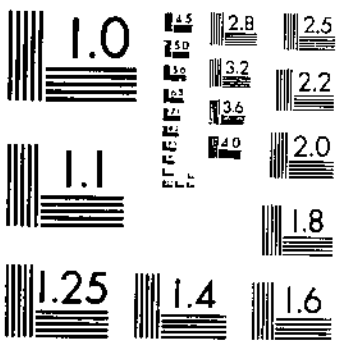
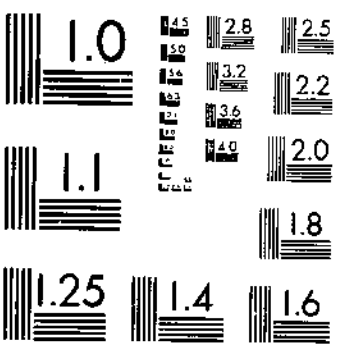
TB 560 (1937) USDA TECHNICAL BULLETINS UPDATA
YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS
SCHNUR, G.L
1 OF 1

START



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TECHNICAL BULLETIN No. 560 April 1937

YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS

By

G. LUTHER SCHNUR

Associate Silviculturist
Allegheny Forest Experiment Station
Forest Service

UNITED STATES DEPARTMENT OF AGRICULTURE, WASHINGTON, D. C.

...le by the Superintendent of Documents, Washington, D. C. - - - - - - - - - - - - - - - - Price 10 cents

Technical Bulletin No. 560 April 1937

UNITED STATES DEPARTMENT OF AGRICULTURE

WASHINGTON, D. C.

YIELD, STAND, AND VOLUME TABLES FOR EVEN-AGED UPLAND OAK FORESTS

By G. Luther Schnur

Associate Silviculturist, Allegheny Forest Experiment Station,[1] Forest Service

CONTENTS

INTRODUCTION

The upland oak region comprises 100 million acres, or one-fifth of the commercial forest area of the United States. It contains 43 billion cubic feet, or one-third of the total stand of hardwoods; and furnishes 2¼ billion cubic feet, or 40 percent, of the annual cut of such species. In addition, it is favorably located in respect to the great industrial regions and centers of population. "It is recognized as the great center of the Nation's hardwood resources" (*26*).[2]

There are two principal forest types in the region (*26*),[3] the chestnut-chestnut oak-yellow poplar type, and the oak-hickory type (fig. 1). These have been further divided (*27*) into 21 cover types, practically all of which are represented in this study.

Forest management in this extensive region has been dependent on a number of volume and yield studies (*6, 8, 9, 12, 18, 29, 30*) based on local data, some of which were very meager. Since the advent of the chestnut blight (*Endothia parasitica*), oak stands in the eastern part of the region have lost one of their fastest-growing components. This has altered the growth capacity of many stands and accordingly lessened the usefulness of some of the earlier yield tables. Recently, yield tables (*15*) and yields for the average site (*1*) for oak in Pennsylvania have been published

[1] Maintained at Philadelphia, Pa., in cooperation with the University of Pennsylvania.
[2] Italic numbers in parentheses refer to Literature Cited, p. 86.
[3] Shantz and Zon's oak-pine type was not included in this study because of the low percentage of oak that generally occurs and the resulting higher percentage of the faster growing pines.

115807°—37——1

The present study, begun on a somewhat local basis more than 10 years ago,[4] was expanded in 1928 to include all portions of the upland oak region. The yield, stand, and volume tables presented [5] were

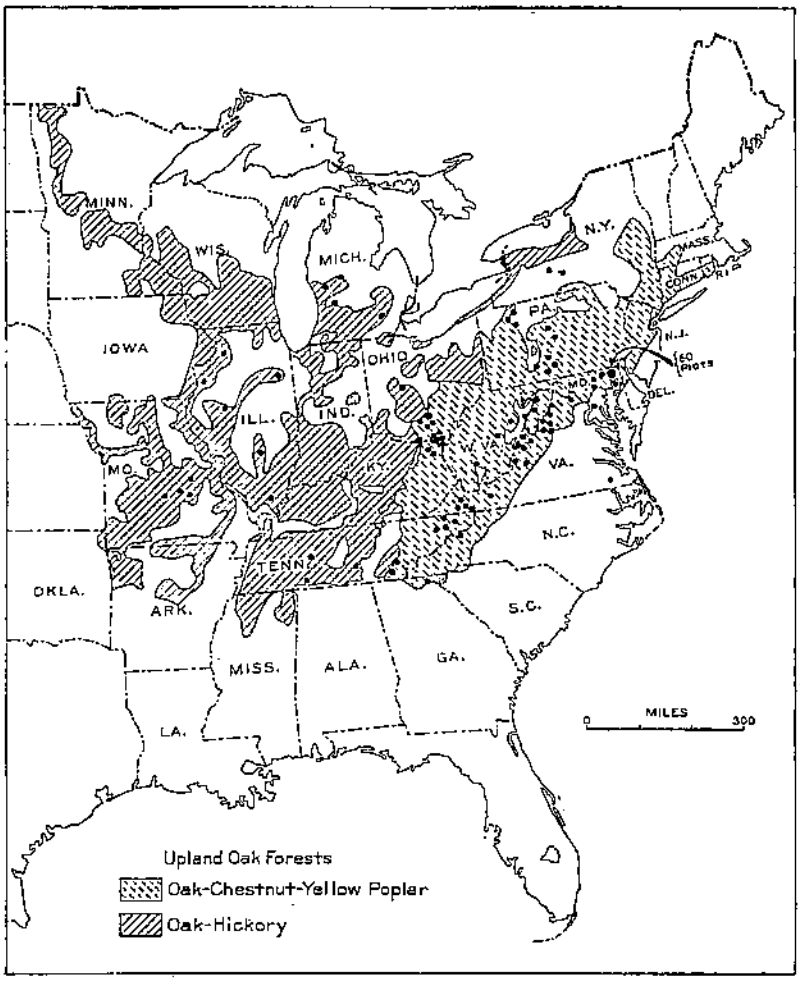


FIGURE 1.—The upland oak forest region, showing location of temporary sample plots. One or more plots were obtained in each designated locality.

computed from measurements obtained on sample plots and from trees cut on logging operations throughout the region.

[4] Prior to 1921, W. W. Ashe, F. W. Besley, E. H. Frothingham, Russel Watson, and W. D. Sterrett worked on different phases of an oak growth study. Some of the results were published in 1931 (*9*). In 1923, however, the present study grew out of the former and was undertaken by Frothingham and E. F. McCarthy at the Appalachian Forest Experiment Station. It was intensified by the establishment of a large number of plots, but was limited to the southern Appalachian Mountain region. Five years later it became a joint project of the Allegheny, Appalachian, and Central States Forest Experiment Stations, under the direction of McCarthy, at that time director of the Central States Station. Under McCarthy's supervision the field data were collected and the preliminary analyses and compilations were made. When McCarthy left the Forest Service, the project was assigned to the Allegheny Station for completion.

[5] The volume tables were computed under the direction of Donald Bruce and L. H. Reineke by their alinement chart method (*21*). The yield and stand tables were computed under the direction of the author, who is indebted, however, to F. X. Schumacher for invaluable aid in outlining the study and in selection of technique.

THE UPLAND OAK FORESTS

The upland oak forests are mostly second-growth sprout stands; the author estimates the remaining areas of virgin upland oak to be 350,000 acres, or only about 0.3 percent of the total upland oak area. A great number of tree species make up the forest. The average percentage composition and frequency of occurrence of the various species, as found in the present study, are shown in table 1. Although the 15 species of oak and 50 associated species found in the region occur in innumerable combinations, from pure stands to mixtures including a great number of species, the five important oaks—white, black, scarlet, chestnut, and red—make up an average of 83 percent of the stand basal area.

TABLE 1.—*Stand composition and frequency of occurrence of species on sample plots*

[Composition and frequency of occurrence on the plots]

Species	All plots			Site 40 (35–44)			Site 50 (45–54)			Site 60 (55–64)			Site 70 (65–74)			Site 80 (75–84)		
	Stand composition		Frequency of occurrence	Stand composition		Frequency of occurrence	Stand composition		Frequency of occurrence	Stand composition		Frequency of occurrence	Stand composition		Frequency of occurrence	Stand composition		Frequency of occurrence
	Basal area	Number of trees		Basal area	Number of trees		Basal area	Number of trees		Basal area	Number of trees		Basal area	Number of trees		Basal area	Number of trees	
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
White oak (*Quercus alba* L.)	28.23	31.29	95.30	20.70	23.23	75.00	31.00	34.95	91.07	29.77	32.07	95.98	28.29	31.25	97.79	18.04	24.31	93.33
Black oak (*Q. velutina* La M.)	19.11	13.45	91.58	15.63	11.75	75.00	10.64	7.24	73.21	16.99	12.15	94.26	22.84	15.90	95.59	29.79	20.89	96.67
Scarlet oak (*Q. coccinea* Muenchh.)	17.08	10.85	79.70	6.57	5.10	75.00	15.02	8.96	76.79	18.28	11.55	86.21	16.17	10.50	75.00	18.76	12.26	70.00
Chestnut oak (*Q. montana* Willd.)	13.73	13.50	63.36	21.80	22.95	75.00	16.57	15.20	62.50	13.25	13.00	66.67	13.33	13.48	63.24	10.70	10.01	43.33
Red oak (*Q. borealis maxima* (Marsh.) Ashe)	4.65	3.45	51.98	6.67	5.42	50.00	5.27	4.00	50.00	5.46	4.10	58.05	3.86	2.80	48.53	2.55	1.63	36.67
Post oak (*Q. stellata* Wang.)	.90	1.07	13.37	2.00	2.35	25.00	1.52	1.57	12.50	.25	1.54	18.97	.30	.41	8.09	.15	.33	6.67
Southern red oak (*Q. rubra* L.)	.60	.47	4.21	------	------	------	.06	.08	3.57	1.29	.20	2.87	.78	.56	3.68	2.94	2.47	16.67
Pin oak (*Q. palustris* Muenchh.)	.40	.27	1.73	------	------	------	.81	.99	1.79	.04	.02	1.15	.44	.21	2.94	3.10	2.49	3.33
Blackjack oak (*Q. marilandica* Muenchh.)	.14	.17	1.24	------	------	------	------	------	------	.01	.04	1.15	.01	.03	1.47	------	------	------
Oaks, miscellaneous—Hill's (*Q. ellipsoidalis* E. J. Hill), bear (*Q. ilicifolia* Wang.), dwarf chinquapin (*Q. prinoides* Willd.)	.14	.10	1.98	------	------	------	.79	.35	5.36	.04	.05	2.30	.02	.08	.74	------	------	------
Oaks, swamp—swamp white (*Q. bicolor* Willd.), willow (*Q. phellos* L.), shingle (*Q. imbricaria* Michx.)	.05	.05	2.97	------	------	------	.02	.01	3.57	.05	.04	3.45	.03	.04	2.21	.13	.09	3.33
Total	85.03	74.67	------	73.37	70.80	------	81.70	73.38	------	85.43	74.76	------	86.07	75.26	------	86.16	74.48	------
Hickory[1]—bitternut (*Hicoria cordiformis* (Wang.) Britt.), bigleaf shagbark (*H. laciniosa* (Michx.) Sarg.)	2.69	6.08	70.05	9.80	13.70	75.09	3.44	5.95	67.86	2.37	5.92	69.54	2.62	6.21	72.79	2.58	5.90	70.00
Virginia pine (*Pinus virginiana* Mill.)	1.86	1.10	14.11	7.87	4.68	50.00	3.67	1.96	17.86	2.41	1.43	16.09	.56	.41	5.56	.64	.41	13.32
Chestnut (*Castanea dentata* (Marsh.) Borkh.)	1.84	1.62	24.50	3.80	2.45	25.00	2.83	2.14	28.57	1.51	1.55	24.14	1.86	1.57	24.26	1.56	1.35	20.00
Red maple (*Acer rubrum* L.)	1.31	4.23	52.21	1.20	1.35	50.00	1.64	5.51	46.43	1.37	5.10	59.77	1.12	2.72	47.06	1.40	4.48	43.33
Yellow poplar (*Liriodendron tulipifera* L.)	.84	.77	20.30	------	------	------	.18	.19	10.71	.71	.51	16.09	1.20	1.11	25.00	1.14	1.68	36.67
Ash—black (*Fraxinus nigra* Marsh.), red (*F. pennsylvanica* Marsh.)	.62	.97	21.04	------	------	------	.21	.51	10.71	.69	1.05	19.54	.77	1.18	27.21	.44	.58	26.67

Group A, miscellaneous—hophornbeam (*Ostrya virginiana* (Mill.) Koch), blue beech (*Carpinus caroliniana* Walt.), persimmon (*Diospyros virginiana* L.), sourwood (*Oxydendron arboreum* (L.) de C.), holly (*Ilex opaca* Aiton), sassafras (*Sassafras variifolium* (Salisb.) Ktze.)	.57	1.43	30.20	.62	1.28	50.00	.38	.87	21.43	.33	1.06	30.46	.66	1.54	29.41	1.67	3.66	43.33
Red gum (*Liquidambar styraciflua* L.)	.54	.77	5.20							.65	.87	5.75	.71	1.12	7.35	.26	.21	3.33
Black gum (*Nyssa sylvatica* Marsh.)	.48	1.71	37.62	1.22	2.78	50.00	.44	2.17	42.86	.56	1.87	39.66	.40	1.49	33.82	.36	.88	30.00
Shortleaf pine (*Pinus echinata* Mill)	.47	.31	4.21				.80	.43	7.14	.44	.30	5.17	.22	.22	.74	1.24	.66	10.00
Black locust (*Robinia pseudoacacia* L.)	.44	.29	15.10	1.55	1.08	25.00	.67	.39	19.64	.53	.33	17.82	.23	.20	10.29	.18	.19	10.00
Pitch pine (*Pinus rigida* Mill.)	.43	.29	4.95				.19	.14	5.36	.55	.28	6.32	.48	.43	4.41			
Group B, miscellaneous—red mulberry (*Morus rubra* L.) redbud (*Cercis canadensis* L.), staghorn sumach (*Rhus hirta* (L.) Sudw.), hawthorns (Crataegus spp.), dogwood (*Cornus florida* L.), serviceberry (*Amelanchier canadensis* (L.) Med., *A. laevis* Weig.)	.41	2.09	35.15		.15	25.00	.52	2.13	44.64	.48	2.24	37.36	.32	2.16	31.62	.15	.86	23.33
Northern white pine (*Pinus strobus* L.)	.35	.29	7.18				.33	.30	7.14	.35	.30	9.77	.42	.32	5.15	.03	.08	3.33
White ash (*Fraxinus americana* L.)	.30	.54	11.63				.44	.44	16.07	.13	.26	9.20	.41	.75	13.97	.50	1.11	10.00
Unknown or dead chestnut	.26	.26	3.71				.63	.77	3.57	.31	.27	5.17	.08	.06	2.21	.15	.21	3.33
Black walnut (*Juglans nigra* L.)	.20	.15	8.42				.15	.09	3.57	.17	.16	7.47	.22	.12	8.82	.36	.39	20.00
Beech (*Fagus grandifolia* Ehrh.)	.18	.56	12.13	.30	.75	25.00	.13	.20	7.14	.13	.34	8.62	.24	.95	18.38	.27	.79	13.33
Black cherry (*Prunus serotina* Ehrh.)	.18	.12	4.95				.19	.33	7.14	.13	.08	4.02	.27	.11	5.88	.01	.03	3.33
Pignut hickory (*Hicoria glabra* (Mill.) Sweet)	.18	.42	3.47				.22	.47	1.79	.17	.31	2.87	.17	.50	5.15	.25	.71	3.33
Largetooth aspen (*Populus grandidentata* Michx.)	.13	.08	2.23				.21	.10	3.57	.17	.10	1.72	.04	.03	1.47	.18	.11	6.67
Sugar maple (*Acer saccharum* Marsh.)	.12	.36	10.89	.27	.98	25.00	.27	.57	10.71	.04	.17	6.90	.14	.40	14.71	.23	.74	13.33
Shagbark hickory (*Hicoria ovata* (Mill.) Britt.)	.11	.20	1.76				.32	.55	1.79	.13	.25	2.30	.01	.03	.74	.02	.08	3.33
Aspen (*Populus tremuloides* Michx.)	.09	.07	2.23				.33	.27	5.36	.01	.01	1.15	.11	.06	2.21	.01	.03	3.33
Chokecherry (*Prunus virginiana* L.)	.07	.08	3.47				.05	.06	1.79	.02	.03	1.72	.15	.16	5.88	.01	.03	3.33
Butternut (*Juglans cinerea* L.)	.06	.04	2.97				.02	.02	1.79	.06	.05	2.30	.10	.06	5.15			
Cucumber magnolia (*Magnolia accuminata* L.), including mountain magnolia (*M. fraseri* Walt.)	.05	.08	2.48				.04	.06	3.57	.02	.03	1.72	.09	.16	3.68			
Elm—American (*Ulmus americana* L.) and slippery (*U. fulva* Michx.)	.05	.18	4.46							.07	.18	4.02	.07	.29	7.35	.01	.04	3.33
Sycamore (*Platanus occidentalis* L.)	.04	.04	2.72							.01	.01	.57	.08	.08	5.15	.18	.19	10.00
Sweet birch (*Betula lenta* L.)	.03	.04	2.23							.01	.01	.53	.06	.10	5.88			
Eastern hemlock (*Tsuga canadensis* Carr.)	.03	.04	.50										.08	.10	1.47			
Mockernut hickory (*Hicoria alba* (L.) Britt.)	.02	.07	.74							.02	.11	.57	.02	.04	.74	.01	.12	3.33
Basswood (*Tilia glabra* Vent.), including (*T. heterophylla michauxii* (Nutt.) Sarg.)	.01	.03	1.24							.01	.03	1.72	.01	.04	1.47			
Eastern red cedar (*Juniperus virginiana* L.)	.01	.02	2.23							.01	.03	3.45	.01	.02	2.21			

[1] Undesignated hickories included.

