

**Natural Resources Conservation Service**  
**Technical Forestry Note TX-FS-12-6**

Pre-commercial thinning releases over-crowded pine or hardwood stands to prevent stagnation, decrease the risk of insects and disease, and increase the growth of remaining trees. Trees are typically removed by mowing, disking, chopping, cutting, spraying or prescribed burning. More details found in the text....



**Pre-commercial thinning – Benefits/Costs?**

**What is pre-commercial thinning?**

Pre-commercial thinning is a thinning method performed prior to trees reaching merchantable size, typically around 4.5 inches dbh (diameter at breast height measured at 4.5 ft. above the ground). The objective of a pre-commercial thinning is to release some trees in overstocked stands by reducing densities to prevent stagnation and increase the growth of the remaining trees. Many southern pine species regenerate by producing a great deal of seed, resulting in thousands of seedlings per acre. Loblolly pine, for example, can be a prolific seed producer under ideal conditions. Natural regeneration practices in even-aged systems through seed-tree or shelterwood methods often results in extreme overstocked conditions that, left untreated, can stagnate growth and lengthen rotation ages (Mann and Lohrey 1974).

The decision to pre-commercially thin a stand is often difficult for many landowners because of the initial costs involved with implementing this treatment. However, allowing trees to continue growing in overstocked conditions will ultimately result in a stand of trees with small diameters and small crowns. Pine trees generally need about one-third of the total height in live crown to sustain effective growth rates over the span of the stand rotation. Pine trees with as little as one-quarter to one-third live crown are capable of producing good tree growth such as the tree in Figure 1, but this is not the case with trees having less than 15 percent live crowns. Even when adequate growing space is provided, those trees do not respond to the available light.

Pre-commercial thinning is generally recommended within the first 3-4 years of stand establishment to maintain a rotation length under 35 years. In previous research, mechanical thinning stands at an early age allowed the use of smaller, more fuel efficient machinery which was practical and cost effective (Grano 1969). Other research suggests that when managing for higher quality products on a longer rotation, pre-commercial thinning manually on an operator select basis at an advanced age (13 years in this case) could also be economically viable (Moorhead, Dangerfield, and Edwards 1997).



Figure 1. This pine tree has 32 ft. of live crown and a total height of 80 ft. for a live crown ratio of 40 percent.

### **How is pre-commercial thinning done?**

Pre-commercial thinning can be accomplished using a variety of techniques. Spraying herbicides in a band to remove the sprayed seedlings is one method of reducing the number of stems per acre. Herbicides such as Krenite or glyphosate only remove the seedlings that are sprayed leaving unsprayed seedlings free to grow. If the seedlings are less than 3 feet tall, small tractors, 4-wheelers or even backpack sprayers can be effectively use as a pre-commercial thinning tool.

Mechanical methods are also effective in reducing the number of seedlings per acre. Young seedlings less than 3 feet tall can be cut with a heavy duty bush hog mowers pulled with a small tractor. Figure 2 shows a young natural pine stand being pre-commercially thinned by using a tractor and disk. If the pine seedlings are taller than 3 feet, then a brown tree cutter or Seppi\_m<sup>®</sup> mower would be a better choice to cut rows through the dense pine seedlings (Figure 3). A brown tree cutter is like a bush hog except the cutting blades are much thicker and the frame is heavier as well.



Figure 2. Pre-commercial thinning a young natural stand of loblolly pine. Source: David J. Moorhead, University of Georgia, Bugwood.org



Figure 3. Pre-commercial thinning naturally regenerated loblolly pine using a Seppi\_m<sup>®</sup> mower. Source: David J. Moorhead, University of Georgia, Bugwood.org

Another mechanical method is to pull a rolling drum chopper in rows through the dense seedlings. Rolling drum choppers are generally pulled with a small to medium dozer. The rolling drum has cutting edges that sever the seedlings as it rolls over them and can be used in older stands of trees (Figure 4).



