I will conclude, then, with a re-statement of my belief that artifical regeneration of hardwoods is justified now within the limits of objectives discussed previously, that this activity will almost certainly become more and more important; that the general matters of species-site relations, site preparation treatments, and cultural practices must be known or worked out for those species and sites under consideration; that for most species planting rather than seeding should take precedence even in research; and that there is a great deal of information now available to the researches or the operational tree planter. Our greatest accomplishments will be made when we work species by species within this general framework of understanding.

# Managing Young Hardwood Stands in the Southeastern Coastal Plain: Possibilities and Research Needs

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What is the forester's job in managing hardwood stands between regeneration and the first commercial thinnings? Can he just sit back and bide his time, or are some types of precommercial cultural operations necessary and profitable? Obviously, sound answers to these questions must be based on a knowledge of how young stands behave and how various types of treatments affect stand development and growth.

## SCOPE

Before getting too far into our assigned subject, we want to limit our scope. Our paper is concerned with young even-aged stands managed to produce large-sized, high-quality trees with rotations 40 to 65 years in length. Others at this symposium are discussing short rotations and such site improvement measures as cultivation, fertilization, and drainage; we will not cover these aspects.

In a rather intensive review, we found the literature scant in references to young stand management studies in the Southeastern Coastal Plain. Consequently, our approach will be to speculate on the relationships of young stand density to growth, tree size, and quality drawing heavily on work in other regions.

## STAND DENSITY AND GROWTH RELATIONS

Mar:Möller (1954), in reviewing thinning studies in Denmark and Germany, concluded that growth is influenced by residual densities, and that growth is close to maximum for a rather broad range of densities (fig. 1). The explanation of this seems to lie in the fact that leaf volumes (and, by implication, photosynthesis) are almost equal for this broad range of densities. It is only when densities drop to rather low levels that growth drops off appreciably. It follows that in the range of densities where stand growth is about equal, stands with fewer trees will be putting more growth on each individual tree and thus will reach a given size in a shorter