The majority of the forests are understocked, unhealthy, and in a run-down condition, owing mainly to indiscriminate cutting and grazing, and to fire, disease, and insects. The chestnut blight alone has reduced the stocking and changed the composition (*13*) of more than one-third of these forests. However, well-stocked stands made up of both sprouts and seedlings are occasionally found throughout the region. Some of these are the result of one, two, or even three clear cuttings. For as long as 100 years, many timber areas near the sites of old iron furnaces were periodically clear cut for charcoal and at present appear to represent very nearly the growth capacity of the sites on which they are found.[6] A large number of the study plots were located in such stands. Their yields furnish a measure of the volume of timber that can be obtained under what are thought to be the best natural growing conditions for even-aged stands. Even though the great bulk of the upland oak forests are now understocked, they should, if placed under good forest management, produce yields as good as or perhaps even better than those of the old furnace lands.

All-aged and understocked stands introduce perplexing variables which will require further study.

THE YIELD TABLES

The yield values for fully stocked, even-aged, second-growth upland oak forests as determined in this study are summarized in table 2. Values are presented for even tens of site-quality index, with relative quality stated also. Site index is the height attained at an age of 50 years by the average dominant and codominant oak trees. Values for intermediate site indices can be obtained by interpolation from the tables or graphs.

The maximum mean annual growth of the merchantable stems on an average site is 47 cubic feet, or about 0.55 cord per acre. This is attained at about 50 years and continues at approximately the same rate up to 100 years. Although the rate is not high, it is fairly constant for this period of 50 years, or longer. Oak stands do not give heavy yields in comparison with softwoods, but their ability to maintain very nearly maximum growth for many years is much in their favor.

[6] Excepting possibly the poorer sites, where the percentage of seedlings is low.

TABLE 2.—*Composite yield of second-growth upland oak (stand 0.6 inches d. b. h. and larger)*

Age (years)	Total height, average dominant and codominant oak	Trees per acre	Basal area per acre	Average diameter breast high	Yield per acre					Mean annual growth per acre				
					Entire stem inside bark	Merchantable stem to a 4-inch top outside bark [1]		International rule [2]	Scribner rule [3]	Entire stem inside bark	Merchantable stem to a 4-inch top outside bark [1]		International rule [2]	Scribner rule [3]
	Feet	*Number*	*Square feet*	*Inches*	*Cubic feet*	*Cubic feet*	*Cords*	*Board feet*	*Board feet*	*Cubic feet*	*Cubic feet*	*Cords* [1]	*Board feet*	*Board feet*
SITE INDEX 40—POOR SITE														
10	8	6,850	36	1.0	205					20				
20	17	3,260	60	1.8	485	20	0.24			24	1	0.01		
30	25	1,610	75	2.9	755	270	3.18	100		25	9	.11	3	
40	33	1,020	82	3.8	1,030	680	8.00	600	50	26	17	.20	15	1
50	40	802	89	4.5	1,300	1,060	12.47	1,400	150	26	21	.25	28	3
60	45	651	96	5.2	1,540	1,420	16.71	2,700	400	26	24	.28	45	7
70	48	541	102	5.8	1,765	1,750	20.59	4,250	800	25	25	.29	61	11
80	50	483	109	6.4	1,975	2,050	24.12	5,900	1,450	25	26	.30	74	18
90	52	447	115	6.9	2,175	2,330	27.41	7,600	2,200	24	26	.30	84	24
100	53	411	122	7.4	2,375	2,590	30.47	9,200	3,350	24	26	.30	92	34
SITE INDEX 50—FAIR SITE														
10	13	5,205	39	1.2	270					27				
20	23	2,520	65	2.2	635	70	0.82			32	4	0.04		
30	33	1,246	80	3.4	1,000	540	6.35	350		33	18	.21	12	
40	42	789	88	4.5	1,360	1,090	12.82	1,400	150	34	27	.32	35	4
50	50	623	95	5.3	1,720	1,600	18.82	3,250	500	34	32	.38	65	10
60	56	507	102	6.1	2,050	2,080	24.47	5,600	1,100	34	35	.41	93	18
70	60	419	110	6.9	2,355	2,510	29.53	8,150	2,350	34	36	.42	116	34
80	62	375	117	7.5	2,635	2,900	34.12	10,450	4,000	33	36	.43	131	50
90	64	346	124	8.1	2,900	3,230	38.00	12,600	5,800	32	36	.42	140	64
100	65	320	131	8.7	3,140	3,520	41.41	14,700	7,750	31	35	.41	147	78

[1] Converting factor, 85 cubic feet per cord.

[2] ⅛-inch saw kerf to a 5-inch top inside bark.

[3] To an 8-inch top inside bark.

TABLE 2.—*Composite yield of second-growth upland oak (stand 0.6 inches d. b. h. and larger)*—Continued

SITE INDEX 60—AVERAGE SITE

Age (years)	Total height, average dominant and co-dominant oak	Trees per acre	Basal area per acre	Average diameter breast high	Yield per acre					Mean annual growth per acre				
					Entire stem inside bark	Merchantable stem to a 4-inch top outside bark		International rule	Scribner rule	Entire stem inside bark	Merchantable stem to a 4-inch top outside bark		International rule	Scribner rule
	Feet	*Number*	*Square feet*	*Inches*	*Cubic feet*	*Cubic feet*	*Cords*	*Board feet*	*Board feet*	*Cubic feet*	*Cubic feet*	*Cords*	*Board feet*	*Board feet*
10	17	4,060	41	1.4	345					34				
20	30	1,945	68	2.5	805	170	2.00			40	8	0.10		
30	41	965	84	4.0	1,265	880	10.35	850	50	42	29	.34	28	2
40	51	611	93	5.3	1,725	1,580	18.59	3,200	500	43	40	.46	80	12
50	60	482	100	6.3	2,165	2,230	26.24	6,300	1,400	43	45	.52	126	28
60	67	390	108	7.2	2,590	2,800	32.94	9,700	3,150	43	47	.55	162	52
70	71	326	115	8.0	2,970	3,290	38.71	12,800	5,650	42	47	.55	183	81
80	75	292	123	8.8	3,325	3,730	43.88	15,650	8,350	42	47	.55	196	104
90	77	268	130	9.4	3,655	4,120	48.47	18,300	11,050	41	46	.54	203	123
100	79	248	138	10.1	3,970	4,480	52.71	20,900	13,700	40	45	.53	209	137
SITE INDEX 70—GOOD SITE														
10	21	3,140	43	1.6	410	10	0.12			41	1	0.01		
20	36	1,500	71	2.9	975	360	4.24	150		49	18	.21	8	
30	48	743	88	4.6	1,525	1,270	14.94	1,750	200	51	42	.50	58	7
40	60	472	96	6.0	2,075	2,090	24.59	5,500	1,100	52	52	.61	138	28
50	70	374	104	7.2	2,610	2,830	33.29	9,750	3,250	52	57	.67	195	65
60	78	304	112	8.3	3,115	3,480	40.94	13,900	6,700	52	58	.68	232	112
70	83	252	120	9.3	3,575	4,030	47.41	17,700	10,550	51	58	.68	253	151
80	87	224	128	10.2	4,000	4,510	53.06	21,200	14,100	50	56	.66	265	176
90	90	207	136	11.0	4,400	4,960	58.35	24,500	17,200	49	55	.65	272	191
100	92	192	143	11.7	4,780	5,400	63.53	27,650	19,900	48	54	.64	276	199

SITE INDEX 80—EXCELLENT SITE

10	26	2,435	44	1.8	490	20	0.24			49	2	0.02		
20	43	1,160	73	3.4	1,145	620	7.29	350		57	31	.36	18	
30	56	578	90	5.3	1,795	1,690	19.88	3,350	500	60	56	.66	112	17
40	69	366	99	6.9	2,440	2,610	30.71	8,600	2,500	61	65	.77	215	62
50	80	290	107	8.3	3,085	3,450	40.59	13,750	6,650	62	69	.81	275	133
60	89	235	115	9.5	3,690	4,160	48.94	18,600	11,350	62	69	.82	310	189
70	95	196	124	10.7	4,225	4,770	56.12	23,100	15,900	60	68	.80	330	227
80	99	174	132	11.7	4,725	5,340	62.82	27,250	19,700	59	67	.79	341	246
90	103	161	140	12.7	5,200	5,870	69.06	30,950	23,050	58	65	.77	344	256
100	105	148	148	13.6	5,650	6,380	75.06	34,400	26,100	56	64	.75	344	261

BASIC DATA

Since permanent sample plots measured at intervals over a period of years were not available, it was necessary to use the temporary-plot method for determining yield. Its use assumes that contemporaneous measurement of several stands, on similar sites but of various ages, gives the same results as successive measurements of an identical stand over a period of years. For the study 409 temporary plots were measured throughout the region (fig. 1). As stated before, fully stocked, even-aged stands were difficult to find except in the vicinities of old iron furnaces. Nevertheless a fair geographic representation of most of the region was obtained.

PLOT SELECTION AND MEASUREMENT

The study plots were selected to meet the following requirements: (1) Thirty percent or more of the dominant stand composed of upland oak species; (2) fully stocked, as indicated by closed crown canopies (80 to 90 percent of complete closure) and the absence of very dense undergrowth; (3) even-aged; and (4) uniformly spaced tree stems. No distinct holes were permitted in the stand either on the plots or near their boundaries. In a few instances, where plots were established in stands containing recently killed chestnut trees, these trees were measured as if alive.

The field measurements were obtained by the standard methods set up by the committee on standardization appointed by the Society of American Foresters (*28*). Plot surveys were made with a staff compass and steel tape. The diameters of all trees 0.6 inch diameter breast high,[7] and larger were measured with a diameter tape.[8] Heights were measured with an Abney hand level, and ages were counted on cores obtained with a Swedish increment borer.

PRELIMINARY COMPUTATIONS

For each plot a tabulation of basal area, number of trees, and volume in each of four units (total cubic, merchantable cubic, International, and Scribner board feet) was made by species, crown class, and diameter breast high. These values were punched on cards so that the various sortings, countings, and summations necessary for the yield analyses could be made on automatic machines. Volumes were obtained from tables,[9] constructed for this purpose, which will be explained and presented later.

[7] Diameter breast high, 4.5 feet above average ground level.

[8] On some plots, established in 1923, a 2.6-inch lower diameter limit was used. However, the errors involved are relatively small, as most of these plots are in the older age classes having few trees under 2.6 inches diameter breast height.

[9] The following tabulation shows the species for which the various volume tables were used. Only small errors are likely to result from using substitute tables for species for which no tables are available, because the percentage of the stand volume involved is very low, as shown in table 1. Even though the errors are small, some of the selections are subject to criticism. For example, it would be more logical to use the red maple volume table for such tolerant species as beech and sugar maple:

	Volume table and other species for which table was used
White oak	All unknown species.
Red oak	Post oak, southern red oak, pin oak, black-jack oak, and other miscellaneous oak species.
Hickory	Ash.
Virginia pine	All pine, hemlock, and cedar. (For Scribner volumes, 68 percent of the International volume was used.)
Yellow poplar	Aspen, basswood, cucumber, and sycamore.
Red gum	Black gum.
Black cherry	All cherry, beech, sweet birch, elm, sugar maple, and miscellaneous other species.
Black walnut	Butternut.

Height curves for volume determination on each plot were made by a special process after careful analysis.[10] The yield tables were constructed by Bruce's (*3*) and Reineke's (*19*) methods with some modifications which are explained in the text to follow.

ELIMINATION OF PLOTS

Even though the sample stands used in this study were carefully selected as fully stocked, the difficulty met in finding such stands and the chance that an erratic one would be measured accidentally by one of the many field crews necessitated some statistical check on degree of stocking. Reineke (*20*) shows that the *number of trees–average diameter* relation, built up from a sample of an even-aged forest type, can be used as a standard for determining the density of stocking of individual stands. This use requires much less computational work than the usual basal area and number of trees tests because the dependent variable-average diameter takes care of the effect of both age and site. Also, Reineke shows graphically for a number of conifers, both in pure and mixed stands, that this relation is linear if expressed logarithmically. Application of this method to the oak-yield plot values was effected by computation of a logarithmic regression, log number of trees on log average diameter breast high. The resulting linear equation, representing the average relation for all of the yield plots, is—

Log number of trees=3.8638—1.4987 log average diameter breast high[11]

By computing the residuals of log (number of trees) of the individual plots from the regression line, and grouping in terms of the standard error of regression, the grouping shown in table 3 was obtained. This shows no plot sufficiently erratic to warrant elimination. The one plot which is more than three times the standard error from the regression line is not beyond the realm of chance out of a total of 409 plots. Therefore, no plots were eliminated because of abnormal density.

It was, however, found necessary during the height-age analysis later described to eliminate five plots in the 80- and 90-year age classes. The samples of these two classes were found to be skewed; a large portion of the sample in each case was obtained in a single locality. Arbitrary limitation of the number of plots from any one locality resulted in more nearly normal distributions in these classes.

[10] In order to utilize the earlier measured field plots on which data for separate height-diameter curves for each major species had not been obtained, it was necessary to find some satisfactory method of assigning heights for volume computations. After the plots were sorted into 10-foot height classes (probably average dominant height), height-diameter curves were plotted for the two numerically strongest age groups. The 60-, 70-, and 80-foot height-diameter curves for the 50-year class were found practically to coincide with the corresponding curves for the 60-year class. This test indicated no effect of age other than that already taken care of by dealing separately with each 10-foot height class. To test the effect of species the 60-foot height class was used. Separate height-diameter curves were constructed for each of the five major oak species, white, black, scarlet, chestnut, and red. All of these curves followed the same trend; the greatest variation between the lowest and highest was but 5 feet. This indicated that species was of minor importance. A series of height-diameter curves, one for each 10-foot height group, was then plotted on one sheet. Practically all of these merged into one curve at the lower end. Irregularities were ironed out and the final set of harmonized curves was made. This set of curves was tested graphically by plotting height-diameter curves from randomly picked plots from several height classes. No bad discrepancies were detected, so these curves were considered sufficiently accurate for volume determinations. This analysis was made by Ray F. Bower at the Central States Forest Experiment Station in 1928.

[11] Determined from average basal area.

TABLE 3.—*Distribution of plots about regression line for log (number of trees)—log (average d. b. h.) relation, by standard error groups*

Standard error groups	Distribution of plots		Standard error groups	Distribution of plots	
	Number	*Percent*		*Number*	*Percent*
+2 to +3	2	0.5	−2 to −3	2	0.5
+1 to +2	42	10.3	−3 to −4	1	.2
0 to +1	169	41.3			
0 to −1	155	37.9	Total	409	100.0
−1 to −2	38	9.3			

TABLE 4.—*Average number of years required for oak sprouts to reach breast height*

Species	Localities sampled	Sprouts measured	Average age at breast height	Species	Localities sampled	Sprouts measured	Average age at breast height
	Number	*Number*	*Years*		*Number*	*Number*	*Years*
White oak	9	315	1.8	Post oak	1	29	3.1
Black oak	11	140	2.0				
Scarlet oak	5	358	1.4	Average			1.7
Chestnut oak	7	10	1.6				

YIELD ANALYSES

AGE OF STAND

The average age of the dominant and codominant trees was used as the stand age. This was obtained on each plot by averaging ring counts on 5 to 10 cores removed at breast height from as many dominant and codominant trees of the species prevailing. The resulting breast-height ages were corrected to total age by the addition of 2 years. This correction factor, which represents the average time required for the trees to reach breast height, was obtained from sprout analyses, the actual results of which are shown in table 4. Preliminary examination of the sprout measurements showed great variations in height at each age, which indicated both considerable variation in site from tree to tree and in vitality of the old root systems and stumps from which the sprouts originated. Assigning site values to individual sprouts would obviously involve so much speculation and error that no attempt was made to do it. The general average for all sites was used instead. If stump ages are used, a correction factor of 1 year is sufficient. The sample stands were considered even-aged if the ages of the individual trees of the dominant classes did not vary by more than 8 years.

SITE INDEX

The height attained by the average dominant and codominant oak at the age of 50 years was used as the index of site quality. All oaks were grouped together in obtaining this height because species composition changes with site and no one species occurs invariably in the dominant stand on all sites. The diameter of this average tree was obtained for each of the study plots in the customary way by averaging the basal areas of the dominant and codominant oaks and reading

the diameter equivalent from a table. The height was then read as usual from the height-diameter curve for the dominant stand.[12]

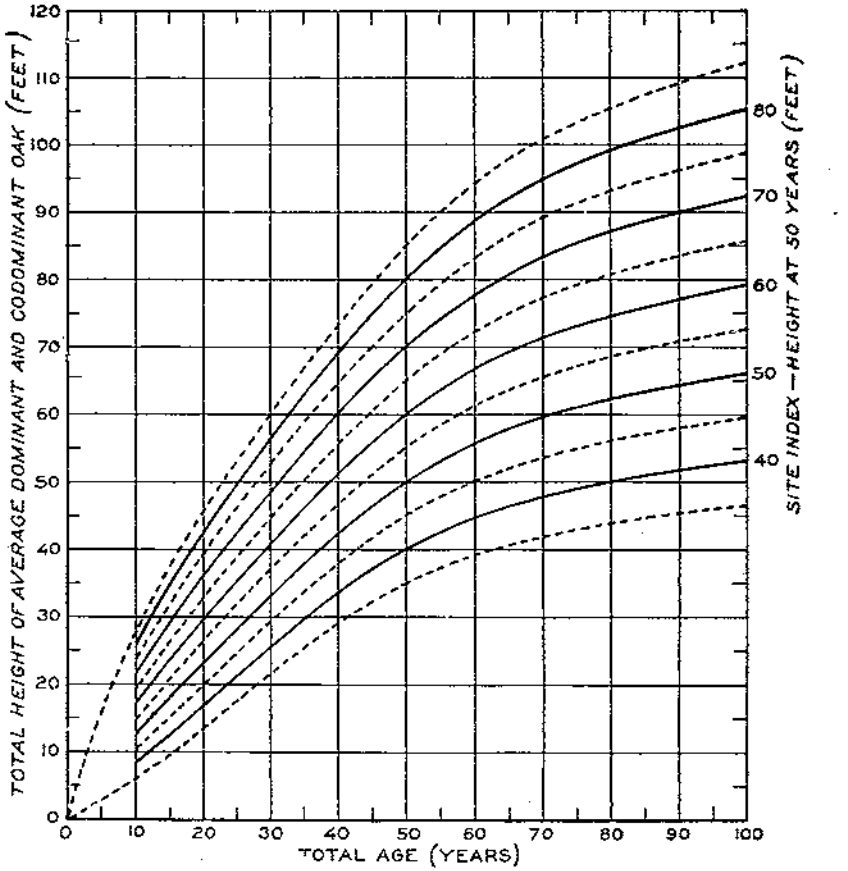


FIGURE 2.—Height curves used for site classification.

