Yield of Unthinned Yellow-Poplar

by

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Decisions about timber management, whether they be made by a small landowner using simple arithmetic or by a corporate forester with the aid of economic investment theory, advanced mathematical techniques, and digital computers, require a basic tool-a list of timber products that can be expected at various ages, that is, a yield table. This paper presents yields from natural unthinned stands of yellow-poplar (*Liriodendron tulipifera* L.) at various ages by site index and density class. It also brings together under one cover some of the previously developed mensurational tools needed to bring this high-value timber species under management.

The yield estimates *were* developed by an analysis of diameter distribution. With this technique, (1) numbers of trees are estimated by diameter class from measurements of age, site index, and stand density, (2) heights of trees of given diameters are estimated from the same independent variables, (3) volume of a tree of a given height and diameter is determined from tree-volume equations, and (4) the volumes are applied to the diameter distribution to obtain per-acre yields. The advantage of this method is that distribution of size classes as well as total volume per acre can be determined. Bennett and Clutter[1] have demonstrated the utility of such information for solution of problems on multiple-product yield.

Cover photo: A yellow-poplar stand near Wolf Ford. Pisgah National Forest. This 40-year-old stand, growing on site 130 land, has 300 trees per acre, and contains nearly 30,000 board feet of sawtimber per acre. The abandoned railroad trestle in the foreground was erected and used by the Carr Lumber Company in logging the area in the 1920's.

METHODS

Plot Selection

Data for this study were obtained from 141 circular ¼-acre plots established in the Appalachian Mountains of North Carolina (93 plots), Virginia (31 plots), and Georgia (17 plots). Stand age, site index, and diameters of all trees ≥ 4.5 inches d.b.h. were determined on each plot. Total height was determined from a random sample of trees in each diameter class.

To be included in the study, a stand had to have 75 percent or more of its overstory, by number of trees, in yellow-poplar. All the stands were even-aged and ranged from 17 to 76 years of age. Site index (fig. 3, Appendix) at age 50 ranged from 75 to 140 feet, and basal area varied from 44 to 208 square feet per acre. The largest and smallest numbers of trees per acre encountered in each age and site index class are shown in table 1.

Sampled stands were free of disease and insect damage and showed no evidence of past cutting. In each of the plots, the trees were well distributed.

[1] Bennett, F. A., and Clutter, J. L. Multiple-product yield estimates for unthinned slash pine plantations—pulpwood, sawtimber, gum. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Pap. SE-35, 21 pp. 1968.

Table 1.-Largest and smallest numbers of trees per acre by age and site index classes[1]

Site index (Feet at age 50)	Age (years) < 21	21-30	31-40	41-50	51-60	61-70	> 70
< 81	----	----	----	220	----	----	----
		----	----	220	----	----	----
81-90	----	228	240	----	140	72	.
	----	228	320	----	168	196	.
91-100	----	160	256	100	96	72	68
	----	380	256	172	208	232	140
101-110	----	176	136	48	84	100	.
	----	364	252	272	272	192	. .
Ill-120	----	152	152	136	132	88	----
	----	252	332	212	156	176	. . .
121-130	216	236	124	96	152	136	. . .
	216	396	256	188	152	136	----
131-140	----	164	140	----	----	----	----
	----	328	204	----	- -	----	----
> 140	184	----	----	----	----	----	----
	184	----	----	----	----	----	----

[1]Only trees 4.5 inches d.b.h. and larger are included.

Diameter Distribution

Diameter distributions based on the 141 sample stands were developed earlier by McGee and Della-Bianca[2] following procedures developed by Clutter and Bennett.[3] The expected number of trees per acre by l-inch diameter classes was calculated for various combinations of age, site index, and stand density. For convenience, these values are presented in tables 8 through 12 in the Appendix.

Height-Diameter Relationships

Before the volumes for individual trees could be determined, it was necessary to compute the heights of trees in given diameter classes. These heights were derived with the following model:[4]

$$[\text{Log}\ (H_c) - \text{Log}\ (H)] = b_0 + b_1\ (1/D - 1/Dmax) + b_2\ (\text{Log}\ T)\ (1/D - 1/Dmax) + b_3\ (1/A)\ (1/D - 1/Dmax) + b_4\ (S)\ (1/D - 1/Dmax) \quad (1)$$

where

Log = common logarithm
H_c = average height of dominant and codominant trees in feet
H = total height in feet of a tree of diameter D in inches
Dmax = maximum diameter occurring in the stand
T = number of trees per acre
A = age of stand in years
s = site index

Maximum diameter is predicted by the equation[5]

$$Dmax = 9.38123 + 2.41398\ (A \times S/1000) - 0.35928\ (A \times T/1000) \quad (2)$$

Coefficients of. the above height model were estimated from the least-squares fit of the model to data from 1,782 sample trees. After simplifying and decoding, the equation for estimating the height of a tree of given diameter is

$$\text{Log}\ (H) = \text{Log}\ (H_c) + 0.01857 - [2.28645 - 0.59146\ \text{Log}\ (T) - 0.64614\ (100/A) + 2.57302\ (S/100)]\ (1/D - 1/Dmax) \quad (3)$$

Several features of this height model merit special attention, First, the mode of expressing the variables insures that estimated

[2]McGee, C. E., and Della-Bianca, Lino. Diameter distributions in natural yellow-poplar stands. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Pap. SE-25, 7 pp. 1967.

[3]Clutter, J. L., and Bennett, F. A. Diameter distributions in old-field slash pine plantations. Ga. Forest Res. Counc. Rep. 13, 9 pp. 1965.

[4]This model was developed by Dr. Jerome L. Clutter, Union-Camp Associate Professor of Forestry, University of Georgia, Athens.

[5]See footnote 2.

height of the largest trees will closely approximate measured height of the dominant and codominant trees' used in estimation of site index; when D = Dmax, Log (H) is equal to Log (H_c) plus a small constant. Secondly, note that for a given stand, values of Log (H,), T, A, S, and Dmax are constants, so that the equation simplifies to

$$\text{Log (H)} = b_0' + b_1' \text{ (l/D)} \qquad (4)$$

Tables 13 through 17 in the Appendix show estimated heights by diameter classes for selected combinations of age, site index, and stand density.

YIELD ESTIMATES

Volumes for individual trees of a specified diameter and estimated height from equation 3 were determined from the tree-volume equations developed by Beck:[6] [7]

Total cubic-foot volume of wood and bark = 0.0025 (D^2 H) — 0.0028 (5)

Cubic-foot volume of wood and bark to a 4-inch top, outside bark = 0.0024 (D^2 H) — 0.641'7 (6)

Cubic-foot volume of wood only to a 4-inch top, outside bark = 0.0020 (D^2 H) — 0.6837 (7)

International ¼-inch board-foot volume = 0.0148 (D^2 H) + 0.0203 (D^3) — 0.5982 (D^2) — 44.8597 (D/H) + 1321.0515 (l/H) — 32.6851 (8)

These volumes for individual trees were then applied to the number of trees in each diameter class for a given combination of age, site index, and stand density (tables 8 through 12) to produce the yield estimates in tables 2 through 5.

There were no readily available statistics, such as the coefficient of determination or standard error of the estimate, that we could use to evaluate the reliability of these yield estimates directly. Therefore, the estimated yields for the 141 sample plots were compared to actual yields and summarized in table 6,

As a further check on the reliability of the method, yields were estimated for an independent sample of six stands and the results compared to actual yield (table 7).

