Thinning Pine Plantations: Why, When and How?

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According to professional foresters, young pine stands in East Texas should be thinned periodically to optimize growth rates and financial returns while minimizing risks from the southern pine beetle (SPB) and wildfires. Information provided in the Texas Forest Service (TFS)-sponsored pine thinning workshops recently held in East Texas may be of interest to landowners who were unable to attend. At these workshops, private consulting foresters James Houser from Jacksonville, Ralph Day from Jasper, and Gary Price from Bivins reviewed the basics of thinning while Dr. Gary Kronrad, professor of forest economics at Stephen F. Austin State University (SFASU), discussed his research on economics of thinning. In addition, Joe Pase, TFS entomologist, discussed the effects of Hurricane Ike on recently-thinned pine stands and Dr. Ron Billings, head of TFS Forest Pest Management, reviewed thinning as a preventive measure for the southern pine beetle. A summary of key points concerning thinning garnered from these workshops is given below.

What is thinning?

Trees compete for light, moisture, and nutrients. If the trees become too crowded, growth slows, they become susceptible to insects, diseases and wildfires, and they may eventually die. Thinnings are cuttings or intermediate harvests made in immature stands to stimulate the growth of the remaining trees and improve the health, yield, and profitability of the stand.

Why thin?

A particular site can only support so many trees per acre of a given diameter. Foresters recommend planting more trees than can mature on an acre with the expectation that periodic thinning will be conducted when the trees begin to compete for nutrients, sunlight, water, and other resources. Thinning redistributes the growth potential of the stand to the trees of highest quality and favors their rapid growth.

Pines in overly-dense stands (those in which the basal area exceeds about 120 square feet per acre) grow more slowly and become increasingly susceptible to the southern pine beetle and other bark beetles. Basal area is a measure of stand density and represents the cross-sectional area of all trees at breast height (4.5 feet above ground level) on an acre of land. Average basal area of a stand can be determined using a 10-factor prism (Figure 1), available from forestry supply stores, or with 1/20-acre (circular plot with 26.3-foot radius) sample plots distributed randomly throughout the plantation. Thinning removes trees most likely to die from competition, insects, or diseases and reduces the potential for losses from wildfires.

From an economics standpoint, thinning also makes good sense. By promoting vigorous growth, thinning reduces the time required to grow trees from low value pulpwood to higher value poles or chip-n-saw material, and ultimately to valuable sawlogs. Commercial thinning provides the landowner with an intermediate return on his/her investment as trees most likely to die before maturing are harvested and sold. In the case of first thinning, the landowner also may qualify for federal cost shares under the Southern Pine Beetle Prevention Program.

Are thinned stands more prone to storm damage?

Growing trees and conducting thinning operations are not without risk. Experience has shown that widely-spaced trees and heavily-thinned stands are more prone to wind and ice damage than are unthinned stands. Nevertheless, the benefits of thinning far outweigh the risks. Recently, to monitor the impact of Hurricane Ike on thinned stands in southeast Texas, the Texas Forest Service conducted a survey of landowners within the hurricane impact zone who had thinned their pine stands since 2005 as part of the SPB Prevention Program. Results from 130 landowners showed that only 7 percent of the surveyed plantations had suffered heavy losses from Hurricane Ike while 55 percent were unaffected. Typically, the most severe damage occurred when the thinned stand was located adjacent to an open field or clearcut. Most stands with light to moderate damage are expected to recover. Complete results of this survey will be presented at a later date.

Precommercial versus commercial thinning.

Thinning conducted in young pine stands before the trees are merchantable is termed "precommercial thinning." Most pine plantations planted at 622 trees per acre (7 x 10-foot spacing) or less do not require thinning before the trees attain 6 inches in diameter, considered the minimum size for commercial thinning. A common exception is a natural stand that has regenerated with over 700 trees per acre or a plantation that has experienced heavy in-growth of additional natural pine seedlings. Unlike a commercial thinning, a precommercial thinning costs the landowner directly. Current rates range from $80 to $200 per acre, averaging $125 per acre. Precommercial thinning in natural stands is often done by cutting parallel rows every 20 or 30 feet in the stand to release the leave trees, using a mulcher, weed eater with saw head, chainsaw, or bull dozer. The Texas Forest Service offers federal cost shares in 25 East Texas counties for precommercial thinning of overstocked young pine stands to reduce their susceptibility to the southern pine beetle.