Figure 4. A small rolling drum chopper used to conduct a pre-commercial thinning. Source: David J. Moorhead, University of Georgia, Bugwood.org

The earlier you decide on pre-commercial thinning, the more options are available for you to select from. Dense pine seedlings less than 3 feet tall could be thinned using any of the methods mentioned above. Large seedlings require the use of heavier equipment and thus eliminate the use of smaller tractors, bush hogs and 4-wheelers. The smaller tractor equipment results in lower costs compared to the tree cutters and rolling drum choppers.

### **What are the silvicultural benefits?**

When implemented properly and in a timely fashion, pre-commercial thinning increases diameter growth of residual trees and increases in tree diameter correlates to increases in tree volume. Additionally, pre-commercial thinning prevents the stand from stagnating, which could eventually lead to excessive tree mortality, increase the potential for pine beetle invasions, or extend the rotation length (period of time it takes for trees to reach financial maturity). A stagnated pine stand is one where the numerous trees per acre have small live crown ratios, small diameters and low volumes per acre. Additionally, pre-commercial thinning allows for desirable herbaceous vegetation to grow as more sunlight light reaches the forest floor.

Example: Three pine stands received a received a pre-commercial thinning. These stands were naturally regenerated in 1977 and ten years later received the pre-commercial thinning treatments. Figure 5 shows the difference in tree diameters ten years (1997) after conducting the pre-commercial thinning. Before age 10, the stands had regenerated naturally with over 3,000 seedlings per acre and after ten years of self-thinning and mortality there were still 2,000 seedlings per acre. The pre-commercial thinning treatments included: 1) no treatment; 2) a 'single chop' which included a pass of the roller chopper in one direction; 3) a 'chop and thin' which in addition to the roller chopper included a light thinning with 6 ft. of space between trees in residual rows; and 4) a 'double thin' which in addition to the roller chopper pass included a heavy thinning

with 10 ft. of space between trees in residual rows. By age 20, trees in the untreated control plots were still primarily unmerchantable in size. In the treated plots, all of the thinning treatments at age 10 boosted diameter growth into merchantable sizes (greater than 4.5 inches d.b.h.), and by age 20 the average stand diameters were within pulpwood sizes. More intense treatments resulted in greater diameter growth, and in the ‘double thin’ treatment many of the trees had even reached sawtimber size.



Figure 5. Photos showing the same pine stand at age 20. The top left received no pre-commercial thinning. The top right had a single pass rolling chop (Single chop). Lower left had the chopping plus 6 feet of space between residual trees (Chop + thin). Lower right received the chopping plus 10 feet of space between residual trees (Double thin).

### **What are the economic benefits?**

Although pine trees in pre-commercially thinned areas have a great deal more merchantable volume than untreated stands, financial analyses must weigh the cost of the initial treatment against the potential future returns. A financial decision criterion called Net Present Value (NPV) is often used to make the determination of returns and to select between mutually exclusive projects. Net Present Value is defined as the present value of expected future returns minus the present value of expected future costs plus initial costs discounted with the appropriate interest rate or required rate of return (Gunter and Haney 1984). Any project or activity with a positive NPV will indicate that the project will earn more than the selected interest rate. Projects with the highest NPV are most desirable. In

these analyses a real (net of inflation) interest rate of 5% is considered typically an average comparison to investing in money market or other savings accounts.

Figure 6 shows the NPV per acre for control (no thin) and three pre-commercial treatments applied in the loblolly pine stand depicted in Figure 5 as well as for two additional locations. This financial analysis used treatment costs of \$40 per acre for single chop, \$52 per acre for chop and thin, and \$62 per acre for the double thin (Watson, Straka and Bullard 1987). These are the appropriate pre-commercial thinning costs at the time this operation was undertaken in 1987. The value of the stand at age 20 (1997) was based upon average stand diameter and number of trees per acre. Volume was calculated in cords per acre and multiplied by Timber Mart South stumpage values (\$10.00/cord for pulpwood size trees). An approximate value was derived similarly for the merchantable trees in the untreated control plots. In this example, the two most intensive treatments resulted in the greatest returns which were more than double than no thinning and single chop, even considering the high initial thinning costs. Returns from single chop thinning were also better than no thinning but significantly lower in returns compared to the chop and thin and double chop treatments.