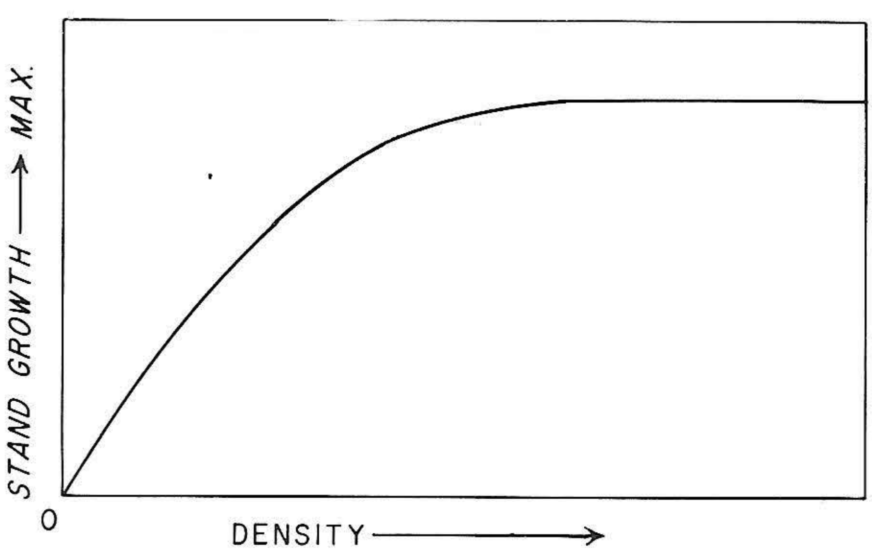


*Figure 1—General relation and stand growth and density (from Mar:Moller 1954).*

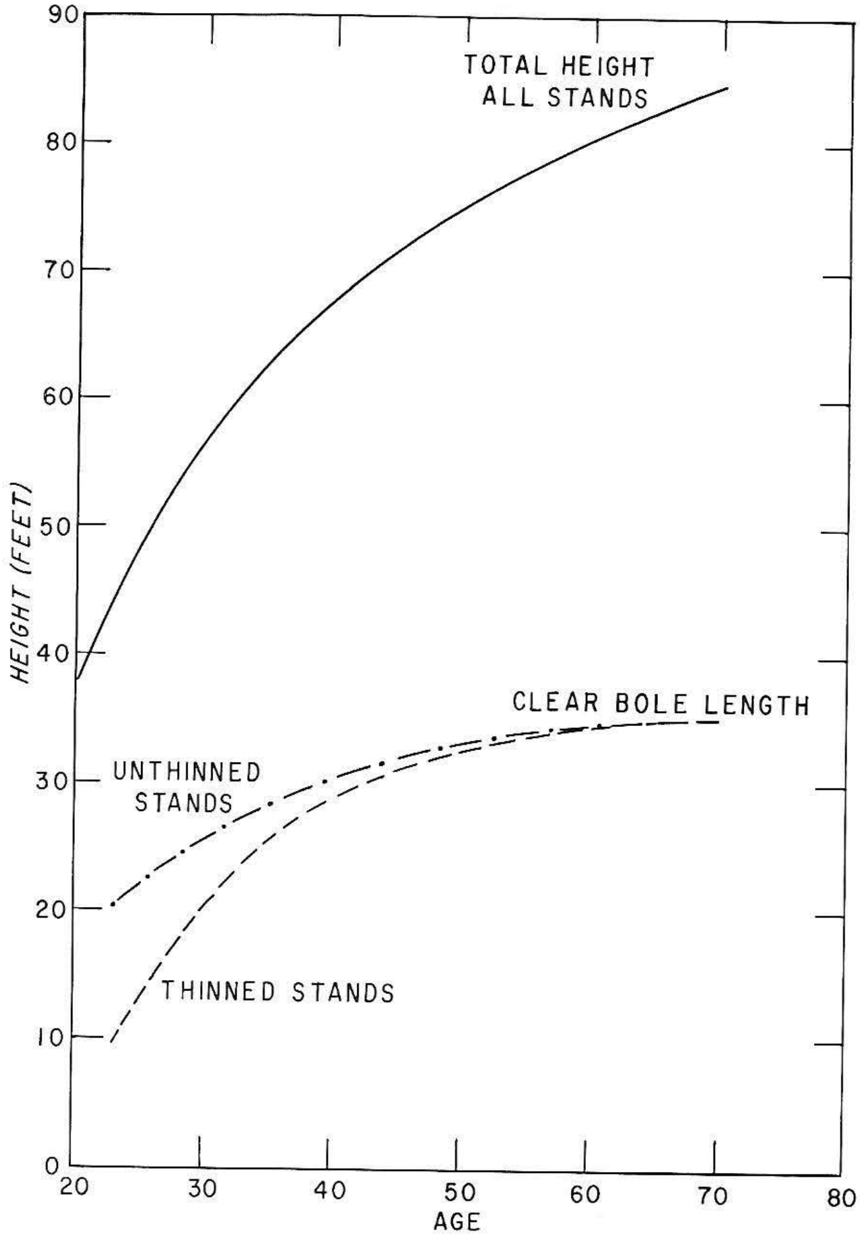


*Figure 2–Relationship of total height and clear bole length to age for thinned and unthinned stands of white ash (adapted from Holsoe 1947).*

period of time. Zasada (1952) presented a case of an aspen stand in the Lake States in which precommercial thinning tripled pulpwood and box bolt stumpage returns by increasing tree size, yield, and unit product value. He estimated that rotation age could be shortened 10 to 15 years by thinning. In the Central States, Roach (1963) has concluded that rotations can be reduced in length by 40 percent with 2 or 3 thinnings (e.g., a 65-year rotation reduced to 40 years). He recommends that thinnings (or cleanings) be made early in the life of the stand, especially on good sites and if high value products are desired. These results--that growth is about equal for a rather wide range of high densities and that rotation length can be shortened by precommercial thinnings--would seem to be applicable to our coastal plain.

## STAND DENSITY AND TREE QUALITY

Assuming it is possible to shorten rotation age by growing individual trees faster through thinnings, what effect does this have on tree quality? More specifically, how does decreasing stand density affect clear bole length and epicormic branching?

### Clear Bole Length

Looking at the development of clear boles in both thinned and unthinned stands of white ash, Holsoe (1947) developed the relationships illustrated in figure 2. You will notice that although there is a difference in clear bole lengths between thinned and unthinned stands, this difference is greatest at early ages, less than 2 feet at age 40, and disappears at age 58. Also notice the difference in slope between total height and clear bole length curves. Although total height increased 16 feet from age 40 to age 65, clear bole length increased only 4 to 6 feet in unthinned and thinned stands, respectively. Even though board-foot volume was increased, little was gained with respect to clear bole length by carrying the stand an additional 25 years.

### Pruning

Pruning offers an artificial means of controlling clear bole length and could lessen the difference between clear length in thinned and unthinned stands at early ages. Actually any thinning schedule should be linked with a pruning policy, because artificial pruning will make possible heavier thinnings than would be justified if reliance were placed on natural pruning (Smith 1962). Furthermore, pruning intended to produce clear material should be limited to trees capable of growing rapidly in diameter. Therefore, we might say that money invested in pruning operations is best spent on young stands.

Epicormic Branching

How do precommercial thinning and pruning affect epicormic branching?

Conover and Ralston (1959) reported on a Lakes States thinning and pruning study in which epicormic branches were examined 2 and 11 growing seasons after a second thinning made at age 19. Although epicormic branching was common in both thinned and unthinned plots, thinned plots tended to have more trees with sprouts than unthinned plots. The magnitude of this difference was dependent upon crown class. The dominants 11 years after treatment had no sprouting on the unthinned plots, and only about 4 percent on the thinned plots. Differences between thinned and unthinned plots were greater for codominant and intermediate trees, but practically nil for the suppressed class. Crown class averages for percent of trees having epicormics were 2, 13, 40, and 74 percent for dominant, codominant, intermediate and suppressed classes, respectively. Length of time since thinning was also an important factor; the few epicormic branches that occurred on dominants and codominants were small and often disappeared after one growing season. There were considerable differences between species in their propensity to sprout. Sugar maple had the most epicormic branching and white ash the least. Pruning had no apparent effect on sprouting.

Apparently precommercial thinning to increase tree size and pruning to increase clear bole length, if applied to vigorous dominant and codominant crop trees, will not lead to serious problems in epicormic branching. In fact, this follows Smith's (1962) philosophy that the best way to keep epicormic branching at a minimum is to develop good crown by thinnings and maintain crop trees as dominants throughout their rotation.

## RESEARCH NEEDS

We have tried to give you a hurried look at some of the possibilities of precommercial thinning and pruning--two cultural operations for young hardwood stands. The possibilities look good, but the dearth of information for hardwoods in the Southeastern Coastal Plain emphasizes the critical need for research in this field. We think some of the concepts we have touched on should be tested and verified in our region. We think the research should be aimed at young stand differentiation ability (Gilbert 1965), and the effects of stand density and cultural treatments on stand development. Research is needed on how and why these differences develop under various stand treatments, how they are affected by soil and site conditions, and what part inherited characteristics play in these differences. Physiologists, geneticists, soil scientists, and silviculturists will all be needed to carry out this research.

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