DISCUSSION

Cubic-Foot Estimates

The average differences between actual and estimated cubic-foot volumes (i.e., the sum of signed deviations of estimated volume from actual volume divided by number of plots) of the 141 sample plots were very nearly zero (table 6). Examination of the differences in relation to age, site index, and density indicates that the diameter-distribution method gives unbiased estimates of total and merchantable cubic-foot volume per acre. The standard deviation of differences for total cubic-foot volume in table 6 shows that one can expect approximately 68 percent of the estimates to be within 1,010 cubic feet of actual volume, but that 28 percent of these estimates will be in error by 1,010 to 2,020 cubic feet per acre.

The reliability of cubic-foot estimates was corroborated by application to the independent sample of stands (table 7). Estimated average volume was very close to actual volume, and two-thirds of the errors were less than 1,010 cubic feet.

Total and merchantable cubic-foot yields increased with increasing age, site index, and density level. There was no culmination of cubic-foot yield within the range of densities sampled. The greater the number of trees, the larger the yield at all ages and levels of site index. However, for a given age and site index, each additional tree added did not add equal amounts to yield (fig. 1). This was particularly true as stand age increased. For example, when the number of trees at age 60 on site index 100 is increased from 100 to 150 per acre, total cubic-foot volume is increased by 810 cubic feet per acre; but, when the number is increased by another 50 trees (from 150 to 200 trees per acre), total volume is increased by only 460 cubic feet per acre. As more trees are added, increasing numbers fall into the smaller diameter classes and the number of trees in the larger diameter classes *is* reduced (tables 8 through 12).

[6] Beck, D. E. Cubic-foot volume tables for yellow-poplar in' the southern Appalachians. Southeast. 'Forest Exp. Sta., U. S. Forest Serv. Res. Note SE-16, 4 pp. 1963.

[7] Beck, D. E. International ¼-inch board-foot volumes and board-foot/cubic-foot ratios for Southern Appalachian yellow-poplar. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Note SE-27, 4 pp. 1964.

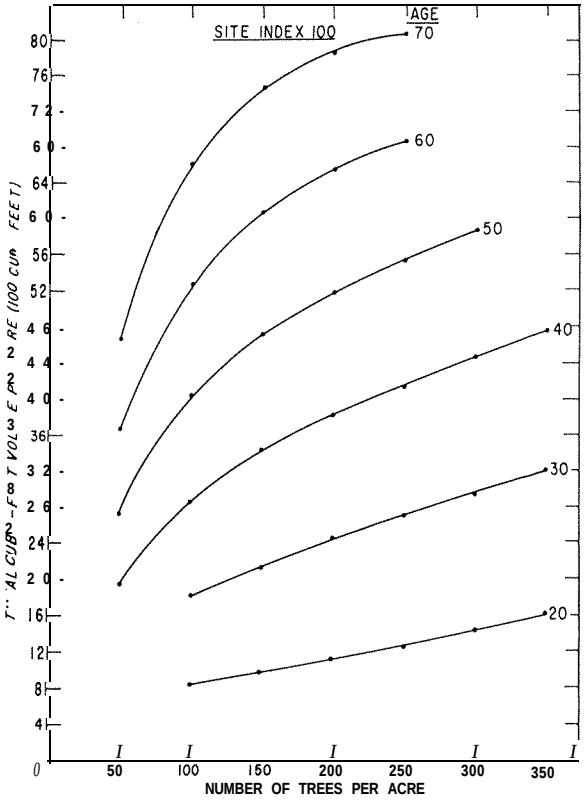

Figure 1.—Total cubic-foot volume per acre increases with number of trees. In older stands the rate of increase decliner sharply after the first 100 trees per acre.

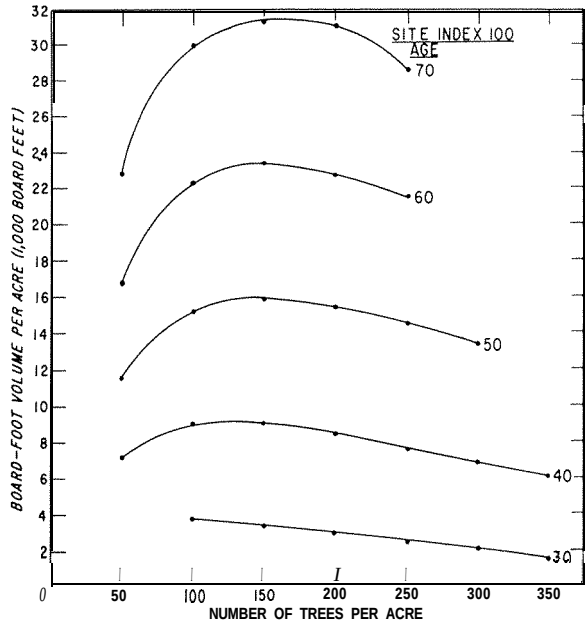

Figure Z.-For certain combinations of age and site index, board-foot yield culminates with increasing stand density.

Board-Foot Estimates

Estimates of board-foot volume were not as precise as those for cubic-foot volume. The coefficient of variation for board-foot volume was 31 as compared to 20 for total cubic-foot volume. However, the difference between the averages for actual and estimated board-foot volume was small, and there was no evidence of bias (table 6).

Again, application of the estimating procedure for board-foot volume to the independent sample (table '7) shows the expected degree of precision. Estimated average volume closely approximates average actual volume; two-thirds of the individual estimates are in error by less than 5,380 board-feet per acre.

Unlike the cubic-foot yields, board-foot yield culminated with increasing numbers of trees for certain combinations of age and site index (fig. 2). Increasing the number of trees from 100 to 150 per acre on site index 100 at age 60 increased sawtimber volume by 1,100 board feet per acre, but an additional 50 trees (200 per acre) resulted in a decrease of 600 board-feet per acre. In this case, the decrease in average tree size associated with increasing numbers of trees resulted in an actual loss of merchantable volume.

APPLICATION OF YIELD ESTIMATES

The diameter distributions, height-diameter relationships, and volume yields presented here are representative of the natural development of · unthinned yellow-poplar stands. It should be recognized that managed stands of the future will be thinned and will not have diameter distributions and volume yields identical to those for the stands reported here.

It is important to note that the tables do not describe changes with time on a given site. To determine yields, it must be assumed that a given number of trees will be present at a specified time. This, however, should not impose undue restriction on use of the tables. Within the range of ages and densities sampled, the change in numbers of trees larger than 4.5 inches d.b.h.

(Text concluded on page 9)

Table 2.-Total cubic-foot yield of wood and bark for unthinned yellow-poplar stands of various stand densities, site indices, and ages[1]

Trees per acre (number)	Age (years)					
	20	30	40	50	60	70
	Cubic feet per acre					
SITE INDEX 90						
50	----	---	1,560	2,170	2,850	3,590
100	730	1,510	2,330	3,180	4,080	5,020
150	860	1,810	2,760	3,710	4,660	5,580
200	980	2,020	3,050	4,030	4,950	5,780
250	1,110	2,210	3,280	4,260	5,130	5,870
300	1,250	2,400	3,490	4,450	----	----
350	1,410	2,600	3,710	----	----	----
SITE INDEX 100						
50	----	----	1,920	2,730	3,640	4,670
100	840	1,810	2,870	4.020	5,270	6,610
150	990	2,180	3,430	4,730	6,080	7,450
200						
250	1,120 1,270	2,450 2,700	4,140 3,820	5,180 5,540	6,540 6,870	7,840 8,090
300	1,430	2,950	4,460	5,870	....	----
350	1,620	3,220	4,770	----	----	----
SITE INDEX 110						
50	I_.-	_-_	2,340	3,380	4,600	5,990
100	960	2,150	3,500	5,020	6,720	8,600
150	1,130	2,600	4,210	5,960	7,840	9,830
200	1,280	2,940	4,740	6,610	8,550	10,540
250	1,450	3,270	5,200	7,160	9,130	11,060
300	1,650	3,610	5,650	7,670	----	----
350	1,870	3,980	6,120	----	----	----
SITE INDEX 120						
50	----	----	2,810	4,150	5,730	7,600
100	1,090	2,530	4,230	6,200	8,470	11,070
200	1,290	3,080	5,130	7,440	10,020	12,870
250	1,470 1,670	3,520 3,960	5,830 6,480	8,360 9,170	11,100 ----	.... ----
300	1,910	4,410	7,120	9,960	----	----
350	2,180	4,910	7,790	----	----	—
SITE INDEX 130						
50	----	----	3,360	5,040	7,080	9,530
loo	1,240	2,970	5,080	7,600	10,590	14,130
150	1,460	3,630	6,210	9,220	12,700	----
200	1,680	4,190	7,140	10,490	----	----
250	1,920	4,760	8,020	11,660	----	----
300	2,220	5,370	8,920	12,830	----	----
350	2,560	6,030	9,850	----	----	----

[1]Only trees 4.5 inches d.b.h. and larger are included.