When to thin?

The first thinning of pine plantations should be scheduled when one or more indicators suggest that competition among trees is becoming a problem. Severe competition leads to stagnation and predisposes the stand to bark beetle infestations. Useful indicators that a thinning is needed are 1) an average stand basal area that exceeds 100-120 square feet per acre, 2) average live crown ratio (ratio of the portion of the tree bole with green branches to the total tree height) of less than

35 percent, or 3) radial growth, determined using an increment borer, begins to markedly slow down (Figure 2).

The first thinning, in particular, should be dictated by forest health considerations and be conducted to maintain vigorous growth, and not be delayed by poor market conditions. In most cases, the increased growth in response to timely thinning will yield profits that far outweigh the loss of returns due to a poor pulpwood or chip market. In addition, if the stand qualifies, federal cost share incentives are currently available in 25 East Texas counties for first thinning of dense pine stands under the Southern Pine Beetle Prevention Program.

As Dr. Kronrad's research at SFASU confirms, the timing of the first thinning and the number of thinnings to schedule prior to harvest will depend on site quality, more than any other factor. Plantations on good sites (productive soils) will grow faster and be ready to thin at an earlier age than plantations on poor sites with slow growth. Similarly, the stand on a good site will produce sawtimber and be ready for harvest at a younger age, following two, three, or four periodic thinnings. Stands on poorer sites may need thinning only once or twice and may have to be carried for longer rotations if sawtimber is the management objective. A professional forester can determine the site quality (index) of your land.

The first commercial thinning should not be scheduled before the trees average at least 6 inches in diameter at breast height (dbh) and are at least 40 feet tall. This is the minimum size that is operable for most loggers. Most pines in East Texas will be 12-15 years of age when they attain this size. Again, the age at first thinning will vary with site quality.

How to thin?

Very carefully. Loggers should strive to skin up or damage as few trees as possible during the thinning operation. Trees with large basal wounds (missing bark) should be removed during the thinning operation. If left in the stand, these wounded trees are targets for bark beetles, particularly the black turpentine beetle.

To prepare for thinning, a forester can mark every tree to retain in the plantation, leaving the poorly formed, suppressed, or diseased trees unmarked to be removed. Thinning "from below" is most recommended, to favor the dominant and co-dominant trees as eventual crop trees. In plantation situations, foresters will most often recommend a row thinning, in which a logger removes every 3rd, 4th, or 5th row (Figure 3). This releases the trees adjacent to the downed row and provides access for equipment to thin within the leave rows. Undesirable (crooked, forked, suppressed, diseased, etc.) trees are then removed from the leave rows to reduce the stand density to optimal levels of 70 to 90 square feet of basal area per acre.

In row thinning operations, the forester can mark the trees to remove or leave in the remaining rows or choose the operator select method. In this approach, a trained logger is told the final basal area to be achieved and selects the trees to remove as the thinning progresses to meet the

basal area goal. To the extent possible, an experienced thinning operator will leave the best trees more-or-less uniformly spaced with room to grow throughout the plantation. However, it is best to have a professional forester oversee the thinning operation to ensure that the job is done correctly and to meet the landowner's goals.

Every thinning method has its advantages and disadvantages. Let's review the major pros and cons for thinning every third, fourth, or fifth row in pine plantations.

3rd Row Thinning: Removing every third row in thinning operations releases every leave tree on one side and causes the least amount of damage to the residual trees. Accordingly, it allows easy access to the leave rows and is the least costly thinning method. But, the disadvantages outweigh the advantages. This approach directly reduces basal area by 33 percent and a third of the potential crop trees are eliminated in the downed rows. If the pre-thinning basal area is not more than 120 square feet per acre, then no trees can be removed from the leave rows without reducing basal area below 80 square feet per acre. Such a thinned stand may still be susceptible to SPB infestations which may expand along unthinned rows.