The average relation between height and age for each 10-foot site index is presented in figure 2 and table 5. The site index of any stand is obtained from this chart in the usual way by plotting the height of

[12] On a good many plots established during 1924, heights were measured on only two or three sample trees out of the dominant stand, so that it was impossible to construct height-diameter curves directly. A careful analysis of the height-diameter relation and a special technique for the construction of the curves were worked out by B. Lucas at the Central States Forest Experiment Station in 1930. The average dominant height of each study plot was first computed by averaging the heights of all the trees measured. The plots were then combined by 10-foot average height groups, and height-diameter curves drawn for each group. As much as 15 feet difference occurred between trees of the same diameter in different groups. These groups were next subdivided by crown classes and new curves drawn. This time not much difference resulted between the dominant and codominant classes or between the intermediate and suppressed classes, but considerable difference was noted between the 2 groups. Comparisons between species showed very little difference. On the basis of these findings 2 sets of harmonized curves were made for the various average height groups, 1 for the dominant and codominant classes and 1 for the intermediate and suppressed. With these harmonized curves as guides, the height-diameter curves for individual plots were drawn by superimposing the actual height-diameter measurements for the plot, plotted on transparent graph paper, on the harmonized curve representing the same average height class. Since the harmonized curves were made for 10-foot average height classes only, interpolation was necessary when the average height of the plot was not an even 10-foot value. This was accomplished graphically by raising or lowering the superimposed sheet the required number of units. Since the individual plots varied in density, a shifting to left or right was then necessary to get the best fit to the plotted points. If a plot was below average density, the diameters tended to be somewhat larger for the same height, and if above the average they would be smaller. The same procedure was used to obtain both the dominant and subdominant curves.

the average dominant and codominant oak, as determined from measurements of the actual stand in question, over the age of the stand and reading the site index value from the curve passing nearest to this point. More exact readings can obviously be obtained by interpolation.

TABLE 5.—*Total height of average dominant and codominant oak*

Total age (years)	Total height by site index [1]—					Total age (years)	Total height by site index—				
	40	50	60	70	80		40	50	60	70	80
	Feet	*Feet*	*Feet*	*Feet*	*Feet*		*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
10	8	13	17	21	26	60	45	56	67	78	89
15	12	18	24	29	35	65	46	58	69	81	92
20	17	23	30	36	43	70	48	60	71	83	95
25	21	28	35	42	50	75	49	61	73	85	97
30	25	33	41	48	56	80	50	62	75	87	99
35	29	38	46	54	63	85	51	63	76	89	101
40	33	42	51	60	69	90	52	64	77	90	103
45	37	46	56	65	75	95	52	65	78	91	104
50	40	50	60	70	80	100	53	65	79	92	105
55	43	53	64	74	85						

[1] Total height of average dominant and codominant oak at 50 years.

DERIVATION OF THE SITE-INDEX CURVES

One of the most important problems involved in the construction of yield tables from contemporaneous measurements of different stands, rather than from periodic remeasurements of identical stands, is that of assigning a site quality to those stands which are not of the reference age (in this case 50 years). The contemporaneous data may be used only on the assumption that the sample plot distributions throughout the range of site quality are approximately similar, in a geometric sense, for each age class. If so, an average curve of the dominant heights of all plots over age can be accepted as a satisfactory approximation of the *dominant height—age* curve for the average site. For the oak-yield plots these heights are as given in column 2, table 6. The points representing plots on other than the average site are distributed in the form of a comet-shaped belt widening with advancing age.

TABLE 6.—*Location of site-classification curves*

Total age (years)	Height and standard deviation of average dominant oaks	Height by site index—						
		30	40	50	60	70	80	90
	Feet	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
10	18.1± 3.61	4.0	8.3	12.6	16.9	21.2	25.6	29.9
20	31.2± 5.32	10.4	16.8	25.1	29.5	35.8	42.2	48.5
30	42.7± 6.42	17.6	25.3	32.9	40.6	48.3	56.0	63.6
40	53.4± 7.42	24.4	33.3	42.1	51.0	59.9	68.8	77.6
50	62.7± 8.37	30.0	40.0	50.0	60.0	70.0	80.0	90.0
60	69.6± 9.23	33.5	44.6	55.6	66.6	77.6	88.7	99.7
70	74.3± 9.83	35.9	47.7	59.4	71.2	82.9	94.6	106.3
80	77.0±10.29	37.4	49.7	62.0	74.3	86.6	98.9	111.1
90	80.3±10.62	38.8	51.5	64.2	76.9	89.5	102.3	114.9
100	82.5±10.90	39.9	53.0	65.9	79.0	92.0	105.1	118.0

In most yield studies recently made for second-growth stands the average curve is used to obtain, by anamorphosis, a series of curves showing the heights attained at various ages on other than the average

site. These height curves are so spaced as to pass through the 40-foot, 50-foot, and successive 10-foot points on the 50-year ordinate, or reference age commonly used. The use of anamorphosis is a distinct step forward from the earlier technique of dividing the comet-shaped belt of points, by eye, into an arbitrary number of similar site-class belts, and of drawing, freehand, through the midzone of each a curve representative of height growth on that site. But the use of anamorphosis assumes that the percentage relationship between heights on different sites at 50 years holds for all other ages. For example, if the height of the average dominant tree at 50 years on the poorest site is, as in the present case, about 60 percent of the height on the average site, an anamorphic curve for the poorest site would show a height

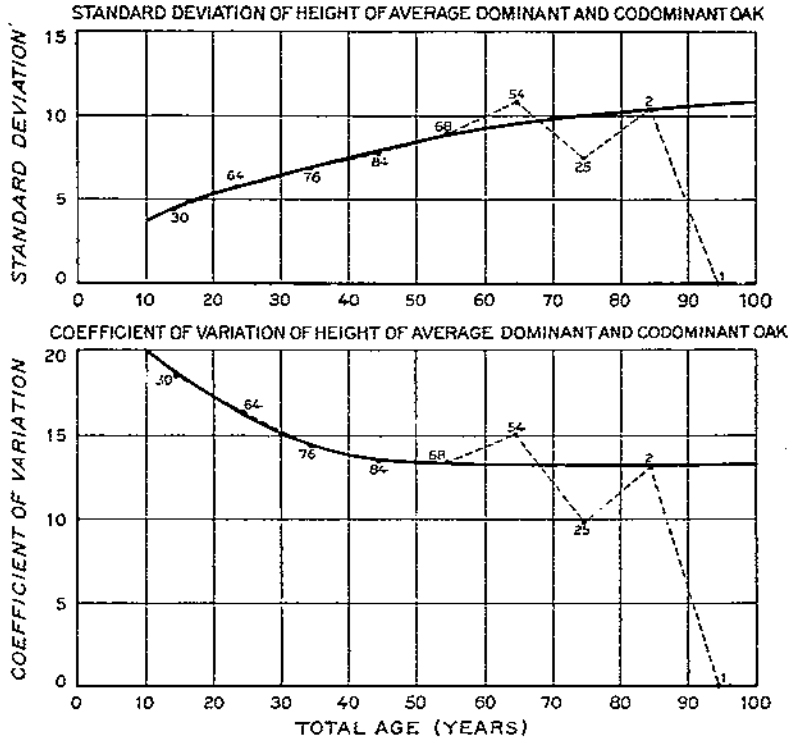


FIGURE 3.—Relation of standard deviation and coefficient of variation of height to age.

about 60 percent of that for the average site at 20 years or at any other age.

Actually, the percentage varies, particularly for the lesser ages. This will be seen from column 2 of table 6. The standard deviation from the height on the average site at 20 years, if multiplied by 3 and subtracted from the average (column 2), gives 15.2 feet as the height on the poorest site,[13] which is less than 50 percent of the average. At 10 years the ratio has dropped to 40 percent. These percentage variations were found to be significantly correlated with age, as shown in figure 3.[14]

[13] If the 20-year plots are distributed normally, in a statistical sense, about their mean, only 1 out of 370 plots would be more than three times the standard deviation from the average.

[14] F. X. Schumacher originally suggested this test (5).

Since one percentage value was not applicable at all ages it was necessary to use varying percentages. This was accomplished by computing the 10-foot height intervals on the 50-year ordinate (the classification age) in standard units (standard deviation) above or below the average curved value and applying these on each 10-year ordinate, converting back to actual height values by using the respective standard unit equivalents and curved averages. The generalized equation for computing height of any site-index curve at any age is:

$$H_{I.a}=H_a-\sigma_a\left(\frac{H_A-I}{\sigma_A}\right)$$

where $H_{I.a}$=height of any site index I at any age a;
H_a=average height at any age a;
H_A=average height at any reference age A;
σ_a=standard deviation of height about the average at any age a;
σ_A=standard deviation of height about the average at any reference age A.

The equation for these computations in the present study is:

$$H_{I.a}=H_a-\sigma_a\left(\frac{62.7-I}{8.37}\right)$$

where 62.7=average height at the reference age, 50 years, from table 6, and 8.37=standard deviation at the reference age, 50 years, from table 6.

Example: What is height of site-index curve 40 at 20 years? From table 6 the average height at 20 years is found to be 31.2 feet and the standard deviation, 5.32 feet. Substituting these values in the equation above and solving—

$$\begin{aligned}H_{40.20}&=31.2-5.32\left(\frac{62.7-40}{8.37}\right)\\&=31.2-14.4\\&=16.8\end{aligned}$$

This method was used for computing the points in table 6 which were, in turn, plotted to form the customary set of site-index curves which have been presented in figure 2 and table 5. Determination of the site index of any stand can be made by use of the following equation:

$$I=H_A+\sigma_A\left(\frac{H-H_a}{\sigma_a}\right)$$

where H=average dominant height of the stand in question, and the other terms are as defined above.

Example: What is the site index of a stand 40 years old with an average height of 48 feet? From table 6 the average height at 40 years is found to be 53.4 feet and the standard deviation is 7.42 feet. Substituting and solving—

$$\begin{aligned}I&=62.7+8.37\left(\frac{48-53.4}{7.42}\right)\\&=62.7-6.1\\&=56.6\end{aligned}$$

PLOT DISTRIBUTION

Distribution of the sample stands by age and site index is shown in table 7. A good sample with respect to both site and age is indicated, though a weakness above 80 years is apparent. Considerable difficulty was experienced by the field parties in finding fully stocked plots in the older age classes.

TABLE 7.—*Plot distribution by age class and site index*

Total age (years)	Plot distribution by site index—							Total
	30–39	40–49	50–59	60–69	70–79	80–89	90–99	
	Number	*Number*	*Number*	*Number*	*Number*	*Number*	*Number*	
10–19			10	15	5			30
20–29		5	18	29	12			64
30–39		1	25	35	13	1	1	76
40–49	1	2	33	36	10	2		84
50–59		2	17	28	19	2		68
60–69	1	2	17	23	9	2		54
70–79			8	15	2			25
80–89				1	1			2
90–99				1				1
Total	2	12	128	183	71	7	1	404

NUMBER OF TREES

Yield data for the total stand were based on all trees 0.6 inch d. b. h. and over. The average curve of number of trees over age was plotted on semilogarithmic graph paper, in effect using logarithm of number of trees over age. Use of this type of paper contracts the curve at the younger ages, where number of trees is great, making a decidedly less pronounced curve than on arithmetic paper and facilitating fitting the curve to the points.[15] The series of curves for number of trees on different sites was obtained by a combination of mathematical and graphic methods of correlation. A multiple linear correlation between logarithm of number of trees, age, and site index was computed. The equation is:

$$\text{Log (number of trees)} = -0.01431\ \text{age} - 0.01113\ \text{site index} + 4.12427$$

This was modified by using Bruce and Reineke's (*4*) alinement-chart method to take care of the curvilinear relation between log (number of trees) and age. The net regression of log (number of trees) on site index showed no curvilinearity. The resulting values read from the modified alinement chart are shown in table 8 and pictured in figure 4. The curves shown in this figure have the usual form, dropping rapidly in the younger age classes, then gradually flattening out. Thus, an average site has approximately 4,000 trees at 10 years of age, 1,000 at 30 years, and 500 at 50 years.

[15] It was found a good plan to replot this curve on arithmetic paper to be sure of a smooth trend.

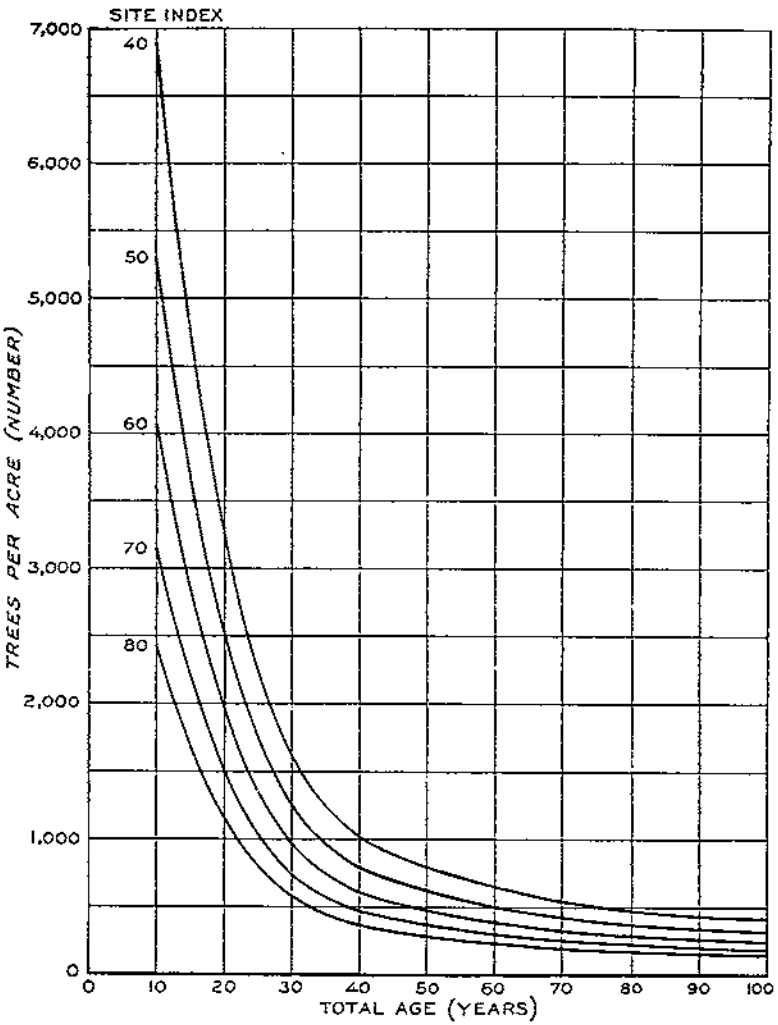


FIGURE 4.—Number of trees per acre showing trends with age by site index.

TABLE 8.—*Total number of trees per acre 0.6 inch d. b. h. and larger*

Total age (years)	Trees per acre by site index—					Total age (years)	Trees per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Number	*Number*	*Number*	*Number*	*Number*		*Number*	*Number*	*Number*	*Number*	*Number*
10	6,850	5,295	4,060	3,140	2,435	60	651	507	390	304	235
15	4,710	3,660	2,825	2,170	1,675	65	590	457	353	274	212
20	3,260	2,520	1,945	1,500	1,160	70	541	419	326	252	196
25	2,235	1,730	1,340	1,030	796	75	506	391	305	235	182
30	1,610	1,246	965	743	575	80	483	375	292	224	174
35	1,245	967	744	578	447	85	464	361	280	215	168
40	1,020	789	611	472	366	90	447	346	268	207	161
45	898	694	535	413	321	95	428	332	254	198	154
50	802	623	482	374	290	100	411	320	248	192	148
55	724	563	434	336	260						

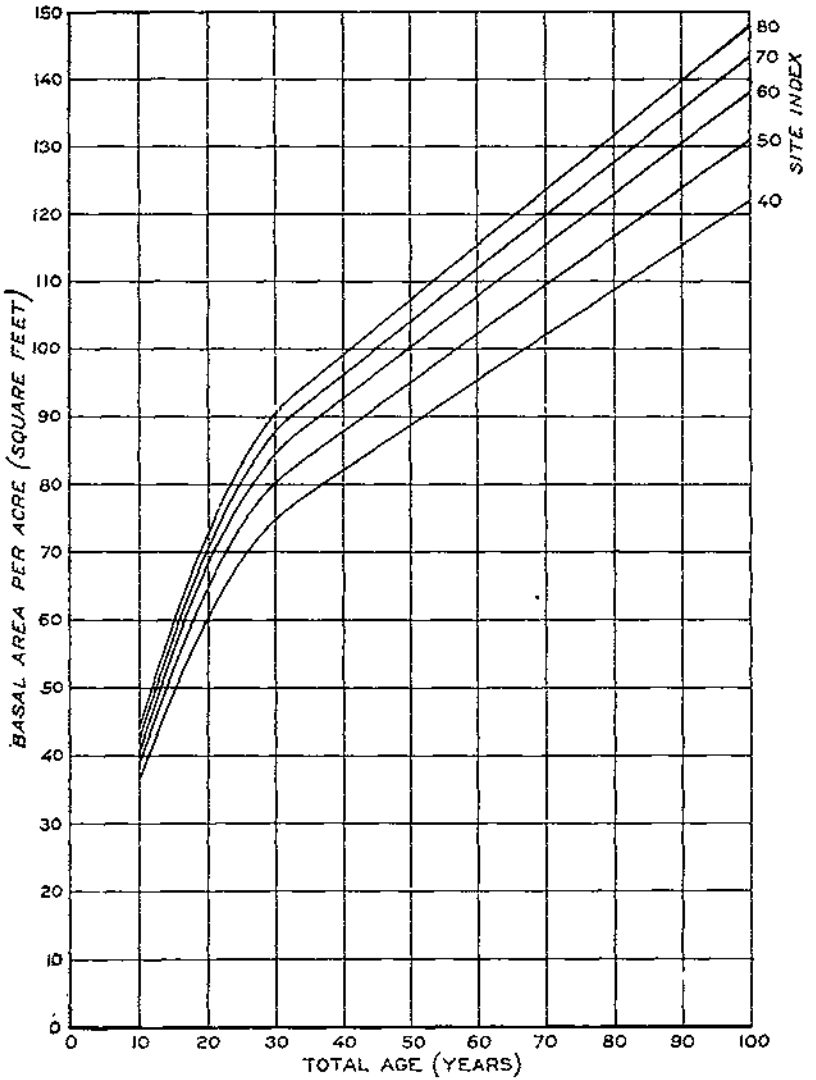


FIGURE 5.—Total basal area per acre for trees over 0.6 inch d. b. h. showing trend with age by site index.