Table J.-Cubic-foot yield of wood and bark to a 4-inch top, outside bark, for unthinned yellow-poplar stands of various stand densities, site indices, and ages[1]

Trees per acre (number)	Age (years)					
	20	30	40	50	60	70
	Cubic feet per acre					
SITE INDEX 90						
50	....	....	1,470	2,050	2,700	3,410
100	640	1,380	2,170	2,990	3,860	4,750
150	730	1,640	2,560	3,470	4,380	5,260
200	810	1,810	2,800	3,140	4,620	5,420
250	900	1,960	2,990	3,930	4,760	5,470
300	1,010	2,110	3,160	4,080	....	....
350	1,130	2,270	3,330	....	....	....
SITE INDEX 100						
50	....	....	1,810	2,590	3,460	4,450
100	740	1,670	2,690	3,800	4,990	6,280
150	860	1,990	3,190	4,440	5,740	7,050
200	950	2,220	3,540	4,850	6,150	7,400
250	1,060	2,430	3,820	5,160	6,430	7,610
300	1,180	2,640	4,090	5,440	....	....
350	1,330	2,860	4,360	....	....	....
SITE INDEX 110						
50	....	....	2,210	3,220	4,380	5,720
100	860	2,000	3,300	4,760	6,380	8.190
200	990	2,400	3,950	5,620	7,430	9,340
250	1,240 1,100	2,80 2,700	4,830 4,420	6,220 6,710	8,600 8,080	10,460 [illegible]
300	1,390	3,280	5,240	7,180	....	....
350	1,570	3,600	5,650	....	....	....
SITE INDEX 120						
50	....	....	2,670	3,950	5,470	7,260
100	980	2,370	4,000	5,890	8,070	10,570
150	1,140	2,860	4,830	7,050	9,520	12,260
200						
250	1,20 1,440	3,250 3,640	5,470 6,060	7,900 8,640	11,510...	....
300	1,640	4,040	6,650	9,370	....	....
350	1,870	4,490	7,250	....	....	....
SITE INDEX 130						
50	....	....	3,190	4,810	6,770	9,110
100	1,120	2,780	4,810	7,240	10,110	13,500
150	1,310	3,390	5,870	8,760	12,100	....
200	1,480	3,900	6,730	9,950	....	....
250	1,690	4,410	7,540	11,040	....	....
300	1,940	4,960	8,380	....	....	....
350	2,230	5,560	9,240	—	....	....

[1]Only trees 4.5 inches d.b.h. and larger are included.

Table 4.-Cubic-foot yield of wood only to a 4-inch top, outside bark, for unthinned yellow-poplar stands of various stand densities, site indices, and ages[1]

Trees per acre (number)	Age (years)					
	20	30	40	50	60	70
	Cubic feet per acre					
SITE INDEX 90						
50	----	----	1,220	1,700	2,240	2,840
100	520	1,140	1,790	2,480	3,200	3,950
200	590	1,340	2,110	2,870	3,620	4,360
250	720 650	1,480 1,600	2,300	3,090	3,930 3,820	4,490
				3240		4,520
300	800	1,710	2,590	3,360	—	----
350	890	1,840	2,730	----	----	----
SITE INDEX 100						
50	----	----	1,500	2,150	2,880	3,700
100	600	1,380	2,230	3,150	4,150	5,220
150	690	1,640	2,640	3,680	4,760	5,860
200						
250	760 840	1,990 1,820	2,920 3,150	4,010 4,260	5,090 5,320	6,140 6,300
300	940	2,150	3,360	4,490	----	----
350	1,060	2,330	3,580	----	----	--
SITE INDEX 110						
50						
100	704 ----	1,650 ----	2,730	2,670 3,950	3,640 5,300	4,760 6,810
200	800	1,970	3,270	4,660	6,170	7,760
250	990 890	2,450 2,220	3,650	5,560 5,150	7,130 6,710	8,680 8,290
300						
350	1,260 1,110	2,940 2,690	4,650 4,320	5,930 ----	----	----
					----	----
SITE INDEX 120						
50						
100	810 ----	1,960 ----	2,220 3,320	4,900 3,290	6,710 4,550	6,140 8,790
200	930	2,360	4,000	5,850	7,910	10,190
250	1,040 1,160	2,680 2,990	4,530 5,010	6,550 7,170	8,740 ----	----
						----
300	1,320	3,330	5,500	7,760	----	----
350	1,500	3,690	5,990	----	----	----
SITE INDEX 130						
50	----	----	2,650	4,000	5,630	7,590
100	920	2,300	3,990	6,010	8,410	11,230
150	1,070	2,800	4,870	7,280	10,060	....
200	1,200	3,200	5,580	8,260	----	----
250	1,370	3,640	6,250	9,160	----	----
300	1,570	4,090	6,940	----	----	----
350	1,800	4,580	7,640	—	----	----

[1]Only trees 4.5 inches d.b.h. and larger are included.

Table 5.—International ¼-inch board-foot yield to an 8-inch top, outside bark, for unthinned yellow-poplar stands of various stand densities, site indices, and ages[1]

Trees per acre (number)	Age (years) 20	30	40	50	60	70
	Board feet per acre					
SITE INDEX 90						
50	....	. . . .	5,180	8,490	12,240	16,480
100	260	2,480	6,260	10,750	15,670	20,920
150	180	2,090	5,960	10,690	15,730	20,830
200	40	1,630	5,210	9,750	14,530	19,120
250		1,230	4,370	8,540	12,920	17,000
300	20	880	3,520	7,230	....	....
350	10	590	2,670	....	....	....
SITE INDEX 100						
50	....	....	7,120	11,590	16,790	22,830
100	460	3,760	9,020	15,270	22,270	29,990
150	290	3,420	9,100	15,940	23,370	31,170
200	180	2.930	8,540	15,430	22.770	30,150
250	120	2,460	7,780	14,510	21,580	28,460
300	80	2,040	6,960	13,410	....	....
350	50	1,640	6,070	....	....	....
SITE INDEX 110						
50	....	....	9,400	15,310	22,370	30,720
100	750	5,340	12,380	20,810	30,520	41,580
150	520	5,160	13,070	22,580	33,190	44,760
200	370	4,750	12,950	22,890	33,740	45,150
250	270	4,330	12,550	22,670	33,550	44,630
300	210	3,940	12,050	22,230	....	....
350	170	3,550	11,450	....	....	....
SITE INDEX 120						
50	....	....	12,070	19,740	29,080	40,440
100	1,120	7,250	16,390	27,530	40,710	56,250
150	850	7,370	17,970	30,830	45,640	62,420
200	660	7,170	18,570	32,420	48,000	
250	550	6,960	18,870	33,410	....	....
300	470	6,780	19,080	34,200	....	
350	420	6,600	19,190	....	....	....
SITE INDEX 130						
50	....	....	15,160	24,950	37,190	52,270
100	1,600	9,500	21,120	35,590	53,220	74,650
150	1,310	10,070	23,880	40,940	61,220	....
200	1,100	10,270	25,560	44,350	. . .	. . .
250	990	10,470	26,960	47,180	. . .	....
300	940	10,740	28,320	....	....	....
350	920	11,050	....	....	....	....