4th Row Thinning: Removing every 4th row directly removes 25 percent of the basal area and a quarter of the potential crop trees, allowing the operator to select and remove a greater number of undesirable trees from the leave rows. The operator has more flexibility to adjust spacing and favor crop trees compared to a 3rd row thinning. On the down side, the equipment must be able to extend into the interior row to thin around chosen crop trees and the potential for damaging leave trees during extraction is increased. Cost of thinning may increase as a result.

5th Row Thinning: Many foresters recommend this method because only 20 percent of the potential crop trees are eliminated with removal of every 5th row. A greater volume of undesirable trees can thus be removed from the leave rows to release crop trees. But, the operator will need to thin two rows deep from each side of every access row to achieve a uniformly spaced thinning operation. Thus, the likelihood of damage to leave trees is increased and the cost may be somewhat greater. If done correctly and with care, however, plantations thinned by the 5th row method probably are least vulnerable to the spread of SPB infestations, due to the more uniform spacing among trees (Figure 3).

Thinning as a prevention measure for SPB.

Pine stands in East Texas are prone to infestation by the southern pine beetle when the stand basal area is greater than 120 square feet per acre and tree height is 50 feet or more. Loblolly pine stands on poorly-drained, bottomland soils are particularly susceptible. The same overcrowded stand conditions that cause trees to stagnate also favor beetle infestations. In turn, the most recommended method to prevent the occurrence and spread of SPB is to thin pine stands periodically to maintain basal areas in the range of 80-100 square feet per acre. The same

stand density is optimal for vigorous tree growth. Definitely, for the landowner, it is a thin, win, win situation.

Federal cost shares for SPB Prevention

In 2003, the Texas Forest Service, in cooperation with the Forest Health Protection branch of the US Forest Service, initiated the Southern Pine Beetle Prevention Program. A major goal of this Program is to encourage landowners to thin SPB-prone pine stands as a preventive measure. Cost shares are offered as an incentive to offset poor market conditions for pine pulpwood.

The Texas Forest Service still has federal cost shares available for both precommercial and first merchantable thinning of pines stands in 25 beetle-prone counties of East Texas. These counties are **Anderson, Angelina, Cass, Cherokee, Gregg, Hardin, Harrison, Houston, Jasper, Liberty, Marion, Montgomery, Nacogdoches, Newton, Orange, Panola, Polk, Rusk, Sabine, San Augustine, San Jacinto, Shelby, Trinity, Tyler**, and **Walker** counties. Cost shares range from $25 to $50 per acre, depending on location, for first merchatable thinning of stands that rate as high hazard for SPB infestation. In the case of precommercial thinning, the SPB Prevention Program will reimburse landowners from 50 to 70 percent of actual costs, up to $105 per acre, depending on location of the tract. Pine stands in Southeast Texas, particularly those within 5 miles of a National Forest, qualify for higher rates than those in Northeast Texas. The Program also reimburses landowners $5 per acre for services of a private consulting forester. Check with your nearest Texas Forest Service office or on line at http://texasforestservice.tamu.edu for details.

In summary, landowners have a variety of reasons to thin their pine stands. Although market conditions for wood harvested from thinned stands may be poor, don't let this be the only factor in the decision of when to thin. The first thinning, in particular, should be timed to avoid prolonged reduction in tree growth and for forest health reasons, regardless of market conditions or the threat of an occasional wind or ice storm. With the second and third thinning, landowners have more "wiggle room" for timing the thinning to coincide with good market conditions. If in doubt on when and how to thin, consult a professional forester.

Figure 1: To measure stand basal area using a prism, from a randomly-chosen plot center within a pine stand, count every nearby tree if the split image of the tree trunk viewed through the prism overlaps (“in” tree) and don’t count trees in which the split image is completely separated (no overlap). If a 10-factor prism is used, multiply the average number of “in” trees per plot by 10 to estimate the basal area of the stand in square feet per acre (i.e., 12 “in” trees per plot X 10 = 120 square feet per acre). Photo by James Houser, Jacksonville, TX.

Figure 2: These growth rings show rapid growth for the first six years, followed by retarded growth for the next 13 years. To maintain vigorous growth, increase tree value, and foster resistance to bark beetles, thinning in this stand should have been scheduled shortly after growth rings first showed a marked reduction in width.