STAND BASAL AREA

The average relation between the total stand basal area (all trees 0.6 inch d. b. h. and over) and age for the various sites is shown in figure 5.[16] The values read from these curves are presented in table 9. This analysis was accomplished graphically by a series of approximations using the alinement-chart method.[17]

[16] It is recognized that the straight-line relation above 40 years is not absolutely maintained and that there should be a tendency for the curves to flatten out with advancing age. However, the data would not permit any but a straight line. It is believed that there may have been a tendency on the part of the field crews to establish the boundaries of plots in the older stands too close to the trunks of the trees selected and in this way increase the basal area. The difficulty of finding older stands probably contributed to this tendency.

[17] See footnote on page 20.

TABLE 9.—*Total basal area per acre including all trees 0.6 inch d. b. h. and larger*

Total age (years)	Basal area per acre by site index—					Total age (years)	Basal area per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Sq. ft.	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*		*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
10	36	39	41	43	44	60	96	102	108	112	115
15	49	53	56	58	60	65	99	106	112	116	120
20	60	65	68	71	73	70	102	110	115	120	124
25	69	74	78	80	83	75	105	113	119	124	128
30	75	80	84	88	90	80	109	117	123	128	132
35	79	84	89	92	95	85	112	120	127	132	136
40	82	88	93	96	99	90	115	124	130	136	140
45	85	92	96	100	103	95	119	127	134	139	144
50	89	95	100	104	107	100	122	131	138	143	148
55	92	99	104	108	111						

DIAMETER OF THE AVERAGE TREE

Diameter of the tree of average basal area was obtained in the usual manner by dividing the stand basal area by the number of trees and reading the diameter equivalent from a basal-area table. The average relation with age and site was obtained in the same way from the average curves of basal area and number of trees.[18] The average diameter equivalents were plotted and smoothed. The average relation with age and site is presented in figure 6 and table 10.

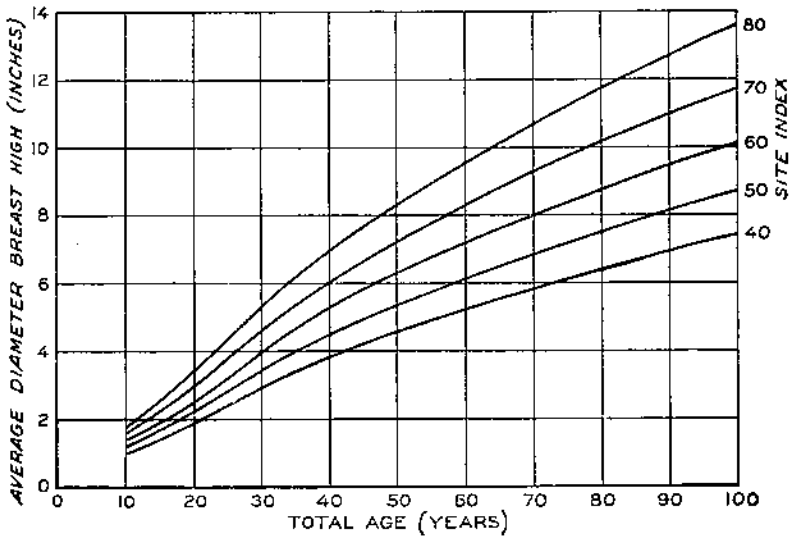


FIGURE 6.—Diameter of average tree at breast height showing trend with age by site index.

[17] The procedure followed in the basal area–age–site correlation was as follows: (1) A percentage alinement chart was made by Reineke's (*19*) method. (2) Age and site scales were adjusted simultaneously as explained by Reineke and Bruce (*21, pp. 11–14*). (Old values of age and site used for both adjustments.) (3) With new age and site values, new estimates of basal area were read. (4) With new basal area values both age and site axes were again tested and adjusted if necessary. Only site axis needed adjustment. (5) Basal area over age for site indices 40 and 80 were then read and plotted as a test to see if the relation was behaving normally. A constant percentage difference was noted between the two sites. (6) New estimates of basal area were read and the actual values were plotted over the estimated. The basal area axis was adjusted because the relation was not a 45° line. (7) Another test of site index 40 and 80 was made followed by successive adjustments of site, age, and basal area until no further improvement was evident. It was found important to make the test curves of basal area over age after each change of the chart. Application of this method of analysis to these data was made by G. M. Jemison.

[18] This is a digression from the standard method. The standard, direct correlation between average basal area, age, and site resulted in an average percentage deviation twice as large and a standard error of estimate four times as large as those of the method presented here (see table 32, p. 34). The difficulties encountered in this correlation and the poor results obtained led to the use of the less desirable method, which in this study gives closer conformity to the basic data.

TABLE 10.—*Diameter of the average tree by age class and site index*

Total age (years)	Diameter at breast height by site index—					Total age (years)	Diameter at breast height by site index—				
	40	50	60	70	80		40	50	60	70	80
	Inches	*Inches*	*Inches*	*Inches*	*Inches*		*Inches*	*Inches*	*Inches*	*Inches*	*Inches*
10	1.0	1.2	1.4	1.6	1.8	60	5.2	6.1	7.2	8.3	9.5
15	1.4	1.7	1.9	2.2	2.6	65	5.5	6.5	7.6	8.8	10.1
20	1.8	2.2	2.5	2.9	3.4	70	5.8	6.9	8.0	9.3	10.7
25	2.4	2.8	3.2	3.8	4.4	75	6.1	7.2	8.4	9.8	11.2
30	2.9	3.4	4.0	4.6	5.3	80	6.4	7.5	8.8	10.2	11.7
35	3.4	4.0	4.7	5.4	6.2	85	6.7	7.8	9.1	10.6	12.2
40	3.8	4.5	5.3	6.0	6.9	90	6.9	8.1	9.4	11.0	12.7
45	4.2	4.9	5.8	6.6	7.6	95	7.1	8.4	9.8	11.4	13.1
50	4.5	5.3	6.3	7.2	8.3	100	7.4	8.7	10.1	11.7	13.6
55	4.9	5.7	6.7	7.8	8.9						

HEIGHT OF THE AVERAGE TREE

Height of the average tree (tree of average basal area) was determined in the accustomed way by applying a percentage reduction factor to height values of the dominant stand. Figure 7 shows this percentage relation and table 11 present the final average values.[19]

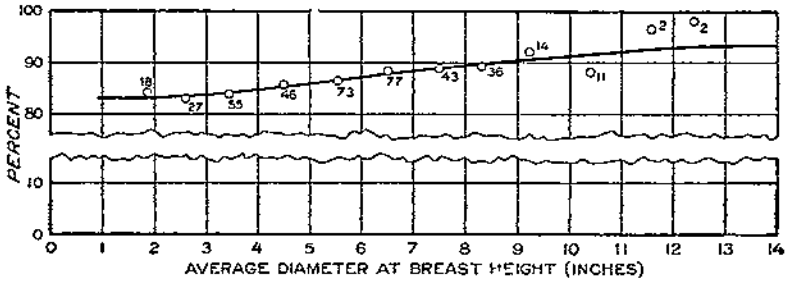


FIGURE 7.—Percentage relation between height of the average tree and height of the average dominant and codominant oak by average diameter.

TABLE 11.—*Total height of the average tree by age class and site index*

Total age (years)	Total height by site index—					Total age (years)	Total height by site index—				
	40	50	60	70	80		40	50	60	70	80
	Feet	*Feet*	*Feet*	*Feet*	*Feet*		*Feet*	*Feet*	*Feet*	*Feet*	*Feet*
10	7	11	14	18	21	60	38	49	59	70	81
15	10	15	20	24	29	65	40	51	62	73	84
20	14	19	25	30	36	70	42	53	64	75	87
25	18	24	30	36	42	75	43	54	66	78	90
30	21	28	35	42	48	80	44	56	68	80	92
35	25	32	40	47	55	85	45	57	69	81	94
40	28	36	44	52	61	90	46	58	70	83	96
45	31	40	48	57	66	95	46	59	71	84	97
50	34	43	52	62	72	100	47	60	72	86	99
55	37	46	56	66	76						

[19] Too much reliance must not be placed on this table, since lack of sufficient height measurements necessitated obtaining the average heights in a rough graphical manner.

YIELD IN CUBIC FEET

The total cubic volume analysis was done graphically by construction of a percentage alinement chart (*19*) which was then modified slightly by adjustment of the site axis in the manner referred to under stand basal area. The relation between stand volume, age, and site, is shown graphically in figure 8 and the values are tabulated in table

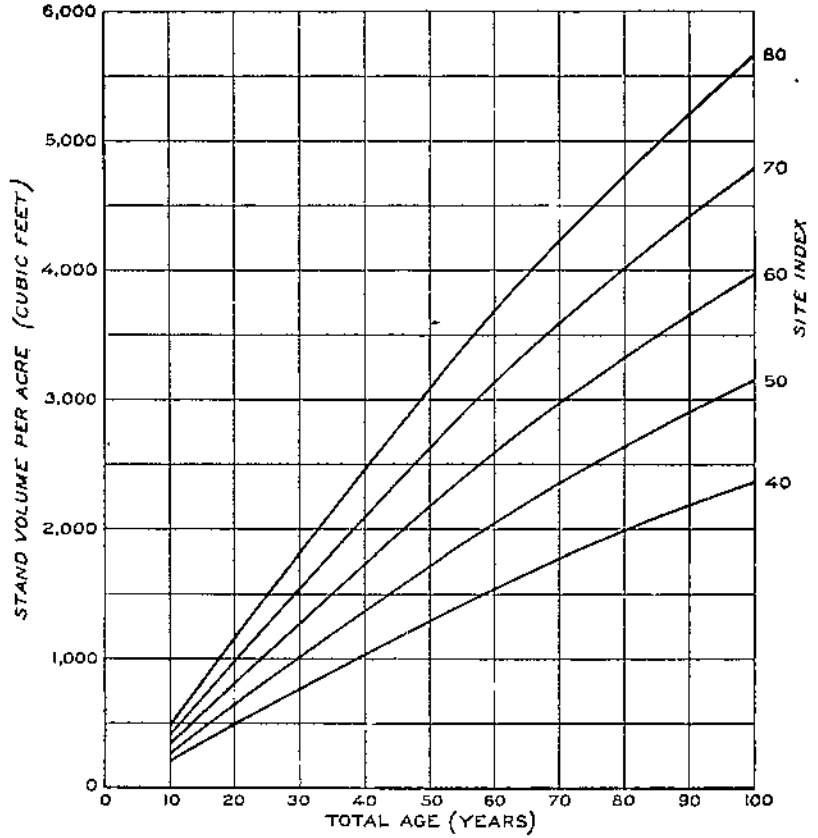


FIGURE 8.—Yield per acre in cubic feet, excluding bark, showing trends with age by site index.

TABLE 12.—*Yield per acre in cubic feet, excluding bark (all trees 0.6 inch d. b. h. and larger included)*

Total age (years)	Yield per acre by site index—					Total age (years)	Yield per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*		*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
10	205	270	345	410	490	60	1,540	2,050	2,590	3,115	3,690
15	345	450	575	695	815	65	1,660	2,210	2,785	3,350	3,960
20	485	635	805	975	1,145	70	1,765	2,355	2,970	3,575	4,225
25	625	820	1,040	1,250	1,470	75	1,875	2,500	3,150	3,795	4,480
30	755	1,000	1,265	1,525	1,795	80	1,975	2,635	3,325	4,000	4,725
35	900	1,180	1,495	1,800	2,120	85	2,075	2,770	3,490	4,205	4,975
40	1,030	1,360	1,725	2,075	2,440	90	2,175	2,900	3,655	4,400	5,200
45	1,165	1,540	1,945	2,350	2,760	95	2,275	3,020	3,810	4,595	5,430
50	1,300	1,720	2,165	2,610	3,085	100	2,375	3,140	3,970	4,780	5,650
55	1,420	1,895	2,385	2,870	3,400						

12. These curves show a remarkably steady increase in volume with advancing age, from the beginning, with practically no early stage of slow growth. This illustrates the early vigor of stands containing sprouts.

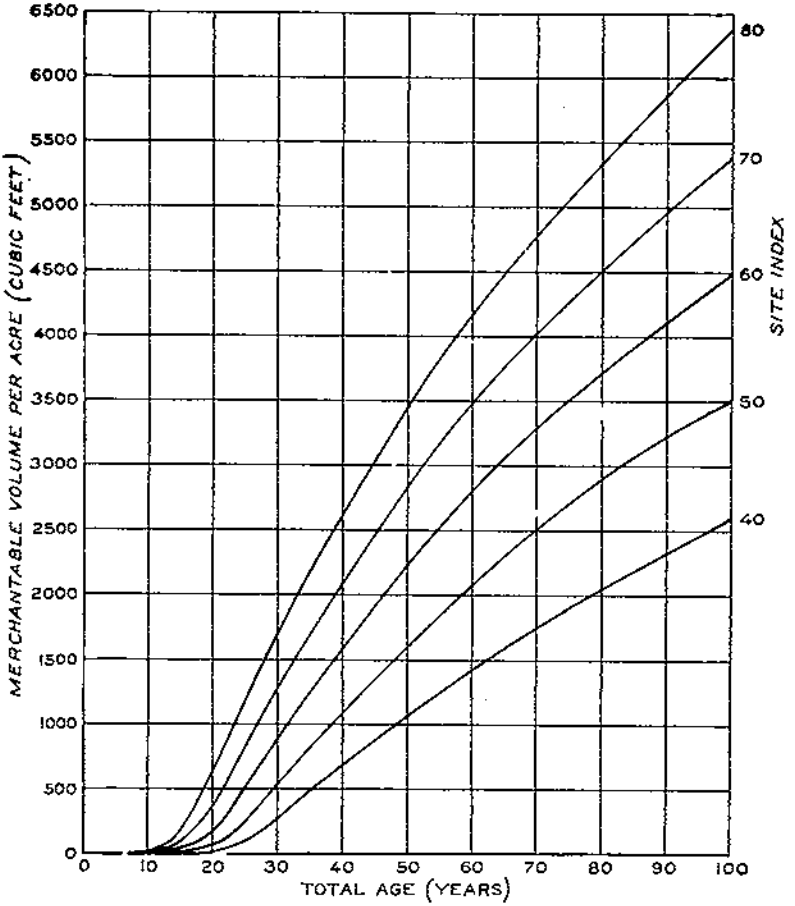


FIGURE 9.—Yield per acre in cubic feet of merchantable stem, including bark (to a 4-inch top outside bark), showing trends with age by site index.

MERCHANTABLE CUBIC AND BOARD-FOOT YIELDS

Yields in merchantable cubic volume and board-foot volumes for both International and Scribner rules at various ages on different sites are presented in figures 9 and 10, and tables 13, 14, and 15. These were computed in the usual manner from the total cubic yield values, using the average ratios for the average diameter of each site-age class read from the curves shown in figure 11.

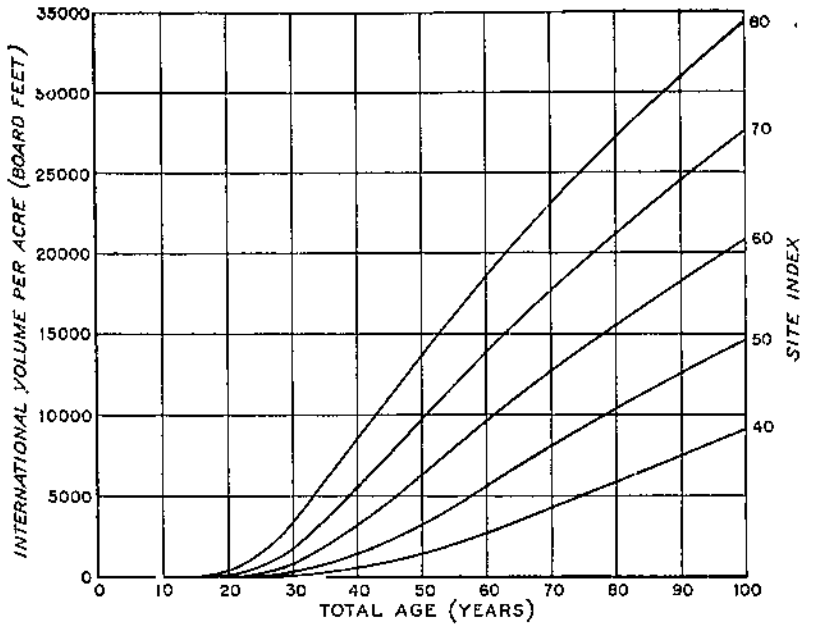


FIGURE 10.—Yield per acre in board feet, International rule (1/8-inch kerf) (to a 5-inch top inside bark), showing trends with age by site index.