[1]Only trees 11.0 inches d.b.h. and larger are included.

Table 6.—Averages of actual and estimated yields for the 141 sample stands

Yield basis	Average actual volume of stand	Average difference between actual and estimated volume	Standard deviation of differences
Total cubic-foot volume	5,060	3	1,010
Cubic-foot volume of wood and bark to a 4.0-inch top	4,740	3	970
Cubic-foot volume of wood only to a 4.0.inch top	3,920	2	810
Board-foot volume	17,100	445	5,380

Table 7.—Actual and estimated per-acre volumes for an independent sample of six yellow-poplar stands

Plot	Age	Site index	Number of trees	Total cubic-foot volume			Board-foot volume		
				Actual	Estimated	Difkrence	Actual	Estimated	Difference
				Cubic feet			feet		
1			88						
2	3938	133 130	288	5,380 9,110	4,300 8,960	+ 150 1,080	23,180 29,720	29,480 17,550	++240
3	67	130	184	7,110	9,440	-2,330	27,460	39,620	—12,160
4	23	91	168	5,780	5,380	i-400	20,720	19,720	+ 1,000
5		124	156	1,770	1,980	-210	1,490	3,240	-1,750
6	39	97	128	3,650	2,890	+760	12,600	7,680	$4,920
Sum				32,800	32,950	-150	115,170	117,290	-2,120
Average volume/acre				5,470	5,490	-25	19,190	19,550	-350

will be slight. Unless the user has independent estimates of mortality in his stands, he can assume that the number of trees per acre will not change over short time periods.

Within the stated limitations, the information presented here can serve as a valuable guide to management planning. Use of the equations and tables requires only a knowledge of the age, site index, and number of trees per acre in the stand. For example, suppose it is determined that a stand of site index 100 will contain 200 trees per acre ≥ 4.5 inches d.b.h. at 50 years of age. The forest manager may be faced with the decision of whether to liquidate the stand at that age or carry it for a longer period. The information in this paper enables him to make a better-informed decision than has heretofore been possible. At age 50 this stand will have 15,430 board feet of merchantable sawtimber per acre (table 5). Table 9 shows that the sawtimber volume is distributed in 89 trees with diameters ranging from 11 to 18 inches. Pulpwood in the remaining 111 trees can be determined by using the appropriate height from table 14 and a specified diameter in equation 6 to determine the volumes of the various diameter classes. Then, by applying the frequency distribution of trees from table 9 it can be determined that 1,210 cubic feet or 15 cords of pulpwood per acre are present in the 5- to lo-inch diameter classes.* On the other hand, if the manager holds the stand to age 60, assuming no change in number of trees, he would have 22,770 board feet of sawtimber plus 13 cords of pulpwood per acre. Distribution by tree size would be as shown in table 9 for age 60 at the level of 200 trees per acre. Similarly, he could obtain yield combinations and size-class distribution at any age up to 70 years. With this information, the manager is in a position to make his decision within the framework of his particular objectives and economic situation.

XA conversion factor of 80 cubic feet of wood per standard cord is assumed. No allowance is made for pulpwood in tops of sawtimber trees.

APPENDIX

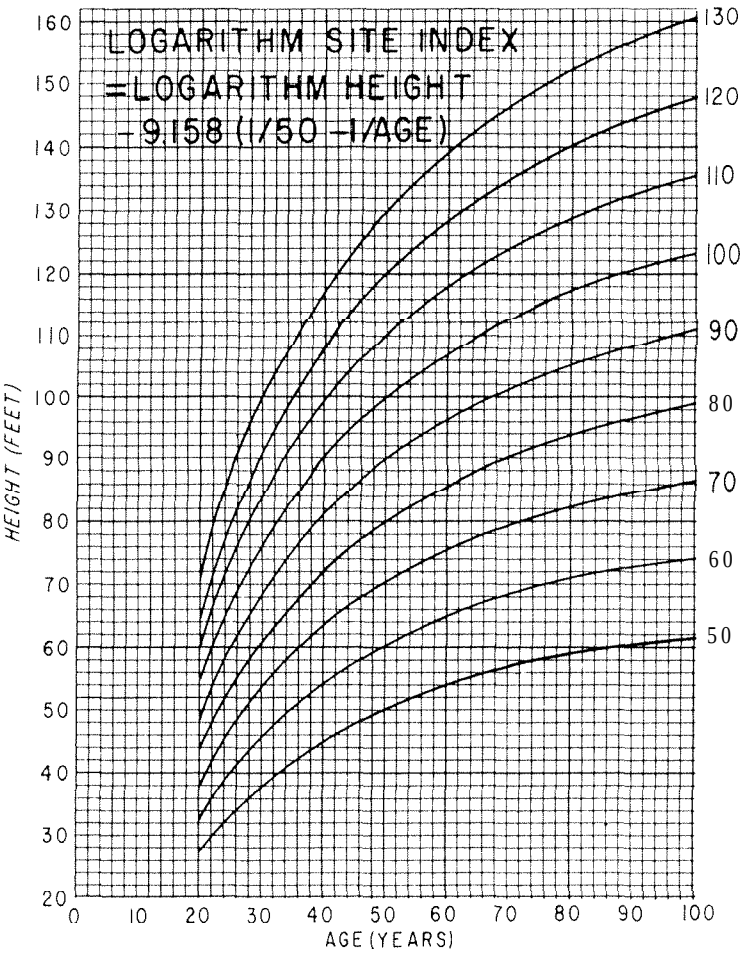

Figure J.--Site index curves at an index age of 50 years for yellow-poplar in the southern Appalachian Mountains. (Reprint of figure 2 in: Beck, D. E. Yellow-poplar site index curves. USDA Forest Serv. Southeast. Forest Exp. Sta. Res. Notes 180, 2 pp. 1962.)

Table &-Diameter distributions for pure natural yellow-poplar stands by age and stand density per acre on site index 90[1]