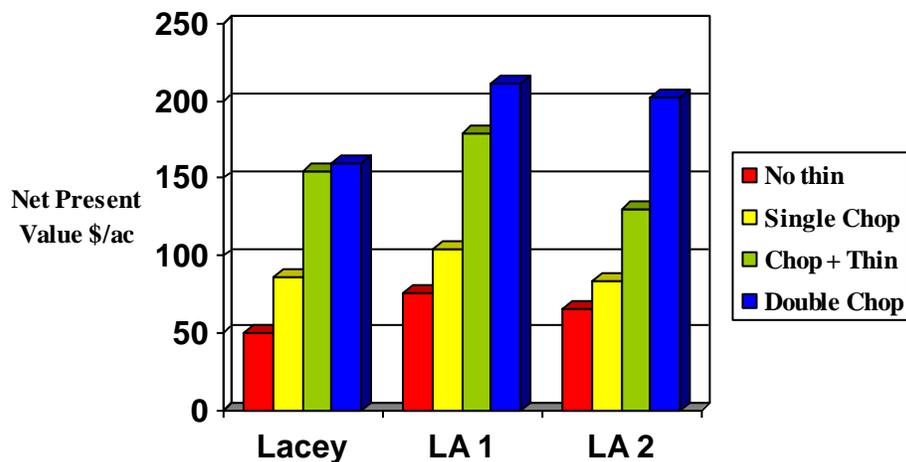


Figure 6. Pre-commercial thinning based on Net Present Value using a 5 percent interest rate. The assumption is to thin or not thin a 10 year old pine stand with over 1,500 trees per acre. The current stand age is 20 years old.

The data for this analysis came from three different locations that received the same pre-commercial thinning treatments. The stands were the same age and underwent similar management prior to the pre-commercial thinning. The treatments included double chop, chop and thin, single chop and no thinning. In each of these areas 4 - 1/10<sup>th</sup> acre permanent plots were established totaling 48 measurement plots. Every tree in the plots was measured for dbh and total height. Thus for each treatment an average dbh, total height and number of trees per acre was determined and used to calculate volumes

per acre. The volume per acre by treatment provided the necessary information to calculate the stands value.

## **Summary**

Pre-commercial thinning could be, when applied properly, a financially attractive investment, it enhances forest health and provides many wildlife habitat benefits. Once natural regeneration is in place, determine the number of seedlings growing per acre. Stands in excess of 2,000 seedlings per acre should receive a pre-commercial thinning. Pre-commercial thinning can be accomplished by mechanical or chemical methods but the primary goal is to reduce the numerous seedlings down to 400 to 800 trees per acre. Pre-commercial thinning can be implemented as early as age 3 or 4, but additional gains in tree growth can also be achieved in treatments applied in older stands along with improved wildlife habitat, access and reducing damage from wildfires.

Written by:

Williams, Richard, State Forester-Texas NRCS and Shane Harrington, Farm Bill Coordinator, Texas Forest Service.

## **Literature Cited**

Grano, C. X. 1969. Pre-commercial thinning of loblolly pine. *Journal of Forestry* 67:825-827.

Gunter, J. E. and H. L. Haney, 1984. *Essentials of forestry investment analysis*. Published by OSU Book Stores Inc., Corvallis, OR. 337 p.

Mann, W. F., Jr and R. E. Lohrey. 1974. Pre-commercial thinning of southern pines. *Journal of Forestry* 72(9):557-560.

Moorhead, D. J., C. W. Dangerfield, Jr. and M. B. Edwards. 1997. Regulating stand density by pre-commercial thinning in naturally regenerated loblolly pine stands: Evaluation of management and economic opportunities. *Proceedings of the Ninth Biennial Southern Silvicultural Research Conference, Clemson, SC, Feb. 25-27, 1997*, USDA General Technical Report SRS-20 pg. 202-204

Watson, W. F., T. J. Straka and S. H. Bullard, 1987. Costs and trends for forestry practices in the South. *Forest Farmer* 26<sup>th</sup> Manual Edition, Vol. 46, No.5. Atlanta, GA. pg. 28-34.