TABLE 13.—*Yield per acre in cubic feet of merchantable stem, including bark, to a 4-inch top outside bark*

Total age (years)	Yield per acre (merchantable) by site index—					Total age (years)	Yield per acre (merchantable) by site index—				
	40	50	60	70	80		40	50	60	70	80
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*		*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*
10	0	0	0	10	20	60	1,420	2,080	2,800	3,480	4,160
15	0	20	40	80	190	65	1,590	2,200	3,050	3,770	4,480
20	20	70	170	360	620	70	1,750	2,510	3,290	4,030	4,770
25	100	250	510	820	1,170	75	1,900	2,710	3,510	4,280	5,060
30	270	540	880	1,270	1,690	80	2,050	2,900	3,730	4,510	5,340
35	480	820	1,240	1,690	2,160	85	2,200	3,070	3,920	4,740	5,600
40	680	1,090	1,580	2,090	2,610	90	2,330	3,230	4,120	4,960	5,870
45	870	1,350	1,910	2,470	3,040	95	2,460	3,380	4,300	5,180	6,130
50	1,060	1,600	2,230	2,830	3,450	100	2,590	3,520	4,480	5,400	6,380
55	1,240	1,810	2,520	3,180	3,820						

TABLE 14.—*Yield per acre in board feet, International rule, 1/8-inch saw kerf, to a 5-inch top inside bark, including all trees having at least one 16-foot log*

Total age (years) [1]	Yield per acre by site index—					Total age (years) [1]	Yield per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Bd. ft.	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*		*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
15	0	0	0	0	50	60	2,700	5,600	9,700	13,900	18,600
20	0	0	0	150	350	65	3,450	6,900	11,300	15,800	20,900
25	0	0	300	700	1,450	70	4,250	8,150	12,800	17,700	23,100
30	100	350	850	1,750	3,350	75	5,100	9,300	14,200	19,500	25,200
35	300	800	1,900	3,550	5,950	80	5,900	10,450	15,650	21,200	27,250
40	600	1,400	3,200	5,500	8,600	85	6,750	11,550	17,000	22,900	29,150
45	950	2,250	4,700	7,650	11,200	90	7,600	12,600	18,300	24,500	30,950
50	1,400	3,250	6,300	9,750	13,750	95	8,350	13,600	19,600	26,100	32,700
55	2,000	4,350	8,000	11,850	16,250	100	9,200	14,700	20,900	27,650	34,400

[1] No trees containing a 16-foot log with a top diameter inside bark of 5.0 inches below 15-year class.

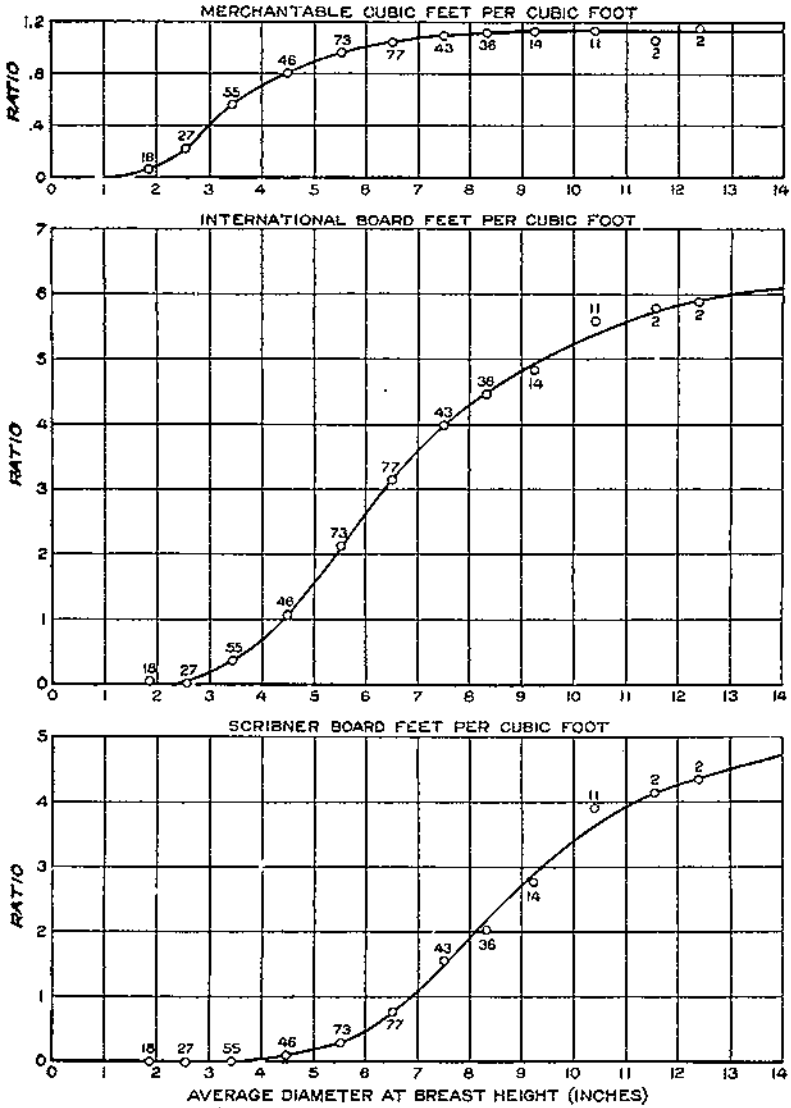


FIGURE 11.—Merchantable cubic foot—total cubic foot and board foot—total cubic foot ratios for various average diameters.

TABLE 15.—*Yield per acre in board feet, Scribner rule, to an 8-inch top inside bark, including all trees having at least one 16-foot log*

Total age (years) [1]	Yield per acre by site index—					Total age (years) [1]	Yield per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Bd. ft.	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*		*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*	*Bd. ft.*
25	0	0	0	50	150	65	550	1,700	4,350	8,550	13,700
30	0	0	50	200	500	70	800	2,300	5,650	10,550	15,900
35	0	50	200	550	1,250	75	1,100	3,150	7,000	12,400	17,850
40	50	150	500	1,100	2,500	80	1,450	4,000	8,350	14,100	19,700
45	100	300	900	2,000	4,300	85	1,800	4,850	9,700	15,700	21,400
50	150	500	1,400	3,250	6,650	90	2,200	5,800	11,050	17,200	23,050
55	250	750	2,150	4,950	9,600	95	2,700	6,700	12,350	18,650	24,500
60	400	1,100	3,150	6,700	11,350	100	3,350	7,750	13,700	19,900	25,100

[1] No trees containing a 16-foot log with a top diameter inside bark of 8.0 inches below 25-year class.

Average-diameter, number-of-trees, and basal-area values for the merchantable cubic- and board-foot stands are presented in tables 16–24. These were also computed from like values for the entire stand by using average ratios. Perfect checks between these tables are not expected, because of differences in weighting.

TABLE 16.—*Average diameter at breast height of the merchantable cubic-foot stand, including all trees having any merchantable cubic volume (to a 4-inch top outside bark)*

Total age (years)	Average diameter at breast height by site index—					Total age (years)	Average diameter at breast height by site index—				
	40	50	60	70	80		40	50	60	70	80
	In.	*In.*	*In.*	*In.*	*In.*		*In.*	*In.*	*In.*	*In.*	*In.*
10	0.0	0.0	0.0	0.0	4.2	60	6.1	6.8	7.7	8.6	9.7
15	.0	1.2	4.3	4.4	4.5	65	6.3	7.1	8.1	9.1	10.2
20	4.3	4.4	4.5	4.7	5.0	70	6.5	7.4	8.4	9.5	10.7
25	4.5	4.7	4.8	5.1	5.5	75	6.8	7.7	8.7	9.9	11.2
30	4.7	5.0	5.2	5.6	6.2	80	7.0	7.9	9.1	10.3	11.7
35	4.9	5.3	5.7	6.1	6.8	85	7.2	8.2	9.4	10.7	12.2
40	5.2	5.6	6.1	6.7	7.5	90	7.4	8.5	9.7	11.0	12.7
45	5.4	5.9	6.5	7.2	8.1	95	7.6	8.7	10.0	11.4	13.1
50	5.6	6.2	7.0	7.7	8.6	100	7.8	9.0	10.3	11.7	13.6
55	5.8	6.5	7.3	8.2	9.2						

TABLE 17.—*Number of trees per acre in merchantable cubic-foot stand, including all trees having any merchantable cubic volume (to a 4-inch top outside bark)*

Total age (years)	Trees per acre by site index—					Total age (years)	Trees per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Number	*Number*	*Number*	*Number*	*Number*		*Number*	*Number*	*Number*	*Number*	*Number*
10	0	0	0	0	49	60	457	403	333	279	225
15	0	25	85	153	251	65	435	377	312	258	207
20	82	176	258	336	406	70	414	356	295	240	192
25	246	327	402	453	454	75	401	340	283	227	181
30	359	436	473	453	410	80	393	330	273	218	173
35	424	475	460	416	358	85	384	322	264	210	165
40	456	467	435	370	313	90	377	314	255	203	159
45	473	450	409	344	287	95	368	306	248	196	154
50	478	442	383	322	265	100	362	298	237	190	150
55	472	425	357	300	244						

TABLE 18.—*Basal area per acre in merchantable cubic-foot stand, including all trees having any merchantable cubic volume (to a 4-inch top outside bark)*

Total age (years)	Basal area per acre by site index—					Total age (years)	Basal area per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Sq. ft.	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*		*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
10	0.0	0.0	0.0	0.0	4.0	60	88.4	98.2	105.6	110.7	114.9
15	.0	2.6	7.6	15.1	25.0	65	92.9	102.5	109.5	114.8	119.0
20	5.8	16.8	26.3	37.5	51.7	70	97.2	106.2	113.8	119.0	123.3
25	23.3	37.0	49.6	63.0	71.2	75	101.4	110.6	118.0	123.2	127.6
30	40.9	56.8	68.4	77.5	83.9	80	105.4	114.3	122.0	127.3	131.7
35	55.3	68.4	79.1	86.1	91.1	85	109.1	118.3	126.0	131.3	135.6
40	64.5	76.7	86.1	92.2	96.3	90	112.8	122.2	130.0	135.5	139.7
45	71.7	83.3	91.6	97.1	101.3	95	116.3	126.0	134.0	139.4	143.7
50	77.7	88.9	96.3	101.9	106.1	100	119.6	129.6	138.1	143.2	147.8
55	83.2	93.8	101.0	106.2	110.3						

TABLE 19.—*Average diameter at breast height of the International board foot stand, including all trees having at least one 16-foot log with a 5-inch top inside bark*

Total age (years)	Average diameter at breast height by site index—					Total age (years)	Average diameter at breast height by site index—				
	40	50	60	70	80		40	50	60	70	80
	In.	*In.*	*In.*	*In.*	*In.*		*In.*	*In.*	*In.*	*In.*	*In.*
15	0.0	0.0	0.0	0.0	7.1	60	7.9	8.3	8.9	9.7	10.6
20	.0	.0	7.1	7.1	7.2	65	8.0	8.5	9.2	10.0	11.1
25	7.0	7.1	7.2	7.3	7.5	70	8.1	8.7	9.5	10.4	11.5
30	7.1	7.2	7.4	7.6	7.9	75	8.3	8.9	9.8	10.8	11.9
35	7.2	7.4	7.6	7.9	8.3	80	8.4	9.1	10.0	11.1	12.3
40	7.3	7.5	7.8	8.2	8.7	85	8.6	9.3	10.3	11.4	12.7
45	7.5	7.7	8.1	8.5	9.2	90	8.7	9.6	10.5	11.7	13.1
50	7.6	7.9	8.3	8.9	9.7	95	8.9	9.8	10.8	12.0	13.5
55	7.7	8.1	8.6	9.3	10.2	100	9.0	10.0	11.0	12.3	13.8

TABLE 20.—*Number of trees per acre in International board foot stand, including all trees having at least one 16-foot log with a 5-inch top inside bark*

Total age (years)	Trees per acre by site index—					Total age (years)	Trees per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Number	*Number*	*Number*	*Number*	*Number*		*Number*	*Number*	*Number*	*Number*	*Number*
15	0	0	0	0	5	60	137	195	214	201	177
20	0	0	6	17	32	65	156	208	209	192	171
25	3	14	28	53	82	70	175	214	206	186	166
30	17	36	64	96	133	75	193	217	204	183	161
35	34	64	103	140	178	80	210	219	203	180	158
40	53	91	139	171	187	85	224	220	202	178	155
45	74	117	174	192	191	90	229	221	201	177	152
50	95	143	202	205	190	95	232	221	200	175	149
55	117	169	213	205	186	100	234	222	199	173	146

TABLE 21.—*Basal area per acre in International board foot stand, including all trees having at least one 16-foot log with a 5-inch top inside bark*

Total age (years)	Basal area per acre by site index—					Total age (years)	Basal area per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Sq. ft.	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*		*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
15	0.0	0.0	0.0	0.0	1.8	60	44.9	70.5	88.6	99.9	108.5
20	.0	.0	1.6	4.6	8.7	65	54.3	79.4	95.4	106.5	114.2
25	.8	3.6	7.8	15.5	25.0	70	63.3	86.9	101.6	112.6	119.6
30	4.5	9.6	18.9	30.0	45.5	75	72.2	92.7	107.1	117.9	124.8
35	9.4	18.7	32.9	47.9	66.8	80	80.0	98.2	112.3	122.8	129.2
40	14.9	27.8	46.1	64.5	79.0	85	86.6	103.5	117.6	127.7	134.2
45	21.4	37.0	59.5	76.8	88.9	90	92.0	108.8	122.7	132.0	138.3
50	28.4	47.6	71.1	85.3	95.6	95	97.0	113.8	127.8	136.5	143.3
55	36.8	59.2	80.3	93.1	102.3	100	102.0	119.1	132.6	140.3	147.8

TABLE 22.—*Average diameter at breast height of the Scribner board foot stand, including all trees having at least one 16-foot log with an 8-inch top inside bark*

Total age (years)	Average diameter at breast height by site index—					Total age (years)	Average diameter at breast height by site index—				
	40	50	60	70	80		40	50	60	70	80
	In.	*In.*	*In.*	*In.*	*In.*		*In.*	*In.*	*In.*	*In.*	*In.*
25	0.0	0.0	0.0	10.6	10.6	65	10.8	11.0	11.3	11.8	12.5
30	.0	.0	10.6	10.6	10.7	70	10.8	11.1	11.4	12.1	12.9
35	.0	10.6	10.7	10.7	10.9	75	10.9	11.2	11.6	12.3	13.2
40	10.6	10.6	10.7	10.8	11.1	80	10.9	11.3	11.7	12.5	13.5
45	10.6	10.7	10.8	11.0	11.3	85	11.0	11.4	11.9	12.8	13.9
50	10.6	10.7	10.9	11.2	11.6	90	11.1	11.5	12.1	13.0	14.2
55	10.7	10.8	11.0	11.4	11.9	95	11.1	11.7	12.3	13.3	14.5
60	10.7	10.9	11.2	11.6	12.2	100	11.2	11.8	12.5	13.5	14.9

TABLE 23.—*Number of trees per acre in Scribner board foot stand, including all trees having at least one 16-foot log with an 8-inch top inside bark*

Total age (years)	Trees per acre by site index—					Total age (years)	Trees per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Number	*Number*	*Number*	*Number*	*Number*		*Number*	*Number*	*Number*	*Number*	*Number*
25	0	0	0	2	5	65	17	36	64	91	107
30	0	0	3	8	14	70	21	45	74	100	111
35	0	2	8	15	26	75	27	54	85	108	114
40	2	6	14	23	40	80	34	64	96	114	118
45	4	10	22	35	58	85	42	74	104	119	120
50	7	15	31	51	78	90	50	83	111	124	121
55	10	20	41	67	92	95	58	90	117	127	122
60	13	28	53	80	101	100	66	102	124	129	122

TABLE 24.—*Basal area per acre in Scribner board foot stand, including all trees having at least one 16-foot log with an 8-inch top inside bark*

Total age (years)	Basal area per acre by site index—					Total age (years)	Basal area per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Sq. ft.	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*		*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*	*Sq. ft.*
25	0.0	0.0	0.0	1.0	2.5	65	10.5	23.6	44.6	69.1	90.6
30	.0	.0	1.7	3.6	6.2	70	13.6	30.4	54.1	79.4	100.1
35	.0	1.7	4.4	8.9	17.1	75	17.5	37.3	63.2	88.9	108.6
40	.2	3.3	8.3	14.9	28.3	80	21.9	44.6	71.8	97.1	116.4
45	1.7	5.6	12.9	23.0	41.3	85	26.8	51.9	80.0	105.1	123.4
50	3.6	8.6	19.0	34.6	54.8	90	32.0	59.5	88.1	112.5	130.0
55	5.3	12.6	26.0	46.0	68.0	95	37.8	67.5	96.1	119.3	136.0
60	7.6	17.4	35.2	57.8	79.6	100	43.9	75.9	103.6	126.0	141.9

YIELD IN CORDS

Satisfactory factors for converting solid wood volumes of oak trees of various diameters to stacked cords have not been determined. A recent study [20] in oak stands gives an average factor of 85 cubic feet of solid wood per cord. With this factor the merchantable cubic yield was converted to cords, as presented in table 25.

[20] Made by the Allegheny Forest Experiment Station on the Black Rock Forest, Cornwall, N. Y.; basis, 22 plies of wood totaling 10 cords.

