Ph.D. is a hardwood Extension Specialist at the University of Kentucky and is responsible for continuing education and research in hardwood silviculture and forest operations. He is also an editor of the *Kentucky Woodlands Magazine*.

Cooperative Extension Service, Department of Forestry, University of Kentucky, 213 Thomas Poe Cooper Bldg., Lexington, KY 40546-0073; E-mail: stringer@uky.edu; Phone: 859.257.5994; Fax: 859.323.1031.