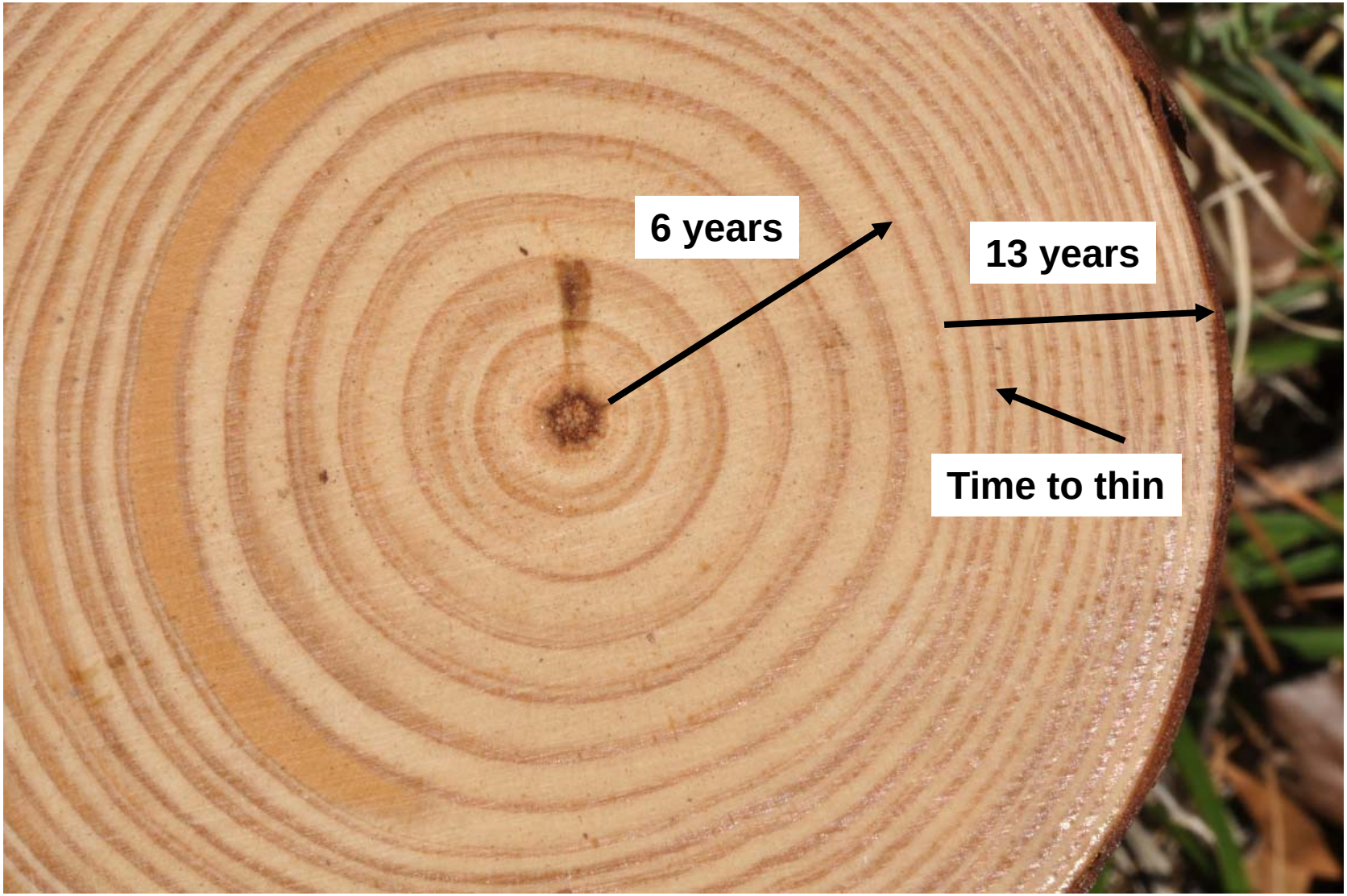
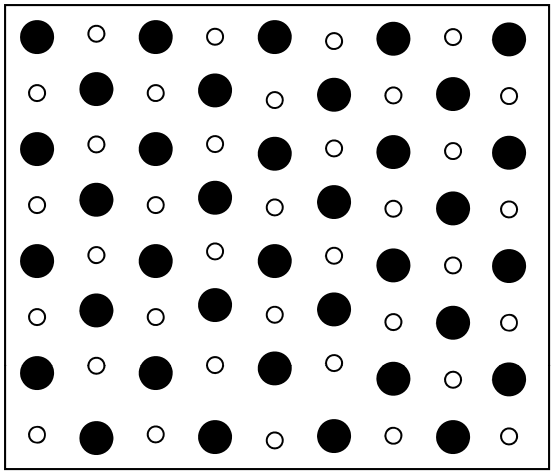
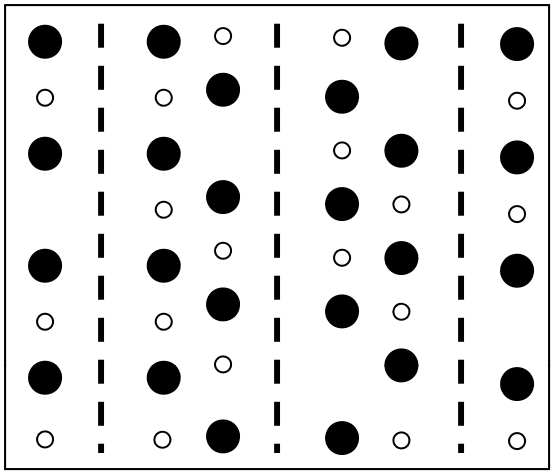


