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EQUATING SITE INDICES OF SLASH PINE PLANTATIONS AND NATURAL STANDS

Abstract.--This Note illustrates that adding a constant to 25-year index values for a plantation does not produce precise equivalent values on a 50-year basis at age 25. It further illustrates that a conversion based on yield is more accurate than one based on height. Precise equivalent values for 25-year and 50-year sites are developed at age 25 on the basis of comparisons of cubic yield for planted and natural stands.

Site indices for natural stands of slash pine are determined from reference curves based on an index age of 50 years. Present reference curves for slash pine plantations are based on an index of 25 years because few plantations were over 25 years of age at the time the curves were constructed. Foresters and tax assessors frequently need to equate sites for the two types of stands, but precise equivalent values have not yet been established. Barnes,[1] who published the first 25-year plantation curves, suggested that adding 20 feet to the 25-year values would roughly equal site index on a 50-year basis as determined from curves published in USDA Miscellaneous Publication 50.[2] But, as Barnes' comparison illustrates, adding 20 feet to bring a balance at age 50 does not necessarily produce similar results at younger ages on all sites. The necessary adjustments at age 25 on the basis of the site index curves in Miscellaneous Publication 50 are as follows:

Site index for plantations at age 25 (Feet)	Equivalent 25-year values from site index curves in Miscellaneous Publication 50 (Feet)
50	70
60	85
70	100
80	115

[1] Barnes, Robert L. Growth and yield of slash pine plantations in Florida. Univ. Fla. Sch. For. Res. Rep. 3, 23 pp. 1955.

[2] USDA Forest Service. Volume, yield, and stand tables for second growth southern pines. Misc. Publ. 50, 202 pp. 1929.

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The values for natural stands were determined by reading from the 50-year curves at age 25 the site index required to produce the 25-year heights of plantations. On the basis of the curves in Miscellaneous Publication 50, one must add 25 feet to adjust plantation site 60, 30 feet to adjust site 70, and 35 feet to adjust site 80.

For today's use, a conversion based on the most recent studies of yield would be more appropriate. The conversion should also be made at age 25 because plantation yields beyond age 30 are not available. The tabulation below outlines, for the two most recent studies of natural stands of slash pine, the 50-year site indices that are equivalent to plantation values at 25 years:

Site index for plantations at age 25	Equivalent site indices for natural stands (50-year basis)	
	Coile and Schumacher[3]	Bennett[4]
(Feet)	(Feet)	(Feet)
50	66	67
60	77	80
70	88	93
80	98	107

The two studies of natural stands differ with respect to the height addition necessary to adjust to the plantation sites. The difference varies from 1 foot for site 50 to 9 feet for site 80. Also, as site increases, the necessary adjustment becomes greater, especially for values determined from the curves in Bennett's Note. A comparison of yields reveals the same trend: as site increases, the difference between yields in natural stands and plantations for a given basal-area stocking increases (table 1). Yield comparisons are for basal-area densities as listed by Coile and Schumacher. This comparison is necessary because the Coile-Schumacher yields apply only to well-stocked stands.

The minor difference in yield between the two studies of natural stands is reassuring and indicates that a conversion based on cubic yield would be more reliable than one based on height alone. A conversion based on yield can be made by plotting cubic yield at age 25 for each of the studies of natural stands over site and then reading the site required to produce values equal to plantation yields at the same age and density. When this approach is used, necessary adjustments are practically identical for the two studies of natural stands:

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[3] Coile, T. S., and Schumacher, F. X. Growth and yields of natural stands of the southern pines. 115 pp. Durham, N. C.: T. S. Coile, Inc. 1960.

[4] Bennett, Frank A. Variable-density yield tables for managed stands of natural slash pine. Southeast. Forest Exp. Stn., USDA Forest Serv. Res. Note SE-141, 7 pp. 1970.

Site index for plantations (Feet)	Site index from Coile and Schumacher[3] (Feet)	Site index from Bennett[4] (Feet)
50	69	69
60	81	82
70	93	93
80	105	105

These identical adjustments are in sharp contrast to the differences exhibited by the height comparisons, and they reflect the fact that volume production, at a given density level, is a better evaluator of site quality than is height. This fact is not surprising when we recall that most site index analyses, in which age is the only independent variable, remove considerably less of the variation in the dependent variable than do cubic yield analyses, in each of which age, site, and stand density are necessarily involved.

Table 1.--Comparison of yields in plantations and natural stands at age 25 on the basis of Coile and Schumacher's density levels

Yields for natural stands				Yields for plantations[3]		
Coile and Schumacher[1]			Bennett[2]			
Site index	Basal area	Volume	Volume	Site index	Basal area	Volume
Feet	Sq. ft.	Cords	Cords	Feet	Sq. ft.	Cords
70	107	22.0	22.8	50	107	21.8
80	115	29.0	30.2	60	115	30.8
90	124	37.2	38.3	70	124	40.7
100	135	47.7	47.3	80	135	53.0

[1]Coile, T. S., and Schumacher, F. X. Growth and yields of natural stands of the southern pines. 115 pp. Durham, N. C.: T. S. Coile, Inc. 1960.

[2]Bennett, Frank A. Variable-density yield tables for managed stands of natural slash pine. Southeast. Forest Exp. Stn., USDA Forest Serv. Res. Note SE-141, 7 pp. 1970.

[3]Bennett, Frank A. Yields and stand structural patterns for old-field plantations of slash pine. Southeast. Forest Exp. Stn., USDA Forest Serv. Res. Pap. SE-60, 81 pp. 1970.

On the basis of the conversion values in the above tabulation, the addition of 20 feet to plantation sites 50 and 60 can be used with a high degree of accuracy, but on sites 70 and 80 the precision will be some-

what lower. If a high degree of precision is required, 23 feet should be added to plantation site 70 and 25 feet should be added to plantation site 80. For example, the plantation yield on site 80 at age 25 and 135 square feet of basal area is 53.0 cords, whereas the average yield for the natural stands on site 100 (an addition of 20 feet) is 47.5 cords. At higher basal-area densities, the difference would be greater.

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