Longleaf Site Index Curves in Planted Stands

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Background and Introduction

Site index is an estimate of site productivity and is the height of the tallest trees (co-dominants and dominant trees; the trees in the uppermost stand canopy position) at a given age. Site index is talked about in terms of a base age; either 25-years for planted stands and 50-years for natural stands, typically. The reasoning for using heights for site index and an estimation of site productivity is that heights are less influenced by stocking (number of trees per acre) at any given age on any given site/soils than diameters which are greatly influenced by number of trees per acre. Longleaf, as of 2017, has wide genetic variation in heights and height growth due to longleaf seedlings coming from seed collection sites from North Carolina to Mississippi, natural regeneration or rogued longleaf seed production areas and differing years of coming out of the grass stage compared to current loblolly and slash available genetics.

Site index curves are pine or hardwood species specific. There are site index curves for loblolly pine, slash pine, shortleaf pine, white oak, yellow poplar, and other pine and hardwood species. Site index curves, regardless of the pine or hardwood species, do not always give an accurate estimate of the actual pine production (mean annual increment in tons/acre/year) due to a number of factors including the pine or hardwood species stocking, woody competition in the stand, forest management intensity, species genetics, and other factors. This paper will address site index curves for planted longleaf on (1) old-field sites, (2) mechanically prepared cut-over sites and (3) unprepared cut-over sites (Boyer 1980).

Longleaf pine site index curves

For longleaf pine there will be height, diameter, and stand growth rates that will be different based on site (soils and land use history), stand (woody competition), and other factors. Longleaf pine's growth rate on well prepared (minimizing herbaceous and woody competition at establishment) sites will grow in height, diameter and wood volume at a greater rate than when these forms of competition for water and nutrients are present on the site. Longleaf pine planed on former old-field, pastures and hay cutting fields (previous crops were corn, cotton, soybeans, peanuts and a winter grain or Bermuda-, Bahia-, or fescue grass) that were historically fertilized and have essentially no woody competition will grow faster than when the same longleaf seedlings are planted on a cut-over site (former crop was one or more rotations of trees) that may not have been fertilized in 25 to 75 years. Properly pre-plant prepared (mechanically, chemically or both) cut-over sites should produce greater heights, diameters and wood volume than unprepared cut-over sites. Hence three planted longleaf site index curves are presented in this paper, one for each site condition prior to planting (Boyer 1980).

Old-field planted longleaf pine site index curves (base age 25-years) are found in Figure 1. Using figure 1, if the tallest ½ or 100 trees per acre average 30 feet at age 10-years, then these tallest trees should be 60 feet tall by age 25-years, hence a site index (base age 25-years) of 60 feet. This longleaf pine site index, base age 25-years, had an average height growth of 3 feet/year in the first 10 years (30 feet average heights of tallest trees in 10 yrs; 30 ft /10 yrs = 3 ft/yr). From age 10-years through age 25-years the tallest trees grew 30 more feet or 2 feet per year average height growth increment (30 feet / 15 years = 2 ft/yr height growth from the end of the 10th year to the end of the 25th year).

Mechanically prepared cut-over planted longleaf site index curves are found in Figure 2. Using Figure 2, if the tallest ½ or 100 trees per acre average 26 feet at age 10-years, then these tallest trees should be 60 feet tall by age 25-years, hence a site index (base age 25-years) of 60 feet. This longleaf pine site index, base age 25-years, had an average height growth of 2.6 feet/year in the first 10 years (26 feet average heights of tallest trees in 10 yrs; 26 ft /10 yrs = 2.6 ft/yr). From age 10-years through age 25-years the tallest trees grew 34 more feet or 2.27 feet per year average height growth increment (34 feet / 15 years = 2.27 ft/yr height growth from the end of the 10th year to the end of the 25th year).

Unprepared cut-over planted longleaf site index curves are found in Figure 3. Using Figure 3, if the tallest ½ or 100 trees per acre average 24 feet at age 10-years, then these tallest trees should be 60 feet tall by age 25-years, hence a site index (base age 25-years) of 60 feet. This longleaf pine site index, base age 25-years, had an average height growth of 2.4 feet/year in the first 10 years (24 feet average heights of tallest trees in 10 yrs; 24 ft /10 yrs = 2.4 ft/yr). From age 10-years through age 25-years the tallest trees grew 36 more feet or 2.4 feet per year average height growth increment (36 feet / 15 years = 2.4 ft/yr height growth from the end of the 10th year to the end of the 25th year).