Total trees (Number)	Basal area (Sq. feet)	Number of trees per diameter class (inches)																							
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
AGE 20																											
100	33	15	21	19	16	12	9	5	3																		
150	43	48	37	25	17	11	7	4	1																		
200	48	95	47	26	15	9	5	2	1																		
250		145	53	26	14	7	4	1	....																		
300	54	194	57	26	13	6	3	1	....																		
350	61	242	61	26	12	6	2	1																			
AGE 30																											
100	51	3	8	13	14	15	14	12	10	7	4																
150	61	12	23	25	24	21	17	13	9	5	I																
200	70	29	39	36	30	24	18	13	8	3	....																
250	77	51	56	46	35	26	18	11	6	1	....																
300	84	77	72	54	39	27	17	10	4	....	....																
350	90	105	87	62	42	28	17	8	1	....	....																
AGE 40																											
50	44	...	....	1	2	4	5	6	6	7	7	6	4	2													
100	67	1	4	8	10	12	12	12	12	11	9	6	3	....													
150	82	5	14	18	20	20	18	16	14	11	8	5	1	. . .													
200	91	14	27	30	29	26	22	19	15	10	6	2		.													
250	98	28	42	42	37	31	25	19	14	9	3	...	. . .	.													
300	106	44	59	53	44	35	27	19	13	6	....	....	____	....													
350	113	62	75	64	51	39	28	19	10	2	....	....	....	____													
AGE 50																											
50	55	....	....	1	1	2	3	4	5	5	6	6	6	5	4	2											
100	82	1	3	5	7	9	10	11	11	10	10	9	7	5	2	....											
150	98	4	10	14	16	17	17	16	14	13	11	9	6	3	....	....											
200	110	10	21	25	25	24	22	19	17	14	11	8	4	....	....	....											
250	117	21	34	36	34	30	26	22	18	14	10	5	.	. ..	....	....											
300	123	34	49	48	42	36	30	23	18	12	7	1			....	____											
AGE 60																											
50	68	. .	....	....	1	2	2	3	3	4	4	5	5	5	5	5	4	2									
100	98	1	2	4	6	7	8	9	9	9	9	9	8	7	6	4	2	....									
150	116	3	8	12	14	14	14	14	14	13	12	10	9	7	5	1	....	....									
200	125	9	19	22	22	22	20	19	16	14	12	10	8	5	2	....	....	____									
250	130	19	31	33	31	28	25	22	18	15	12	9	6	1	....	____	....	____									
AGE 70																											
50	80	....	....	....	1	1	2	2	3	3	3	4	4	4	4	5	4	4	4	2							
100	114	1	2	4	5	6	7	7	7	8	8	8	7	7	7	6	5	4	1	___							
150	132	3	8	11	12	13	13	12	12	11	11	10	9	8	7	5	4	1	....	....							
200	141	9	18	20	20	19	18	17	15	14	12	11	9	8	6	4	....	....	....	___							
250	146	19	30	30	28	26	23	20	17	15	13	11	9	6	3	____	....	....	....	....							

[1]Reprint of table 2 in: McGee, C. E., and Della-Bianca, Lino. Diameter distributions in natural yellow-poplar stands. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Pap. SE-25, 7 pp. 1967.

Table 9.—Diameter distributions for pure natural yellow-poplar stands by age and stand density per acre on site index 100[1]

Total trees (Number)	Basal area (Sq. feet)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
		Number of trees per diameter class (inches)																									
AGE 20																											
150	35	13	20	19	16	12	9	6	4	1																	
200	4146	4304	4036	26	18	12	8	5	2	....																	
				29	18	11	6	3	1	....																	
250	52	129	56	30	17	10	5	2	1	....																	
300	58	173	63	31	17	9	5	2	....	....																	
350	65	214	71	34	17	9	4	1	....	....																	
AGE 30																											
150	56	2	7	11	13	14	14	12	11	8	6	2															
200	68 7	2399	1035	2304	2231	1521	1018	1514	1011	6	3	1															
250	87	40	50	44	36	28	21	15	10	5	1	....															
300	94	60	66	54	42	31	22	15	8	2	....	....															
350	103	79	81	64	48	34	23	14	7	....	....	....															
AGE 40																											
50	48	....	...	1	2	3	4	5	6	6	6	6	6	4	1												
100	74	1	4	6	9	10	11	11	11	11	9	8	6	3	....												
150	91	4	11	16	18	18	17	16	15	13	10	8	4	....	....												
200	104	11	22	26	27	25	22	20	16	13	10	6	2	....	....												
250	113	21	35	38	35	31	27	22	17	13	8	3	....	....	....												
300	122	32	49	49	43	37	30	24	18	12	6	....	....	....	....												
350	131	44	63	60	52	43	34	25	17	10	2	....	....	....													
AGE 50																											
50	62	1	....	1	1	2	2	3	4	4	5	5	6	6	5	4	2										
100	95	3	2	4	6	7	8	9	10	10	10	9	8	7	6	3	....										
150	113		8	12	13	15	15	15	14	13	12	10	9	7	4	....	....										
200	127	8	17	21	22	22	21	19	17	15	13	11	8	5	1	....	....										
250	137	14	28	31	31	29	26	23	20	17	14	10	6	1	....	....	....										
300	147	23	39	42	39	36	31	27	22	18	13	8	2	....	....	....	....										
AGE 60																											
50	76	....	....	....	1	1	2	2	3	3	4	4	4	5	5	5	4	4	3								
100	115	—	2	3	5	6	7	7	8	8	8	8	8	8	7	6	5	4	....								
150	137	2	6	10	11	12	13	13	13	12	11	11	10	9	7	6	4	....	....								
200	150	6	14	18	19	19	19	18	16	15	14	12	10	9	7	4	....	....	....								
2.50	159	13	24	27	27	26	24	22	20	17	15	13	10	8	4	....	....	....	....								
AGE 70																											
50	92	....	....	....	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	3	1					
100	136	....	2	3	4	5	5	6	6	7	7	7	7	7	7	6	6	6	5	4	....	....					
150	157	2	6	9	10	11	11	11	11	11	10	10	9	9	8	7	6	6	3	....	....	....					
200	169	7	14	16	17	17	17	16	15	14	13	12	10	9	8	7	6	2	....	....	....	....					
250	179	13	23	25	25	23	22	20	18	16	15	13	11	10	8	6	2	....	....	....	....	....					

[1]Reprint of table 3 in: McGee, C. E., and Della-Bianca, Lino. Diameter distributions in natural yellow-poplar stands. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Pap. SE-25, 7 pp. 1967.

Table IO.-Diameter distributions for pure natural yellow-poplar stands by age and stand density per acre on site index 110[1]

Total trees (Number)	Basal area (Sq. feet)	Number of trees per diameter class (inches)																								
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
AGE 20																											
100	37	11	18	18	16	13	10	7	5	2																	
150	44	38	35	26	19	13	9	6	3	1																	
250	50	74	48	30	20	13	8	5	2	....																	
300	56	112150	6058	3734	21 20	13 12	7	43	21	....																	
350	72	184	78	41	23	13	7	3	1	....																	
AGE 30																											
100	60	2	6	10	12	13	13	12	11	9	7	4	1														
150	74	8	17	20	21	20	18	15	12	10	6	3	....														
200	86	18	30	32	29	25	21	17	13	9	5	1	.														
250	97	31	44	42	36	30	24	18	13	8	4	—	....														
300	107	45	59	52	43	35	26	19	13	7	1	....	....														
350	117	59	72	63	51	39	29	20	12	5	....	....	....														
AGE 40																											
50	54	....	....	1	2	2	3	4	5	5	6	6	6	5	4	1											
100	83	1	3	5	7	9	10	10	11	10	10	9	7	5	3	....											
150	104	3	9	13	15	16	16	16	15	13	12	10	7	4	1	....											
200	117	8	18	23	24	24	22	20	18	15	12	9	6	1	....	....											
250	129	15	29	33	33	30	27	24	20	16	12	8	3	....	—	....											
300	142	23	40	43	41	37	32	27	22	17	12	6	....		....	—											
350	154	30	51	53	50	44	38	31	24	17	10	2	....	....	....	....											
AGE 50																											
50	70	....	....	.	.	.	.	1	1	2	3	3	4	4	5	5	5'5	5	4	3							
100	109	—	2	3	5	6	7	8	8	9	9	8	8	7	6	4	1										
150	131	2	6	9	12	13	13	14	13	13	12	11	10	9	7	5	1	____									
200	148	5	13	17	19	20	20	19	17	16	14	13	11	8	6	2	____	____									
250	161	10	22	26	27	27	25	23	21	19	16	14	11	7	2	____	____	____									
300	175	16	30	35	35	34	31	28	24	21	18	14	10	4		____	.	____									
AGE 60																											
50	89	....	___	....	1	1	1	2	2	2	3	3	4	4	4	4	5	4	4	4	2						
100	133	. ...	1	2	4	5	6	6	7	7	7	8	8	7	7	7	6	6	4	2	....						
150	161	2	5	8	9	10	11	11	11	11	11	11	10	9	9	8	7	5	2	....	....						
200	177	4	11	15	16	17	17	16	16	15	14	13	12	10	9	8	6	1	....	....	....						
250	190	9	19	22	24	23	22	21	20	18	16	15	13	11	9	7	1	....	....	....	....						
AGE 70																											
50	109	....	....	....	....	1	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	3				
100	159	....	1	2	3	4	5	5	6	6	6	6	6	6	7	6	6	6	6	5	5	3	....				
150	184	2	5	7	8	9	9	10	10	10	10	9	9	9	8	8	7	7	6	5	2	____	____				
200	209	4	10	13	14	15	15	14	14	13	13	12	11	10	10	9	8	7	6	2	....	____	....				
250	220	9	17	20	21	21	20	19	18	16	15	14	13	12	11	9	8	6	1	....	....	....	____				