TABLE 25.—*Yield per acre of merchantable stem in cords, including bark, to a 4-inch top outside bark*

Total age (years)	Yield per acre of merchantable stem by site index—					Total age (years)	Yield per acre of merchantable stem by site index—				
	40	50	60	70	80		40	50	60	70	80
	Cords	*Cords*	*Cords*	*Cords*	*Cords*		*Cords*	*Cords*	*Cords*	*Cords*	*Cords*
10	0.0	0.0	0.0	0.12	0.24	60	16.71	24.47	32.94	40.94	48.94
15	.0	.24	.47	.94	2.24	65	18.71	26.94	35.88	44.35	52.71
20	.24	.82	2.00	4.24	7.29	70	20.59	29.53	38.71	47.41	56.12
25	1.18	2.94	6.00	9.65	13.76	75	22.35	31.88	41.29	50.35	59.53
30	3.18	6.35	10.35	14.94	19.88	80	24.12	34.12	43.88	53.06	62.82
35	5.65	9.65	14.59	19.88	25.41	85	25.88	36.12	46.12	55.76	65.88
40	8.00	12.82	18.59	24.59	30.71	90	27.41	38.00	48.47	58.35	69.06
45	10.24	15.88	22.47	29.06	35.76	95	28.94	39.36	50.59	60.94	72.12
50	12.47	18.82	26.24	33.29	40.59	100	30.47	41.41	52.71	63.53	75.06
55	14.59	21.65	29.65	37.41	44.94						

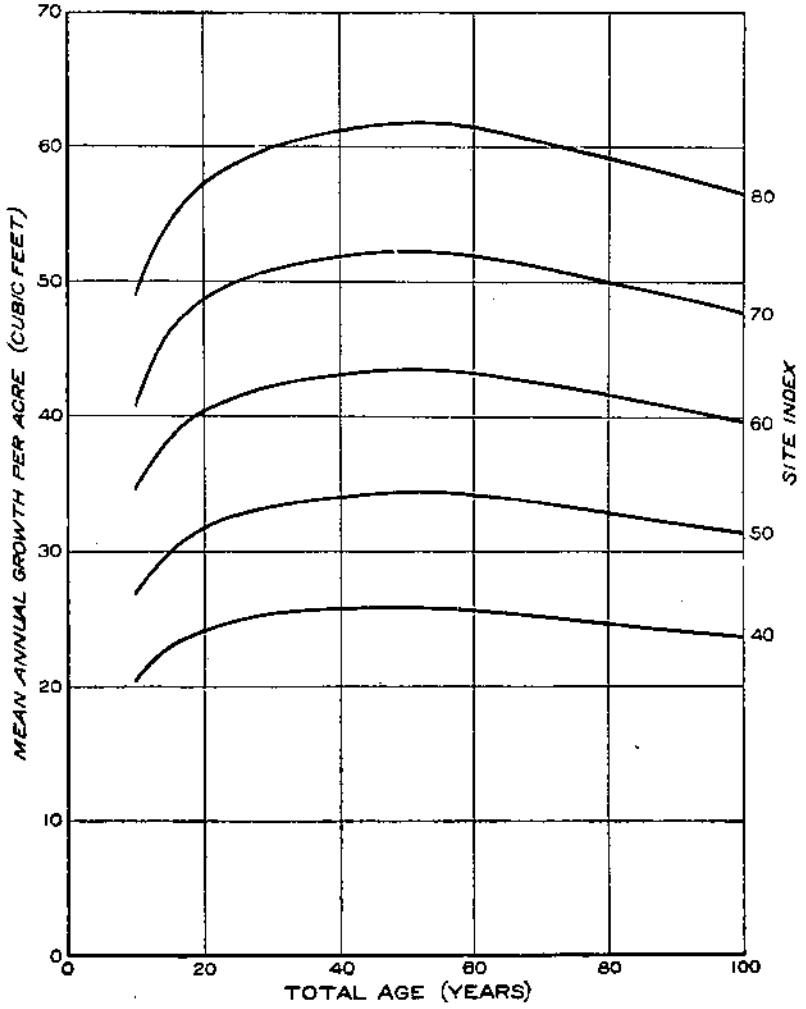


FIGURE 12.—Mean annual growth per acre in cubic feet of entire stand excluding bark, showing trends with age by site index.

MEAN ANNUAL GROWTH

The relations of mean annual growth, in the first four units, to age and site are shown in figures 12, 13, and 14, and the tabular values, including those in cords, are presented in tables 26, 27, 28, 29, and 30. Culmination of growth in total cubic volume occurs at 50 years on all sites. This is the point at which the yearly growth reaches its maximum. The decline on both sides of the point is so gradual, however, that there is only 1 percent difference between the ages of 40 and 60 years. Culmination for the merchantable stand,

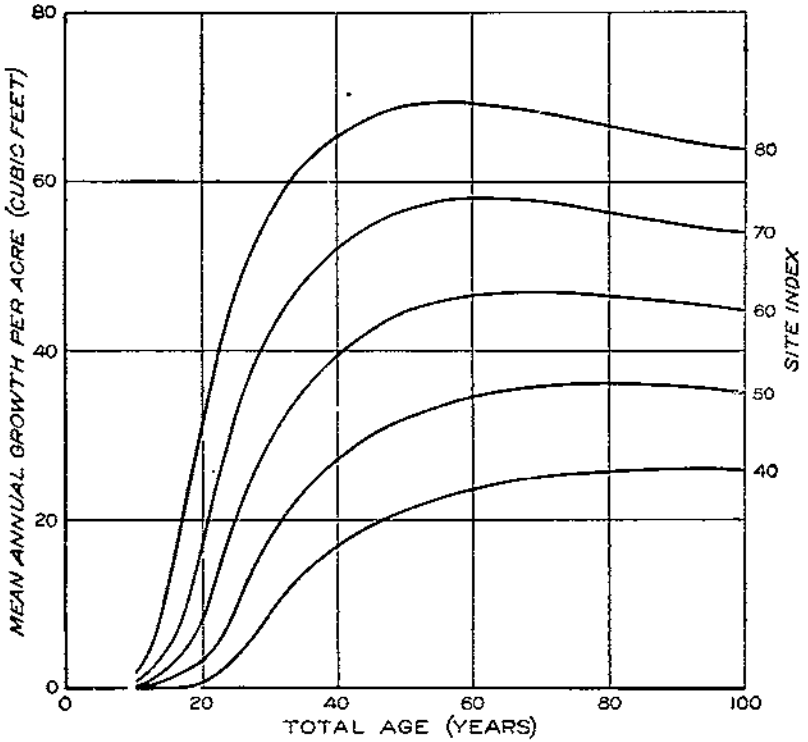


FIGURE 13.—Mean annual growth per acre in cubic feet of merchantable stand including bark, to a 4-inch top outside bark, showing trends with age by site index.

which is of more practical value, takes place at 55 years on the best sites, and at 90 years on the poorest. The trend here also is gradual after the point of culmination is reached, as shown in table 31, which expresses the mean annual growth as a percentage of the maximum for each site. This fact permits considerable leeway in determination of the rotation age when considering only the volume production. The growth rate is within 5 percent of the maximum for a period of approximately 50 years on any site, the best site arriving at this point at about 45 years and the poorest at 70 years.

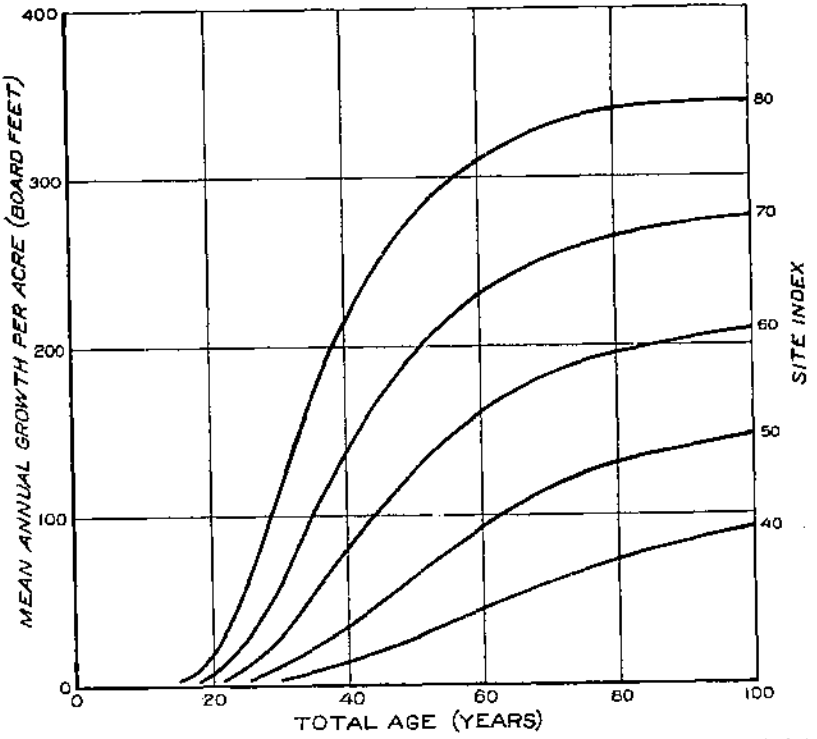


FIGURE 14.—Mean annual growth per acre in board feet, International rule, ⅛-inch kerf to a 5-inch top, inside bark, showing trends with age by site index.

TABLE 26.—*Mean annual growth per acre in cubic feet, entire stand, excluding bark; all trees 0.6 inch d. b. h. and larger included*

Total age (years)	Annual growth per acre by site index—					Total age (years)	Annual growth per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*		*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
10	20	27	34	41	49	60	26	34	43	52	62
15	53	30	38	46	54	65	26	34	43	52	61
20	24	32	40	49	57	70	25	34	42	51	60
25	25	33	42	50	59	75	25	33	42	51	60
30	25	33	42	51	60	80	25	33	42	50	59
35	26	34	43	51	61	85	24	33	41	49	59
40	26	34	43	52	61	90	24	32	41	49	58
45	26	34	43	52	61	95	24	32	40	48	57
50	26	34	43	52	62	100	24	31	40	48	56
55	26	34	43	52	62						

TABLE 27.—*Mean annual growth per acre in cubic feet, merchantable stand, including bark, to a 4-inch top outside bark*

Total age (years)	Annual growth per acre by site index—					Total age (years)	Annual growth per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*		*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
10	0	0	0	1	2	60	24	35	47	58	69
15	0	1	3	5	13	65	24	35	47	58	69
20	1	4	8	18	31	70	25	36	47	58	68
25	4	10	20	33	47	75	25	36	47	57	67
30	9	18	29	42	56	80	26	36	47	56	67
35	14	23	35	48	62	85	26	36	46	56	66
40	17	27	40	52	65	90	26	36	46	55	65
45	19	30	42	55	68	95	26	36	45	55	65
50	21	32	45	57	69	100	26	35	45	54	64
55	23	33	46	58	69						

TABLE 28.—*Mean annual growth per acre in board feet, International rule, ⅛-inch saw kerf, to a 5-inch top inside bark, including all trees having at least one 16-foot log*

Total age (years) [1]	Annual growth per acre by site index—					Total age (years) [1]	Annual growth per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*		*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*
15	0	0	0	0	3	60	45	93	162	232	310
20	0	0	0	5	18	65	53	100	174	243	322
25	0	0	12	28	58	70	61	110	183	253	330
30	3	12	28	58	112	75	68	121	189	260	336
35	9	23	54	101	170	80	74	131	196	265	341
40	15	35	80	136	215	85	79	136	200	269	343
45	21	50	104	170	249	90	84	140	203	272	344
50	28	65	126	195	275	95	88	143	206	275	344
55	36	79	145	215	295	100	92	147	209	276	344

[1] No trees containing a 16-foot log with a top diameter inside bark of 5.0 inches below 15-year class.

TABLE 29.—*Mean annual growth per acre in board feet, Scribner rule, to an 8-inch top inside bark, including all trees having at least one 16-foot log*

Total age (years) [1]	Annual growth per acre by site index—					Total age (years) [1]	Annual growth per acre by site index—				
	40	50	60	70	80		40	50	60	70	80
	Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*		*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*
25	0	0	0	2	6	65	8	26	67	132	211
30	0	0	2	7	17	70	11	34	81	151	227
35	0	1	6	10	36	75	15	42	93	165	238
40	1	4	12	28	62	80	18	50	104	176	246
45	2	7	20	44	96	85	21	57	114	185	252
50	3	10	28	65	133	90	24	64	123	191	256
55	5	14	39	90	164	95	28	71	130	196	259
60	7	18	52	112	189	100	34	78	137	199	261

[1] No trees containing a 16-foot log with a top diameter inside bark of 8.0 inches below 25-year class.

TABLE 30.—*Mean annual growth per acre of merchantable stem in cords,*[1] *including bark, to a 4-inch top outside bark*

Total age (years)	Annual growth per acre, by site index—					Total age (years)	Annual growth per acre, by site index—				
	40	50	60	70	80		40	50	60	70	80
	Cords	*Cords*	*Cords*	*Cords*	*Cords*		*Cords*	*Cords*	*Cords*	*Cords*	*Cords*
10	0.00	0.00	0.00	0.01	0.02	60	0.26	0.41	0.55	0.68	0.82
15	.00	.02	.03	.06	.15	65	.29	.41	.55	.68	.81
20	.01	.04	.10	.21	.36	70	.29	.42	.55	.68	.80
25	.05	.12	.24	.39	.55	75	.30	.43	.55	.67	.79
30	.11	.21	.34	.50	.66	80	.30	.43	.55	.66	.79
35	.16	.26	.42	.57	.73	85	.30	.42	.54	.66	.78
40	.20	.32	.46	.61	.77	90	.30	.42	.54	.65	.77
45	.23	.35	.50	.65	.79	95	.30	.42	.53	.64	.76
50	.25	.38	.52	.67	.81	100	.30	.41	.53	.64	.75
55	.27	.39	.54	.68	.82						

[1] Converting factor, 85 cubic feet per cord.

TABLE 31.—*Percent of maximum mean annual growth per acre, at successive ages—merchantable stem, including bark, to a 4-inch top outside bark* [1]

Total age (years)	Maximum merchantable cubic feet per acre by site index—				
	40	50	60	70	80
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
10	0	0	0	2	3
15	0	3	6	9	19
20	4	11	17	31	45
25	15	26	43	57	68
30	35	50	62	72	81
35	54	64	74	83	90
40	65	75	85	90	94
45	73	83	89	95	99
50	81	89	96	98	100
55	88	92	98	100	100
60	92	97	100	100	100
65	92	97	100	100	100
70	96	100	100	100	99
75	96	100	100	98	97
80	100	100	100	97	97
85	100	100	98	97	96
90	100	100	98	95	94
95	100	100	96	95	94
100	100	97	96	93	93

[1] Heavy lines enclose ages and sites between which stand may be cut and yet obtain within 5 percent of the maximum mean annual growth.

ACCURACY OF THE YIELD TABLES

Measures of the association of the various yield values with age and site, and the standard errors of estimate of the yield tables, are given in table 32. The percentage of variation accounted for, shown in column 3, indicates the part of the variation of the particular yield unit that is associated with age and site. The differences between these values and 100 percent are the percentages of variation not accounted for. The difference between stand basal area and total volume with respect to percentage not accounted for is striking. Age and site account for 88 percent of the variation in volume and only 59 percent in basal area—a difference of 29 percent. Yet the stand-

ard errors of estimate show practically no difference in the reliability of estimating. The reason for this is the correlation between volume and height. Site index is based on height and height is one of the variables which determine volume. Higher correlations are expected since both the dependent and one of the independent variables contain height factors. This is true for all correlations with volume units.

TABLE 32.—*Check of basic data against yield tables*

Yield table unit	Correlation index	Variation accounted for	Deviation		Standard error of estimate		Standard error of yield-table readings
			Average	Aggregate			
		Percent	*Percent*	*Percent*	*Units*	*Percent*	*Percent*
Stand basal area.....square feet...	0.769	59	11	+0.17	13.6	14.5	±0.72
Number of trees.....logarithms...	.904	82	25	+.07	.1202	25.7	±1.28
Average diameter.....inches...	.934	87	11	−.48	.78	13.6	±.68
Average height.....feet...	.965	93	6	−.26	4.0	8.2	±.41
Total volume.....cubic feet...	.936	88	12	−.32	321	16.2	±.81
Merchantable volume.....do....	.958	92	10	−.25	350	29.4	±1.46
International volume.....board feet...	.954	91	30	+1.04	1,807	47.4	±2.36
Scribner volume.....do....	.919	84	45	−2.8	1,516	68.8	±3.42

In general the aggregate and average deviations and the standard errors compare favorably with those found in other yield studies. One must bear in mind, however, that these data cover a wide range of conditions as to location and species composition. Distinct differences in geologic formation, residual soil, and climate occur over this vast region. As usual, the tables for merchantable cubic- and board-foot units have large errors of estimate and percentage deviations, because the decided influence of density on tree size is accentuated where tree size is the factor governing yield. McIntyre's studies in oak stands in Pennsylvania (*15*), which indicate an average of 5 percent more oak by basal area than the present study, show less scatter about the average.

USE OF TABLES FOR YIELD PREDICTION IN UNDERSTOCKED STANDS

Application of normal yield tables to understocked stands is at best an approximation, especially when dealing with mixed stands. The yield table is a measure of the natural growing capacity of the best stocked stands, indicates what yields can be attained, and gives a goal to strive for and perhaps surpass under scientific management. Approximate yield predictions are usually obtained by correcting future tabular yield values by use of the present percentage relation between actual basal area, computed from a sample of the forest in question, and tabular basal area for the same age and site. Application of this percentage correction to tabular values at a future age gives a conservative estimate of yield, since understocked stands tend to approach normality with advancing age. For most practical purposes such predictions can be made for periods up to 20 years. Complete discussions of this general method of application can be found in a number of publications (*7, 10, 14, 15, 31*) and in the standard texts on forest mensuration.

EFFECT OF DENSITY AND SPECIES COMPOSITION ON YIELD

Table 32 indicates that 12 percent of the variation in total cubic volume yield is due to variables other than age and site. To determine what part of this is due to stand density and what part to species composition, correlations were made between actual yield, in percent of the tabular, and these factors. The correlations obtained were as follows:

Correlation between actual yield in percent of the tabular and—	*Correlation coefficient*
(1) Density, deviation of actual from estimated log number of trees	+0.7180
(2) Basal area of white oak group in percent of the total	−.0829
(3) Basal area of black oak group in percent of the total	−.0684
(4) Basal area of other intolerant group in percent of the total	+.2992
(5) Basal area of other tolerant group in percent of the total	−.0462
(6) All five combined (multiple correlation)	+.7451

A correlation coefficient of 0.119 or larger is significant. Therefore only two of the gross correlations are significant, density being by far the most important. The multiple correlation with all five variables shows very little improvement over the gross correlation with density alone. The indications are, therefore, that density contributes about half ($100 \times 0.718 \times 0.718$) of the variation from the tabular values and that species composition as expressed by these groups is of minor importance. It must be mentioned, however, that species composition probably affects yield more than these correlations show, but its effect is largely removed by the original correlation with site index. This is true because significant correlations occur between species composition and site index. These will be shown later in the stand-table discussion.

CORRELATION OF TOTAL CUBIC VOLUME WITH AGE, SITE, AND DENSITY

A curvilinear multiple correlation of total cubic volume with age, site, and density was made by Bruce and Reineke's method (*4*) and a very satisfactory chart was obtained (fig. 15). The standard error of estimate was lowered 29 percent by including density, and a corresponding improvement in correlation was achieved, as shown in table 33. Comparison of the two estimates of yield is available in figure 16. In the younger age classes there is a greater range in yield with variation in site when density is considered as a variable than when it is omitted from consideration. This might indicate a deficiency of density classes among the younger ages in the sample used. Also, there is a tendency for the poorer sites to have higher yields above 40 years. This indicates that the density of the older stands sampled on the poorer sites was lower than that of the rest of the stands sampled. In other words a correlation between density and site is indicated. This is borne out by the actual correlation coefficient of −0.1612, which is statistically significant.