The planted longleaf site index curves for each of the three site conditions, should only be used as estimates of future heights and hence site index based on the current measured co-dominant and dominant heights. Actual co-dominant and dominant measured heights at a given age on a given site may not "match up" with these curves due to Boyer's (1980) higher initial planting densities (600 – 1000 TPA was common on the old-field sites and 400 – 800 TPA on the cut-over sites) prior to the paper being published and better pre-plant chemical site preparation techniques and post plant herbaceous weed control in the last 10-20 years.
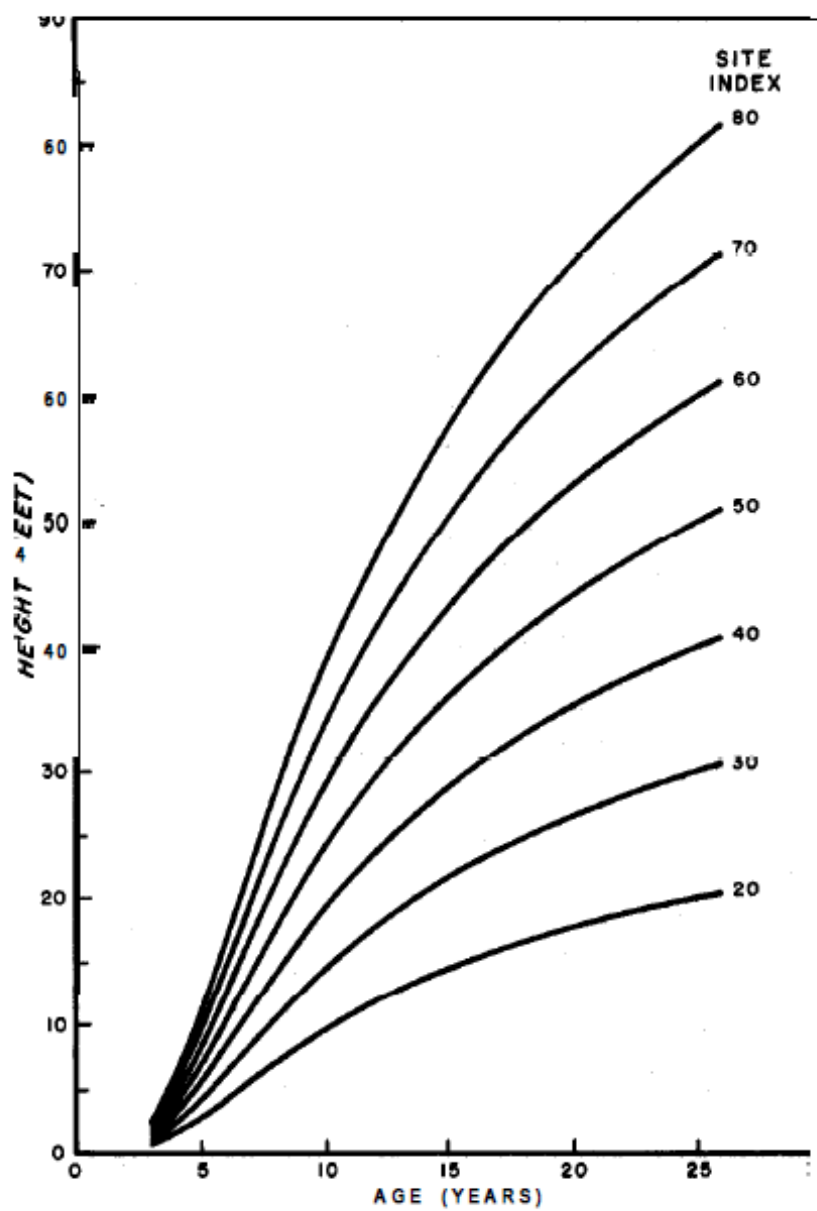
Figure 1 — Site-index curves for longleaf pine plantations on old fields.
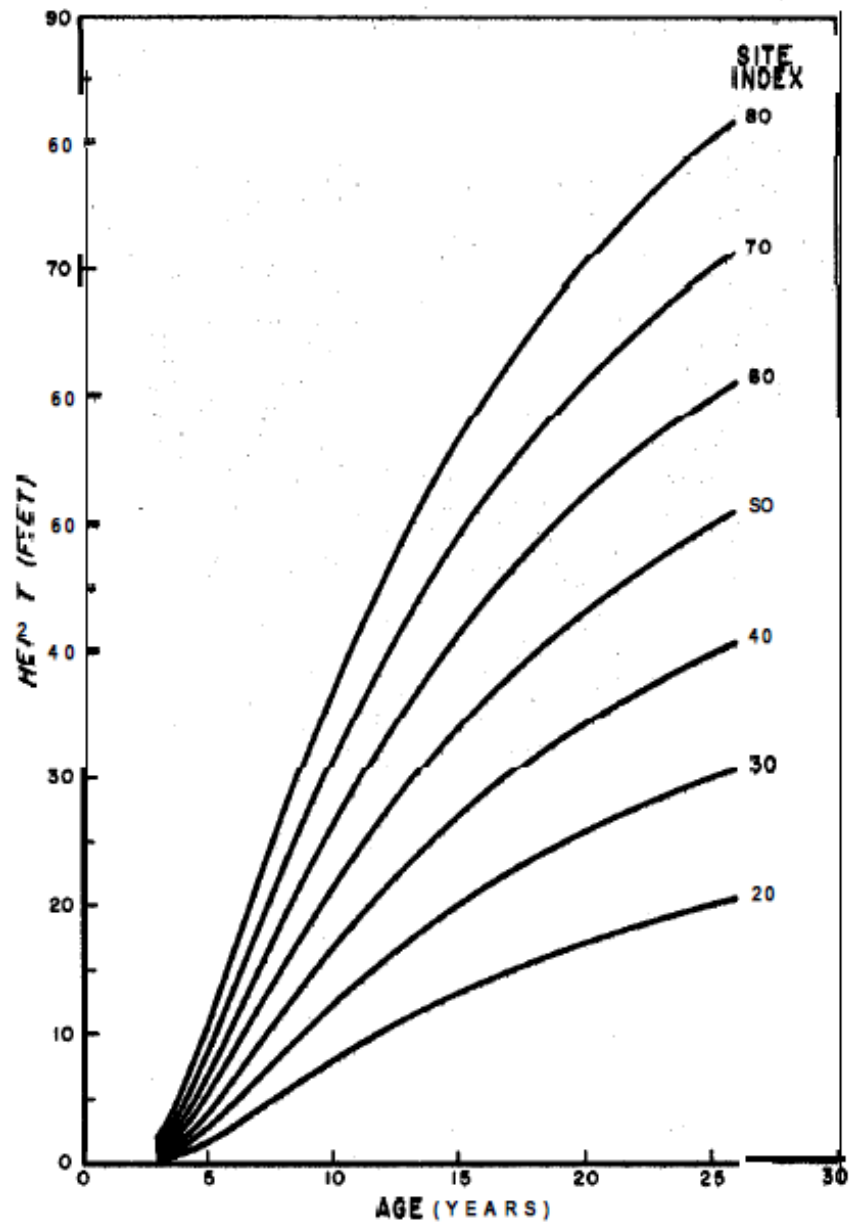
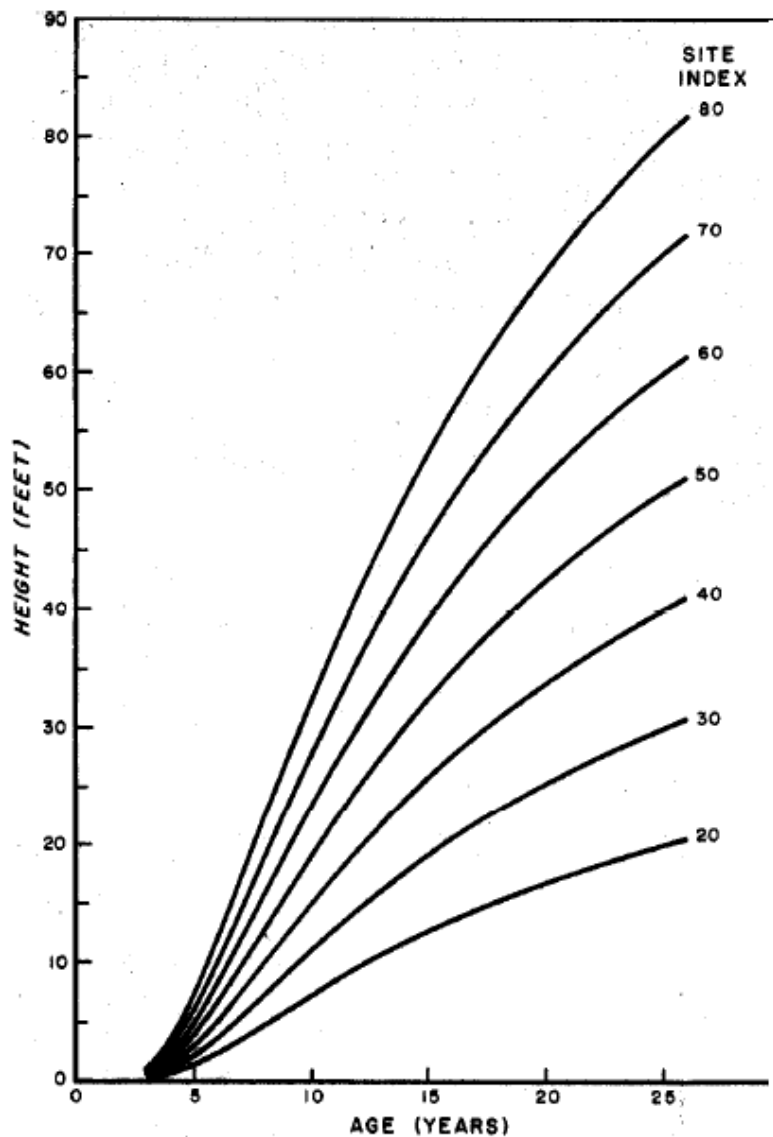Figure 2. — Site-index curves for longleaf pine plantations on mechanically prepared cutover forest sites.

Figure 3. -Site-index curves *for longleaf pine plantations* on unprepared cutover forest sites.

Literature Cited:

Boyer, W.D. 1980. Interim site index curves for longleaf pine plantations. USDA FS Southern Forest Exp. Stn. Res. Note SO-261. So. For, Exp. Stn. New Orleans, LA. 4 p.

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