[1]Reprint of table 4 in: McGee, C. E., and Della-Bianca, Lino. Diameter distributions in natural yellow-poplar stands. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Pap. SE-25, 7 pp. 1967.

Table 11.-Diameter distributions for pure natural yellow-poplar stands by age and stand density per acre on site index 120[1]

Total trees (Number)	Basal area (Sq. feet)	Number of trees per diameter class (inches)																								
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
AGE 20																											
100	39	10	17	17	16	13	10	8	5	3	1																
150	46	33	33	26	20	15	10	7	4	2																	
200	54	64	47	32	22	15	10	6	3	1																	
250	G2	97	59	37	23	15	9	6	3	1																	
300	70	128	70	42	26	16	10	6	2																		
350	80	154	82	48	29	18	11	6	2																		
AGE 30																											
100	67	1	5	8	10	12	12	12	11	10	8	6	4	1													
150	82	6	15	18	19	19	18	16	13	11	8	5	2														
200	95	14	26	29	28	25	22	18	15	11	8	4															
250	108	24	38	39	35	31	26	21	16	11	7	2															
300	121	34	50	49	43	36	30	23	17	11	6	1															
350	134	42	62	59	52	43	34	26	18	11	3																
AGE 40																											
50	59			1	1	2	3	3	4	5	5	5	6	5	5	4	1										
100	93	1	2	4	6	8	9	9	10	10	9	9	8	7	5	3											
150	114	2	8	11	14	15	15	15	14	13	12	11	9	7	4												
200	133	6	15	19	21	22	21	20	18	16	14	12	9	6	1												
250	148	11	23	28	29	29	27	24	22	19	15	12	8	3													
300	163	16	32	37	38	36	32	29	25	21	16	12	6														
350	180	20	40	46	46	43	39	34	29	23	17	11	2														
AGE 50																											
50	**79**					**1**		**1**		**1**		**233344555**				5		4	3	1							
100	122	—	1	3	4	5	6	7	8	8	8	8	8	8	7	7	6	5		1							
150	149	1	5	8	10	11	12	12	12	12	12	11	11	10	9	7	5	2									
200	172	4	10	14	16	17	18	17	17	16	15	14	12	11	9	7	3										
250	188	7	17	21	24	24	23	22	21	19	18	16	14	11	8	4											
300	206	10	23	29	31	31	29	28	26	23	20	18	15	11	6												
AGE 60																											
50	98									1	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4	3
100	154		1	2	3	4	5	6	6	7	7	7	7	7	7	7	6	6	5	4							
150	185	1	4	6	8	9	10	10	10	10	10	10	10	9	9	9	8	7	6	4							
200	208	3	8	12	14	14	15	15	15	14	14	13	12	11	11	10	8	7	4								
AGE 70																											
50	121								1	1	1	1	2	2	2	3	3	3	4	4	4	4	4	4	4		
100	189		1	2	2	3	3	4	4	5	5	6	6	6	6	6	6	6	6	5	5	2					
150	223	1	3	5	7	7	8	8	9	9	9	9	9	8	8	8	8	8	7	7	6	5	1				

[1] Reprint of table 5 in: McGee, C. E., and Della-Bianca, Lino. Diameter distributions in natural yellow-poplar stands. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Pap. SE-25, 7 pp. 1967.

Table 12.—Diameter distributions for pure natural yellow-poplar stands by age and stand density per acre on site index 130[1]

Total trees (Number)	Basal area (Sq. feet)	Number of trees per diameter class (inches)																								
		5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
AGE 20																											
100	41	9	16	16	15	13	11	8	6	4	2																
150	50	29	31	26	20	15	11	8	6	3	1																
200	59	55	45	33	23	17	11	8	5	2	1																
250	67	82	58	39	27	18	12	8	4	2	....																
300	77	106	71	46	31	20	13	8	4	1	....																
350	89	125	83	54	36	23	15	9	4	1	....																
AGE 30																											
100	73	1	4	7	9	11	11	11	11	10	9	7	6	3													
150	91	4	12	16	18	18	17	16	14	12	10	7	5	1													
200	105	11	22	26	26	25	22	19	16	13	10	7	3	....													
250	121	18	32	35	34	31	27	23	19	14	10	6	1	...													
300	137	24	42	45	42	37	32	26	21	16	10	5	....	....													
350	154	29	51	54	50	44	38	31	24	17	10	2	....	....													
AGE 40																											
50	65		....		1	2	2	3	3	4	4	5	5	5	5	5	4	1									
100	104	...	2	4	5	6	8	8	9	9	9	9	8	8	7	5	3	....									
150	128	2	6	9	12	13	14	14	14	13	12	11	10	9	7	4	....	....									
200	150	4	12	16	19	20	20	19	18	17	15	13	11	9	6	1	....	....									
250	170	8	18	24	26	26	26	24	22	20	18	15	12	8	3	....	....	....									
300	190	11	25	31	33	33	32	29	27	24	20	16	12	7	....	....	....	....									
350	211	13	30	38	41	40	38	36	32	28	23	18	11	2	....	....	....	....									
AGE 50																											
50	89	....	....	....	....	1	1	2	2	2	3	3	4	4	4	5	5	5	4	4	1						
100	138	....	1	2	3	4	5	6	7	7	7	8	8	8	7	7	7	6	5	2	....						
150	171	1	4	6	8	10	10	11	11	11	11	11	11	10	9	9	8	6	3	....	....						
200	195	3	8	12	14	15	16	16	16	15	15	14	13	12	11	9	7	4	....	....	....						
250	221	5	13	17	20	21	21	21	20	19	18	17	16	14	12	10	6	....	....	....	....						
AGE 60																											
100	176	....	1	2	2	3	4	4	5	5	2	2	2	3	3	3	4	4	4	4	4	4	4	2			
											6	6	6	6	6	7	6	6	6	6	6	6	5	5	2	2	....
150	217	1	3	5	6	7	8	9	9	9	9	9	9	9	9	9	9	8	7	7	6	2	....	::::			
AGE 70																											
50	125	....	....	_	_	_	_	....	....	.	.	1	1	1	1	1	2	2	2	2	3	3	3	3	3	4	4	4	4	4	2
100	206	....	1	1	2	2	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6	6	5	5	1	...

[1] Revision of table 6 in: McGee, C. E., and Della-Bianca, Lino. Diameter distributions in natural yellow-poplar stands. Southeast. Forest Exp. Sta., U. S. Forest Serv. Res. Pap. SE-25, 7 pp. 1967.