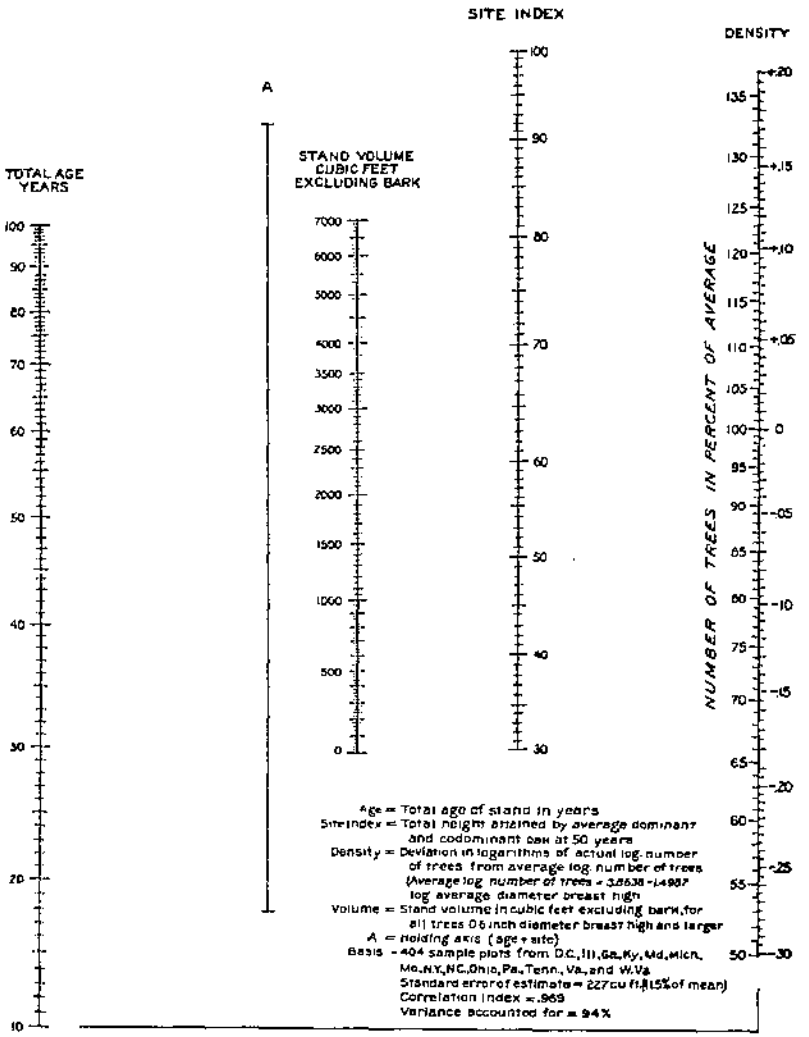


FIGURE 15.—Yield of upland oaks—curvilinear multiple correlation of stand volume with age, site index, and density.

TABLE 33.—*Comparison of yield correlations with and without density included as a variable*

Item	Total cubic volume yield correlated with—	
	Age and site index	Age, site index, and density
Correlation index	0.936	0.969
Percent of variation accounted for	88	94
Standard error of estimate:		
Cubic feet	321	227
Percent	16	11.5

Since density is measured by the number of trees present (fig. 17), the correlation between density and site indicates to some extent that the better sites have fewer numbers of trees for any given stand diameter than the poorer ones. On the other hand the correlation between volume and density is not significant ($r=0.1028$). Accordingly, if there are fewer trees but the same volume on the better sites for the same average diameter, it follows that there is probably less range in tree sizes.

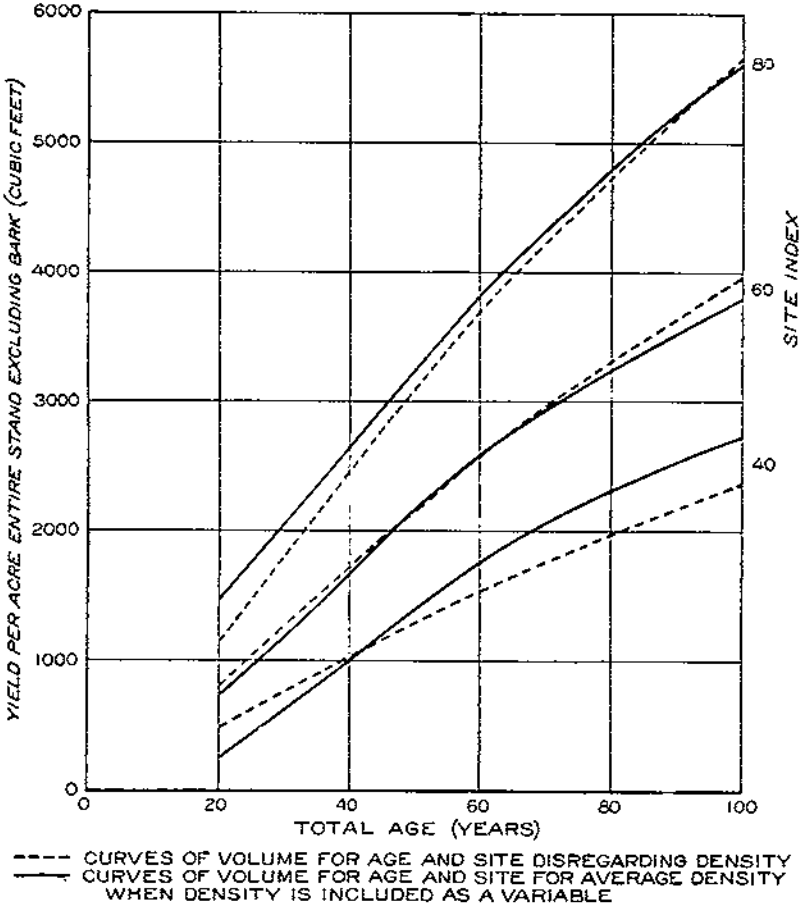


FIGURE 16.—Comparison between total cubic volume curves when correlated with age and site only and when density is included.

A set of total cubic-volume values by age, site index, and density [21] classes are presented in table 34, as read from figure 15. One can readily see from this table that even though density was controlled in the field by selecting fully stocked stands as samples, the variations

[21] Example of computation of density. If the number of trees in an upland oak forest stand is 500 and their average diameter is 5.0 inches, what is the density of the stand? The logarithm of 5.0 is 0.6990. Substituting this value in the equation—average log (number of trees) = 3.8038 − 1.4987 log (average diameter breast high) we get log (number of trees) = 3.8038 − 1.4987 (0.6990) and solving = 3.8038 − 1.0476 = 2.8162. The antilog of 2.8162 = 655, or average number of trees for an average diameter of 5.0 inches, and 500 is 76 percent of 655. Therefore the density of the stand is 76. This can be computed graphically by direct reading from figure 19.

obtained are well worth considering, especially in scientific studies. It is entirely possible to include density as a variable in all of the yield tables, but this requires further analysis, which leads naturally towards application studies in understocked stands. These are planned in future work.

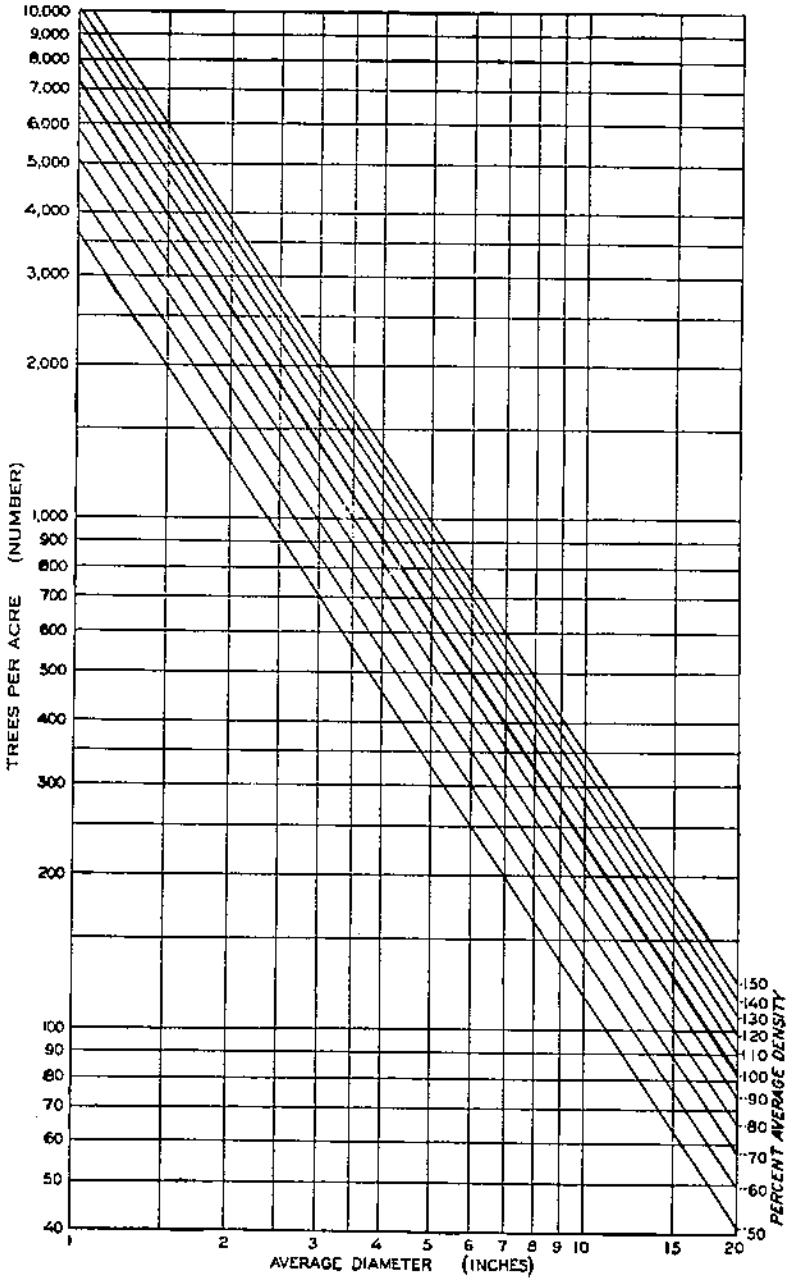


FIGURE 17.—Stand density chart for upland oak.

TABLE 34.—*Yield per acre, excluding bark, by density classes, age, and site; all trees 0.6 inch d. b. h. and larger included*

POOR SITE—INDEX 40

Age (years)	Yield per acre by density class [1]								
	50	60	70	80	90	100	110	120	130
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
10	0	0	0	0	0	0	0	75	180
15	0	0	0	0	0	70	162	262	365
20	0	0	0	73	175	260	350	460	570
25	0	5	141	248	350	440	540	650	775
30	22	175	305	415	525	615	720	842	975
35	182	328	465	587	700	800	908	1,050	1,190
40	335	490	636	763	885	985	1,120	1,270	1,430
45	485	645	805	940	1,075	1,190	1,330	1,480	1,660
50	630	810	970	1,125	1,275	1,400	1,540	1,710	1,900
55	775	955	1,140	1,300	1,460	1,590	1,740	1,920	2,110
60	895	1,090	1,260	1,460	1,620	1,760	1,920	2,100	2,300
65	1,010	1,225	1,425	1,600	1,770	1,920	2,075	2,260	2,450
70	1,130	1,350	1,550	1,740	1,920	2,060	2,230	2,420	2,620
75	1,235	1,460	1,670	1,870	2,040	2,200	2,360	2,560	2,750
80	1,325	1,560	1,775	1,970	2,160	2,310	2,475	2,670	2,880
85	1,420	1,650	1,880	2,075	2,270	2,420	2,590	2,780	3,010
90	1,500	1,750	1,975	2,180	2,370	2,530	2,690	2,910	3,150
95	1,600	1,850	2,080	2,290	2,475	2,635	2,820	3,035	3,275
100	1,675	1,935	2,175	2,380	2,575	2,730	2,925	3,150	3,400

FAIR SITE—INDEX 50

10	0	0	0	0	20	105	198	300	402
15	0	0	7	120	220	302	300	507	622
20	0	60	190	302	402	495	595	710	840
25	85	230	365	480	592	685	795	915	1,065
30	252	398	543	662	785	895	1,000	1,150	1,300
35	405	570	715	850	975	1,090	1,220	1,375	1,535
40	580	750	910	1,060	1,200	1,325	1,470	1,630	1,810
45	740	920	1,100	1,260	1,420	1,540	1,690	1,875	2,060
50	905	1,110	1,300	1,470	1,630	1,770	1,930	2,120	2,310
55	1,070	1,280	1,480	1,665	1,845	1,980	2,150	2,340	2,540
60	1,220	1,440	1,650	1,845	2,010	2,170	2,340	2,530	2,730
65	1,345	1,575	1,795	1,980	2,180	2,335	2,500	2,695	2,920
70	1,475	1,715	1,945	2,148	2,335	2,490	2,660	2,870	3,100
75	1,590	1,845	2,080	2,285	2,460	2,630	2,805	3,050	3,285
80	1,680	1,950	2,185	2,400	2,595	2,755	2,935	3,165	3,415
85	1,790	2,060	2,300	2,505	2,695	2,870	3,060	3,300	3,560
90	1,895	2,160	2,410	2,610	2,810	2,995	3,200	3,445	3,720
95	1,980	2,270	2,510	2,725	2,945	3,130	3,345	3,595	3,890
100	2,090	2,360	2,610	2,830	3,050	3,240	3,460	3,730	4,020

AVERAGE SITE—INDEX 60

10	0	0	30	145	245	330	422	540	650
15	0	95	228	340	445	540	645	755	880
20	140	288	419	540	648	748	855	985	1,135
25	305	460	604	728	850	955	1,080	1,225	1,385
30	475	635	780	928	1,070	1,180	1,320	1,478	1,670
35	650	825	990	1,148	1,300	1,425	1,570	1,740	1,925
40	840	1,030	1,220	1,380	1,540	1,675	1,840	2,015	2,210
45	1,020	1,230	1,430	1,615	1,775	1,925	2,085	2,275	2,470
50	1,215	1,435	1,645	1,835	2,010	2,170	2,335	2,525	2,720
55	1,390	1,630	1,855	2,050	2,240	2,390	2,565	2,755	2,985
60	1,555	1,795	2,030	2,240	2,425	2,580	2,755	2,975	3,220
65	1,695	1,950	2,195	2,400	2,590	2,750	2,945	3,170	3,420
70	1,845	2,110	2,350	2,565	2,750	2,930	3,130	3,370	3,635
75	1,970	2,240	2,485	2,690	2,910	3,100	3,305	3,555	3,850
80	2,085	2,360	2,610	2,820	3,045	3,240	3,455	3,725	4,020
85	2,190	2,465	2,710	2,955	3,175	3,370	3,600	3,890	4,205
90	2,305	2,585	2,840	3,080	3,320	3,530	3,770	4,055	4,390
95	2,410	2,675	2,960	3,210	3,450	3,665	3,920	4,235	4,580
100	2,495	2,785	3,070	3,330	3,580	3,820	4,070	4,400	4,775

[1] Density is percentage of average number of trees.

TABLE 34.—*Yield per acre, excluding bark, by density classes, age, and site; all trees 0.6 inch d. b. h. and larger included*—Continued

GOOD SITE—INDEX 70

Age (years)	Yield per acre by density class [1]								
	50	60	70	80	90	100	110	120	130
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*
10	30	170	310	420	532	622	728	850	985
15	219	308	509	628	745	848	980	1,105	1,255
20	410	568	718	850	975	1,090	1,225	1,380	1,545
25	598	765	925	1,075	1,220	1,350	1,480	1,655	1,835
30	780	970	1,155	1,320	1,475	1,610	1,770	1,945	2,135
35	975	1,180	1,380	1,555	1,730	1,875	2,030	2,225	2,420
40	1,210	1,430	1,645	1,850	2,005	2,160	2,335	2,525	2,725
45	1,415	1,650	1,880	2,080	2,270	2,425	2,595	2,795	3,025
50	1,640	1,900	2,135	2,335	2,530	2,680	2,870	3,090	3,340
55	1,845	2,105	2,350	2,550	2,740	2,925	3,125	3,370	3,630
60	2,020	2,295	2,545	2,755	2,970	3,165	3,375	3,630	3,925
65	2,175	2,450	2,695	2,930	3,170	3,360	3,580	3,870	4,185
70	2,340	2,620	2,880	3,125	3,365	3,575	3,825	4,120	4,460
75	2,475	2,755	3,035	3,295	3,550	3,780	4,030	4,360	4,730
80	2,590	2,890	3,190	3,450	3,720	3,950	4,235	4,570	4,950
85	2,690	3,010	3,315	3,585	3,870	4,120	4,405	4,770	5,180
90	2,810	3,140	3,460	3,760	4,040	4,320	4,615	4,995	5,420
95	2,940	3,270	3,605	3,925	4,225	4,505	4,825	5,225	5,665
100	3,030	3,395	3,745	4,060	4,390	4,680	5,020	5,440	5,890

EXCELLENT SITE—INDEX 80

10	288	435	580	705	830	930	1,055	1,200	1,360
15	482	642	800	940	1,080	1,200	1,335	1,495	1,670
20	685	862	1,035	1,190	1,345	1,470	1,620	1,785	1,970
25	890	1,080	1,277	1,460	1,610	1,752	1,915	2,090	2,285
30	1,120	1,340	1,540	1,725	1,910	2,050	2,215	2,405	2,610
35	1,345	1,575	1,795	1,980	2,180	2,335	2,500	2,690	2,920
40	1,605	1,860	2,090	2,300	2,480	2,645	2,825	3,040	3,275
45	1,845	2,100	2,340	2,550	2,740	2,920	3,125	3,365	3,625
50	2,060	2,360	2,610	2,820	3,035	3,230	3,450	3,725	4,020
55	2,310	2,630	2,830	3,080	3,325	3,530	3,775	4,065	4,410
60	2,480	2,770	3,070	3,320	3,570	3,795	4,055	4,380	4,760
65	2,660	2,960	3,260	3,535	3,810	4,045	4,335	4,690	5,095
70	2,815	3,155	3,470	3,760	4,050	4,325	4,620	5,000	5,420
75	2,985	3,325	3,660	3,970	4,290	4,585	4,900	5,310	5,760
80	3,120	3,475	3,825	4,160	4,490	4,800	5,130	5,555	6,030
85	3,250	3,625	3,990	4,360	4,700	5,010	5,380	5,800	6,325
90	3,400	3,780	4,180	4,540	4,915	5,250	5,620	6,100	6,590
95	3,540	3,950	4,360	4,745	5,140	5,480	5,870	6,370	6,850
100	3,670	4,100	4,530	4,930	5,340	5,690	6,120	6,600	7,120

[1] Density is percentage of average number of trees.