Figure 3. Options to reduce basal area from 130 to 80 square feet per acre using different row thinning intensities plus operator-select method to remove undesirable trees from leave rows.

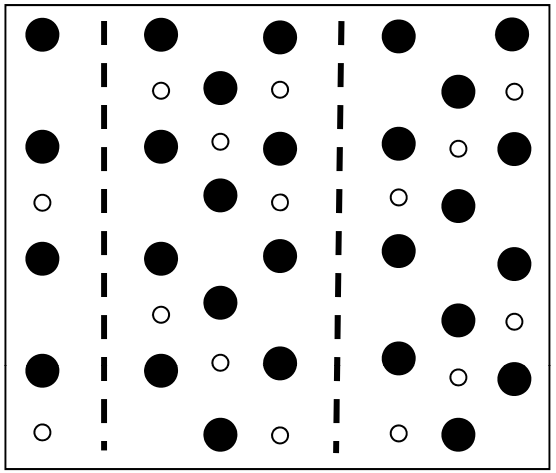
Unthinned



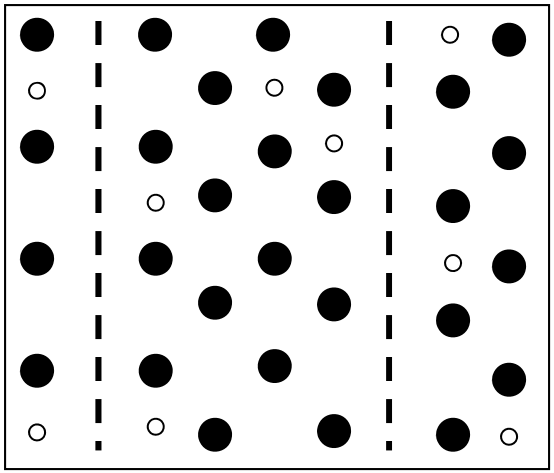
Every **3rd** Row Removed



Every **4th** Row Removed



Every **5th** Row Removed



Volume removed to achieve 80 square feet per acre when initial basal area before thinning is 130

Every **3 rd** row = **33%** in felled rows + **5%** of volume from leave rows

Every **4 th** row = **25%** in felled rows + **13%** of volume from leave rows

Every **5 th** row = **20**% in felled rows + **18%** of volume from leave rows
(Volume taken from leave rows will increase if initial basal area is higher than 130)

● = potential crop tree ○ = non-crop tree ┆ = row removed