Table 13.-Total height by diameter class for pure natural yellow-poplar stands of various ages and stand densities on site index 90

Trees per acre (number)	Total height (feet) by diameter class (inches)																								
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
AGE 20																										
100	47	48	48	49	49	49	50	50	50																	
150	49	49	49	49	50	50	50	50	50																	
200	50	50	50	50	50	50	50	50	----																	
250	50	50	50	50	50	50	50	50	----																	
300	50	50	50	50	50	50	50	50	----																	
350	50	50	50	50	50	50	50	----	----																	
AGE 30																										
100	48	53	57	60	62	64	66	68	69	70	71															
150	50	55	58	61	64	65	67	68	70	71	----															
200	52	56	59	62	64	66	68	69	70	71	----															
250																										
300	53	58	61	63	66	68	69	70	71	--	----															
350	55	59	62	65	67	68	70	71	—	----	—															
AGE 40																										
50	44	51	57	62	66	70	73	75	77	79	81	83	84													
100	47	54	60	65	68	72	74	77	79	81	82	84	85													
150	49	56	62	66	70	73	76	78	80	82	83	85	—													
200	61	58	63	68	71	74	77	79	81	83	84	—	—													
250	53	59	65	69	73	76	78	80	82	84	—	----	—													
300	54	61	66	70	74	77	79	81	83	85	----	----	----													
350	55	62	67	72	75	78	81	83	84	—	—	—	----													
AGE 50																										
50	43	51	58	64	69	73	76	79	82	85	87	89	90	92	93											
100	46	54	61	66	71	75	78	81	84	86	88	90	92	93	----											
150	48	56	63	68	73	77	80	83	86	88	90	92	93	95	----											
200	50	58	65	70	75	79	82	85	87	89	91	93	94	----	—											
250	52	60	66	72	76	80	83	86	89	91	93	94	----	—	—											
300	53	62	68	74	78	82	85	88	90	92	94	----	—	----	----											
AGE 60																										
50	41	50	58	64	69	74	78	82	85	87	90	92	94	96	97	99	100									
100	45	54	61	67	72	77	81	84	87	89	92	94	96	97	99	100	—									
150	47	56	63	69	74	79	83	86	89	91	93	96	97	99	101	----	----									
200	49	58	65	71	76	81	84	88	90	93	95	97	99	101	----	—	----									
250	51	60	67	73	78	82	86	89	92	95	97	99	101	—	----	—	----									
AGE 70																										
50	40	49	57	64	70	75	79	83	86	89	92	94	96	98	100	101	103	104	106							
100	44	53	60	67	73	77	82	85	88	91	94	96	98	100	102	103	105	106	----							
150	46	55	63	69	75	80	84	87	90	93	96	98	100	102	103	105	106	----	----							
200	48	57	65	71	77	82	86	89	92	95	98	100	102	103	105	107	—	----	----							
250	50	59	67	73	79	84	88	91	94	97	100	102	104	105	----	----	----	----	—							

Table 14.—Total height by diameter class for pure natural yellow-poplar stands of various ages and stand densities on site index 100

AGE 20

Trees per acre (number)	Total height (feet) by diameter class (inches)																									
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
100	49	50	52	53	53	54	54	55	55																	
150	50	52	53	53	54	54	55	55	55																	
200	51	53	53	54	54	55	55	55	55																	
250	52	53	54	54	55	55	55	55	—																	
300	53	54	54	55	55	55	55	55	—																	
350	54	54	55	55	55	55	55	55	—																	

AGE 30

Trees per acre (number)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
100	49	55	60	64	67	70	72	74	75	77	78	79														
150	51	57	61	65	68	71	73	75	76	78	79	—														
200	53	58	63	66	69	72	74	75	77	78	—	—														
250	54	59	64	67	70	72	74	76	78	79	—	—														
300	55	61	65	68	71	73	75	77	78	—	—	—														
350	56	62	66	69	72	74	76	78	79	—	—	—														

AGE 40

Trees per acre (number)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
50	44	53	60	65	70	74	78	81	84	86	88	90	92	93												
100	48	56	62	68	73	77	80	83	85	88	90	91	93	94												
150	50	58	64	70	74	78	81	84	87	89	91	93	94	—												
200	52	60	66	71	76	80	83	86	88	90	92	94	—	—												
250	53	61	68	73	77	81	84	87	89	91	93	—	—	—												
300	55	63	69	74	79	82	85	88	91	93	94	—	—	—												
350	56	64	71	76	80	84	87	90	92	94	—	—	—	—												

AGE 50

Trees per acre (number)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
50	43	52	60	67	72	77	81	85	88	91	94	96	98	100	102	104	105									
100	46	55	63	69	75	80	84	87	90	93	96	98	100	102	103	105	—									
150	48	58	65	72	77	82	86	89	92	95	97	99	101	103	105	—	—									
200	50	59	67	74	79	83	87	91	94	96	99	101	103	105	—	—	—									
250	52	61	69	75	81	85	89	93	95	98	100	103	104	—	—	—	—									
300	54	63	71	77	82	87	91	94	97	100	102	104	—	—	—	—	—									

AGE 60

Trees per acre (number)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
50	41	51	59	67	73	78	83	87	91	94	97	99	102	104	106	108	109	111	112							
100	45	54	63	70	76	81	86	90	93	96	99	101	104	106	108	109	111	112	—							
150	47	57	65	72	78	83	88	92	95	98	101	103	106	108	109	111	113	—	—							
200	49	59	67	74	80	85	90	94	97	100	103	105	107	109	111	113	—	—	—							
250	51	61	69	76	82	87	92	96	99	102	105	107	109	111	—	—	—	—	—							

AGE 70

Trees per acre (number)	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
50	40	50	59	66	73	79	83	88	92	95	98	101	104	106	108	110	112	113	115	116	118					
100	43	53	62	70	76	82	86	91	94	98	101	103	106	108	110	112	114	115	117	118	—					
150	46	56	65	72	78	84	89	93	97	100	103	105	108	110	112	114	115	117	118	—	—					
200	48	58	67	74	81	86	91	95	99	102	105	107	110	112	114	116	117	—	—	—	—					
250	49	60	69	76	83	88	93	97	101	104	107	110	112	114	116	118	—	—	—	—	—					

Table 15.—Total height by diameter class for pure natural yellow-poplar stands of various ages and stand densities on site index 110

AGE 20

Trees per acre (number)	Total height (feet) by diameter class (inches)																								
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
100	50	52	54	56	57	58	59	60	60	61																
150	51	54	55	57	58	59	60	60	61	61																
200	52	55	56	57	58	59	60	60	61	....																
250	53	55	57	58	59	60	60	61	61	—																
300	54	56	57	58	59	60	60	61	61	....																
350	55	57	58	59	59	60	61	61	....	....																

AGE 30

100	49	56	62	67	71	74	77	79	81	83	85	86														
150	51	58	64	68	72	75	78	80	82	84	86	87														
200	53	60	65	70	73	76	79	81	83	85	86	....														
250	54	61	66	71	74	77	80	82	84	86	87	....														
300	56	62	68	72	75	78	81	83	85	86	....	....														
350	57	63	69	73	76	79	82	84	86	87	....	—														

AGE 40

50	44	53	61	68	73	78	83	86	89	92	95	97	99	101	103											
100	47	57	64	71	76	81	85	88	91	94	96	99	101	102	104											
150	50	59	66	73	78	83	86	90	93	96	98	100	102	104	—											
200	51	61	68	74	80	84	88	91	94	97	99	101	103	....	....											
250	53	62	70	76	81	86	89	93	96	98	101	103	....	—	....											
300	55	64	71	78	83	87	91	94	97	100	102	104	....	—	—											
350	56	65	73	79	84	89	92	96	99	101	103	—	—	—	—											

AGE 50

50	42	52	61	69	75	81	86	90	94	97	100	103	106	108	110	112	114	115								
100	46	56	64	72	78	84	88	93	96	100	102	105	107	110	112	113	115	....								
150	48	58	67	74	80	86	90	95	98	101	104	107	109	111	113	115	—	....								
200	50	60	69	76	82	88	92	96	100	103	106	108	111	113	115	—	—	—								
250	51	62	71	78	84	89	94	98	102	105	108	110	112	114	.	....	—	—								
300	53	64	72	80	86	91	96	100	104	107	109	112	114	—	....	....	....	—								

AGE 60

50	41	51	61	69	76	82	87	92	96	100	103	106	109	111	114	116	118	120	121	123						
100	44	55	64	72	79	85	90	95	99	102	106	108	111	114	116	118	120	121	123	—						
150	46	57	66	74	81	87	92	97	101	104	108	110	113	115	118	120	121	123	—	—						
200	48	59	68	76	83	89	94	99	103	106	110	112	115	117	119	121	123	....	....	—						
250	50	61	70	78	85	91	96	101	105	108	112	114	117	119	121	123	....	—	—	—						

AGE 70

50																										
100	4339	5450	6063	6671	7395	8365	9107	9912	100	97	101	104	104	107	108	110	111	113	116	113	118	116	120	118	122	120	122	124	126	124	127	126	129	127	129	....	130	_
150	45	56	66	74	81	87	93	98	102	106	109	112	115	118	120	122	124	126	128	129	—	—	....			
200	47	58	68	76	83	90	95	100	104	108	111	114	117	120	122	124	126	128	130	—	—	—	—			
250	48	60	70	78	85	92	97	102	106	110	114	117	119	122	124	126	128	130	....	—	....	—	....			

Table 16.-Total height by diameter class for pure natural yellow-poplar stands of various ages and stand densities on site index 120

AGE 20

Trees per acre (number)	Total height (feet) by diameter class (inches)																									
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
100	50	54	57	59	61	62	63	64	65	66																
150	52	55	58	60	61	63	64	65	66	66																
200	53	56	59	61	62	63	64	65	66	67																
250	54	57	59	61	63	64	65	66	66	----																
300	55	58	60	62	63	64	65	66	67	----																
350	56	58	61	62	63	65	65	66	67	----																

AGE 30

100	49	57	64	69	74	78	81	84	87	89	91	93	95													
150	51	59	66	71	76	79	83	86	88	90	92	94														
200	53	61	67	72	77	81	84	87	89	91	93	95	----													
250	54	62	68	74	78	82	85	88	90	92	94	----	----													
300	55	63	70	75	79	83	86	89	91	93	95	----	----													
350	57	65	71	76	80	84	87	90	92	94	----	----	----													

AGE 40

50	43	54	62	70	76	82	87	91	95	98	101	104	106	108	110	112										
100	47	57	65	73	79	84	89	93	97	100	103	105	108	110	112	114										
150	49	59	68	75	81	86	91	95	98	102	104	107	109	111	113	----										
200	51	61	69	77	83	88	93	97	100	103	106	108	111	113	----	----										
250	52	63	71	78	84	90	94	98	102	105	107	110	112	----	----	----										
300	54	64	73	80	86	91	96	100	103	106	109	111	113	----	----	----										
350	55	66	74	82	88	93	97	101	105	108	110	113	----	----	----	----										

AGE 50

50	41	52	62	70	78	84	90	94	99	103	106	109	112	115	117	120	122	124	125							
150	45	56	65	74	81	87	92	97	101	105	109	112	114	117	119	121	123	125	----							
200	4749	5860	6870	7678	8385	9189	9587	10199	105103	107109	112111	115114	116118	120119	122121	125123	125	----	----							
250	50	62	72	80	87	93	98	103	107	111	114	117	120	122	124	----	----	----	----							
300	52	64	73	82	89	95	100	105	109	113	116	119	122	124	----	----	----	----	----							

AGE GO

50	40	51	61	70	78	85	91	96	101	105	109	112	116	118	121	124	126	128	130	132	133	135				
100	43	54	65	73	81	88	94	99	104	108	111	115	118	121	123	126	128	130	132	133	135	----				
150	45	57	67	76	84	90	96	101	106	110	114	117	120	123	125	128	130	132	133	135	----	----				
200	47	59	69	78	86	92	98	103	108	112	116	119	122	125	127	129	132	134	----	----	----	----				

AGE 70

50	38	50	60	69	77	84	91	96	101	106	110	114	117	120	123	126	128	130	132	134	136	138	139	141		
100	41	53	64	73	81	88	94	100	104	109	113	116	120	123	125	128	130	132	134	136	138	140	141	----		
150	44	56	66	75	83	90	97	102	107	111	115	119	122	125	128	130	132	134	136	138	140	141	----	----		

Table 17.—Total height by diameter class for pure natural yellow-poplar stands of various ages and stand densities on site index 130

Trees per acre (number)	Total height (feet) by diameter class (inches)																									
	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
AGE 20																										
100	50	54	58	61	64	66	67	69	70	71	72															
150	51	56	60	62	65	66	68	69	71	72	72															
200	53	57	61	63	65	67	69	70	71	72	....															
250	54	58	61	64	66	68	69	70	71	72	....															
300	55	59	62	65	67	68	70	71	72	72	....															
350	56	60	63	65	67	69	70	71	72	....	....															
AGE 30																										
100	48	57	65	71	77	81	85	89	92	95	97	99	101	103												
150	50	59	67	73	78	83	87	90	93	96	98	100	102	....												
200	52	61	68	75	80	84	88	91	94	97	99	101	103	....												
250	53	62	70	76	81	86	89	93	95	98	100	102	....	....												
300	55	64	71	77	82	87	91	94	97	99	101	103	....	....												
350	56	65	72	79	84	88	92	95	98	100	102	....	....	....												
AGE 40																										
50	42	53	63	71	78	85	90	95	99	103	107	110	113	115	118	120	122									
100	46	57	66	74	81	87	93	97	102	105	109	112	114	117	119	121	....									
150	48	59	68	76	83	89	95	99	103	107	110	113	116	118	121	123	....									
200	50	61	70	78	85	91	97	101	105	109	112	115	117	120	122	....	....									
250	51	62	72	80	87	93	98	103	107	110	114	116	119	121	....	....	....									
300	53	64	74	82	89	95	100	104	108	112	115	118	121	123	....	....	....									
350	54	66	75	83	90	96	102	106	110	114	117	120	122	....	....	....	....									
AGE 50																										
50	43	54	63	72	80	87	93	98	103	108	112	116	119	122	125	127	129	131	....	....	....	....				
100	46	58	68	77	85	92	98	103	108	112	116	120	123	126	128	131	133	135	....	....						
150	47	60	70	79	87	94	100	105	110	114	118	122	125	128	130	133	135	....	....	....						
250	49	61	72	81	89	96	102	107	112	116	120	124	127	129	132	134	137	....	....	....						
AGE 60																										
50	38	50	61	71	79	87	94	100	105	110	114	118	122	125	128	131	133	136	138	140	142	144	145			
100	42	54	65	74	83	90	97	103	108	113	117	121	124	127	130	133	135	138	140	142	144	145	....			
150	44	56	67	77	85	93	99	105	110	115	119	123	126	130	132	135	137	140	142	144	146	....	....			
AGE 70																										
50	37	49	60	70	79	87	94	100	105	111	115	119	123	127	130	133	135	138	140	142	144	146	148	150	151	153
100	40	52	64	74	82	90	97	103	109	114	118	122	126	129	132	135	138	140	143	145	147	148	150	152	153	....