THE STAND TABLES

Stand tables are essential for forest management, and it is today generally accepted that yield tables are not complete without them. Knowledge of the number of trees that may be expected in the various diameter classes is necessary for solving many problems in forest utilization and valuation. Because oak is used extensively for piece products, the yield of which depends on tree size, stand tables are especially important for the oak region.

It has been shown (*2, 11, 16, 17, 23, 24, 25*) that diameter distributions of even-aged stands follow certain definite laws and have characteristic forms which are determined by certain computed values. Analyses of several oak stands brought out the fact that stands that contain a number of species having different growth characteristics and varying in their tolerance and their adaptability to the site have distributions with several modes. Obviously, such stands must be

separated into their component parts and each analyzed separately, since no two stands have the same composition. Because it was impracticable to analyze each species separately, some grouping was sought. Inspection of a number of stand tallies showed the white oaks to be somewhat smaller in size than the black oaks on the same area. The associated species also were found to fall, perhaps more pronouncedly, into two groups, one of small trees of tolerant species and the other of large trees of intolerant species. Four groups were, therefore, set up as follows: (1) The white oaks; (2) the black oaks; (3) the other intolerant species; and (4) the other tolerant species.[22] A test showed the mean stand diameters (mean of the diameters) of these groups to be significantly different while each individual group seemed to be fairly homogeneous. The mean of the differences of the group means from the plot means (diameter) and their standard errors are given in table 35. They are all significant. Each group mean was also found to be very significantly different from each other group mean, the ratios between the differences and their errors ranging from 18 to 108. Previous investigations (*17*, *24*) show that correlation of the diameter distribution characteristics with mean stand diameter largely eliminates the effect of age and site, so stand analyses are generally based on mean diameter. Since these groups differ significantly in mean diameter, they are considered sufficiently different to require separate analyses.

TABLE 35.—*Mean differences between diameters of species groups and plot*

Species group	Mean difference of diameters from those of entire plot	Standard error of the difference	Ratios of mean difference to its error
White oaks	−0.0873	±0.00819	11
Black oaks	+.8594	±.01244	69
Other intolerant species	−.5482	±.02396	23
Other tolerant species	−1.2778	±.01546	83

The mathematical values which describe diameter distribution are: Number of trees, mean diameter, standard deviation about the mean, coefficient of asymmetry (skewness), and coefficient of excess (kurtosis). The latter is of minor importance, is subject to considerable error, and to obtain it greatly increases the volume of computational work. Moreover, tables of Pearson's type III function (*22*), which disregards kurtosis, were available to simplify the computation of frequencies. The other values were, therefore, the only ones considered. Charlier's types A and B curves have been used very conveniently for diameter distribution analyses (*16*, *17*, *23*, *24*, *25*), again because available tables simplify fitting them. Pearson's type I curve was used in one instance (*23*), and was shown to fit exceedingly well but required a great amount of computational work. Pearson's type III frequency was also tested in the latter case; it was found to fit very well in comparison with Charlier's curves and has the advantage of being more easily computed by direct reading of percentage

[22] The species grouping is as follows, employing the miscellaneous group composition given in table 1: White oaks: White, chestnut, and post oaks, and swamp oaks. Black oaks: Scarlet, black, red, southern red, pin, blackjack, and miscellaneous oaks. Other tolerant species: Black and red gums, beech, sugar and red maple, sweet birch, eastern hemlock, basswood, miscellaneous groups A and B, unknown, and dead trees. Other intolerant species: Chestnut, hickory, hickories, pines, ashes, cherries, yellow poplar, black locust, black walnut, sycamore, largetooth and other aspen, elm, eastern red cedar, butternut, and cucumber. (See table 1 for scientific names of species and composition of miscellaneous groups.)

frequencies from tables of areas. These tables were, therefore, used for fitting Pearson's type III curves to the first three of the above-mentioned four groups.

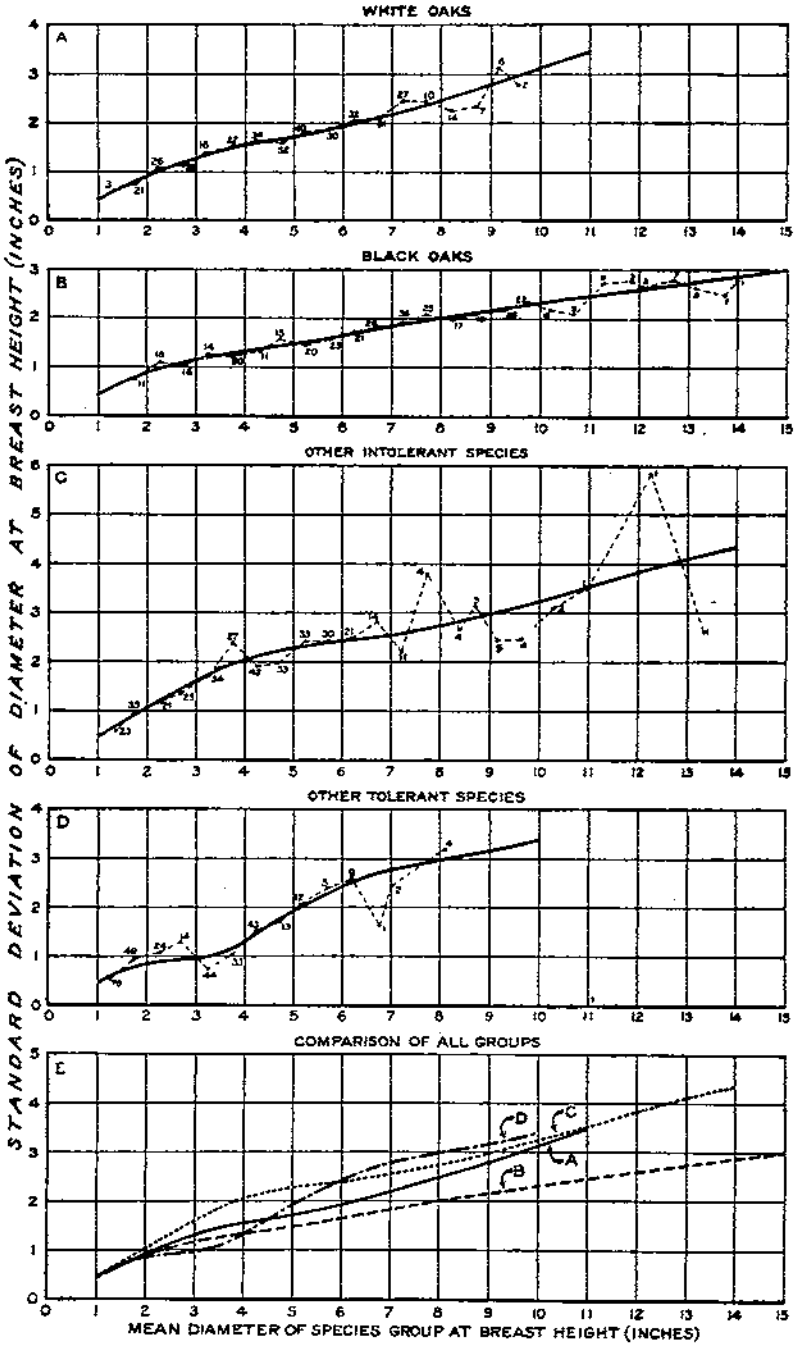


FIGURE 18.—Relation between standard deviation of tree diameters and mean diameter by species groups.

Standard deviation was computed for each 0.5 inch mean diameter (of species group) class separately for each of the four species groups. The average relations are shown in figure 18. The curves differ but appear to be quite satisfactory. An exception is that for the "other tolerant" group, the shape of which indicates the presence of two universes of data. However, the relative importance of this group does not warrant further subdivision. Plotted values of skewness

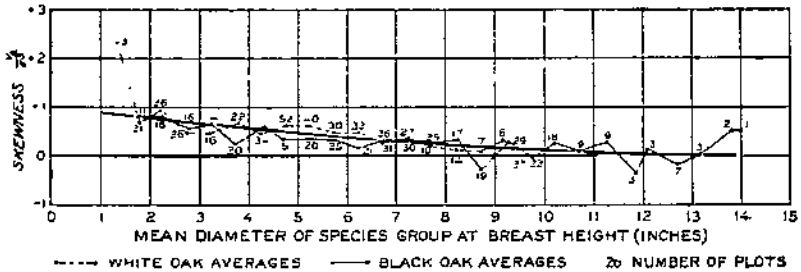


FIGURE 19.—Relation between skewness and mean diameter for the white and black oak groups.

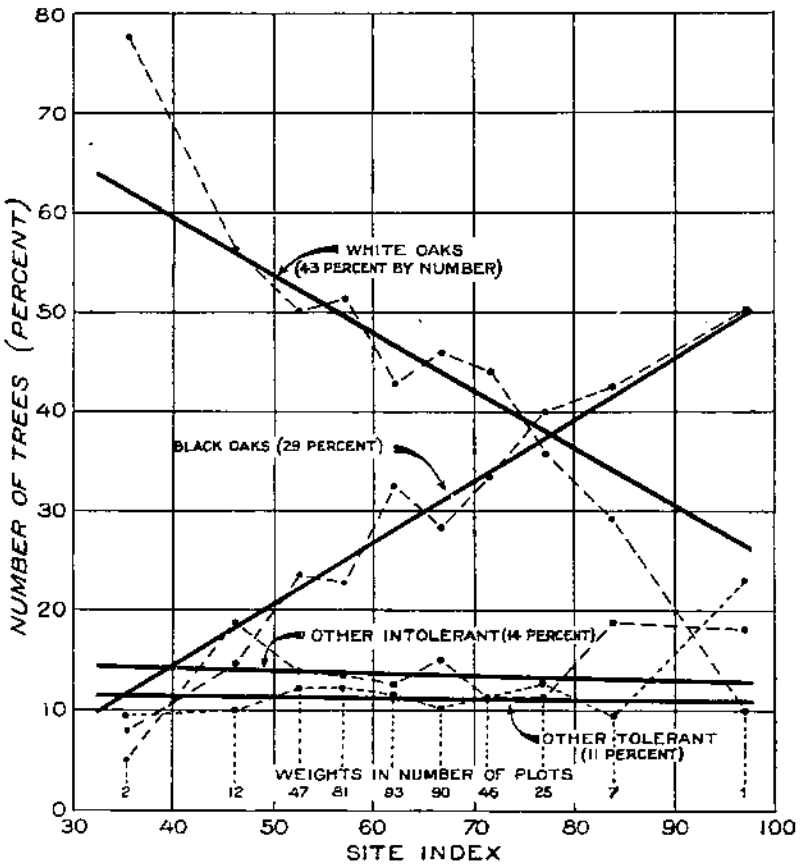


FIGURE 20.—Computed and actual relation between percentage of number of trees by species groups and site index.

in figure 19 show practically the same relation to mean diameter for both of the oak groups. The curve fitted to both of the oak groups averaged together was arbitrarily used for the other intolerant group also. Because skewness values as high as +3 were found in the other tolerant group the tables of Pearson's type III function could not be used. Average percentile curves were drawn for this group.

The percent number of trees in each species group changes with site, as shown in figure 20 and table 36. White oaks decrease and black oaks increase in number with increasing site quality, while the other two groups decrease slightly. These changes in percentage composition are significant for the two oak groups but not for the others. Similar correlations between species composition and age showed no significance.

TABLE 36.—*Percent of number of trees in each species group on different sites*

Species group	Total number of trees by site index—				
	40	50	60	70	80
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
White oaks	50.3	53.5	47.8	42.0	36.3
Black oaks	14.7	20.9	27.0	33.2	39.3
Other intolerant species	14.5	14.2	13.9	13.6	13.3
Other tolerant species	11.5	11.4	11.3	11.2	11.1
Total	100.0	100.0	100.0	100.0	100.0

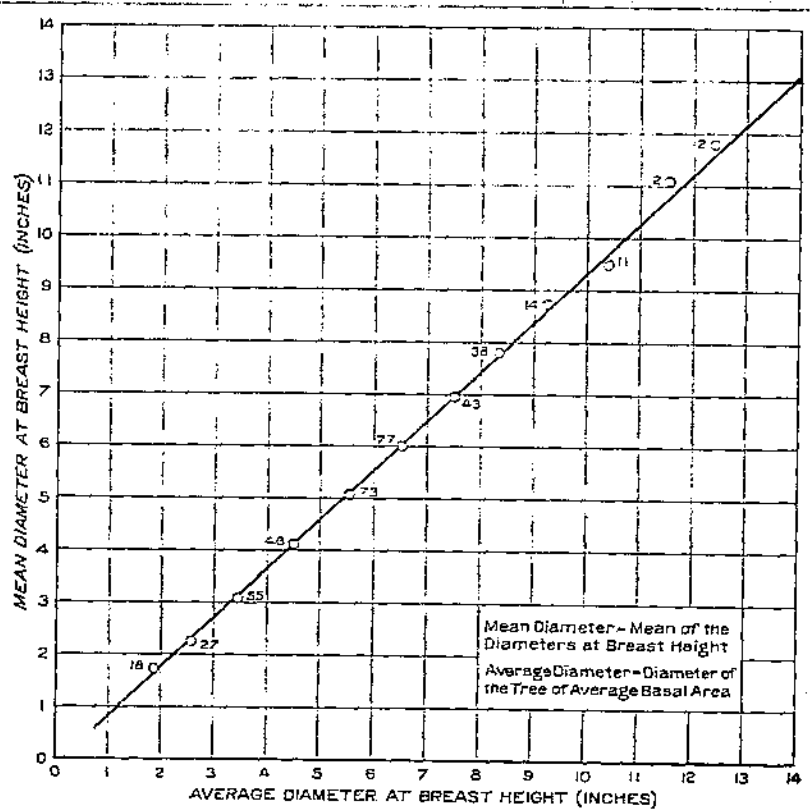


FIGURE 21.—Relation between mean diameter and average diameter of the stand.

For stand analysis the mean diameter (mean of the diameters) of each species group was used as a basis, whereas for yield analysis average diameter of the stand (diameter of tree of average basal area) was used. Figure 21 shows the relation between mean and average diameter of the stand, and figure 22 the relation of each species group to the stand.

For each average stand diameter for each age and site, the mean diameter of each species group was read from the curves in figure 22. The corresponding cumulative frequencies, in percent, were read from

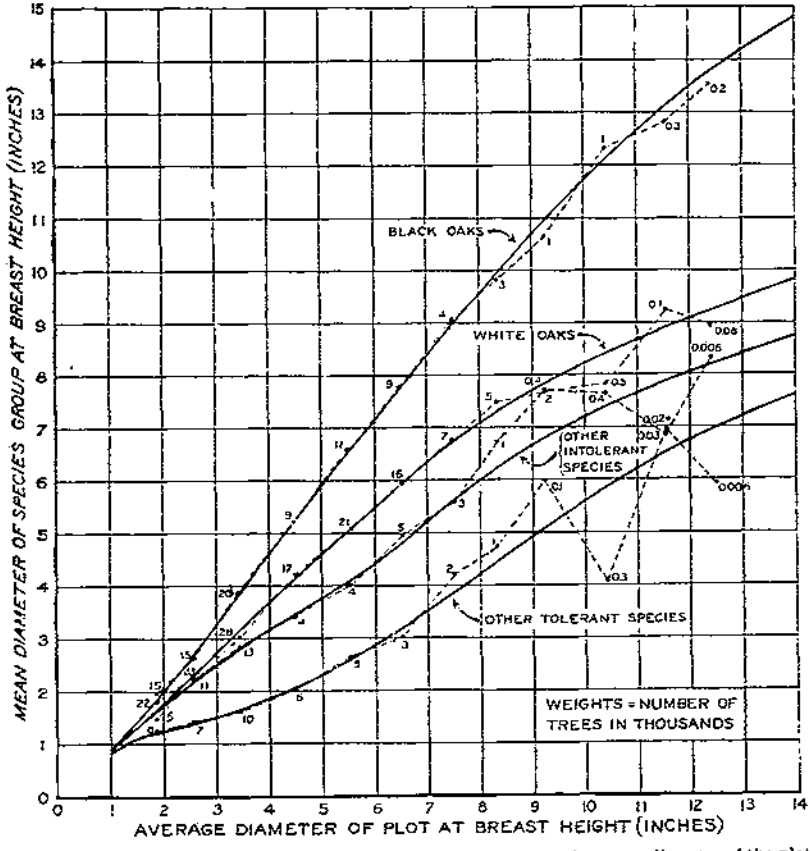


FIGURE 22.—Relation between mean diameter of the species groups and average diameter of the plot.

the tables of Pearson's type III function (*22*), for each of the first three groups, standard deviation and skewness values having been obtained from the curves in figure 18 and curves similar to those in figure 19. The other tolerant group frequencies were read from the percentile curves. These cumulative frequencies were next converted to frequencies by successive subtractions. The final step was to apply these frequencies to the total number of trees in each species group—obtained by multiplying the total number of trees per acre (table 8) by the species group percentages (fig. 20). The completed tables are presented as table 37.

TABLE 37.—*Stand table—Distribution of trees by successive diameter classes, by species groups and age*

SITE INDEX 40—POOR SITE

Age and species group	Trees in each diameter class [1]																								
	0.25 inch	1 inch	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches	9 inches	10 inches	11 inches	12 inches	13 inches	14 inches	15 inches	16 inches	17 inches	18 inches	19 inches	20 inches	21 inches	22 inches	Total
10 years:	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	*No.*	
White oaks	406	3,412	244																					4,062
Black oaks	101	846	60																					1,007
Other intolerant	119	794	80																					993
Other tolerant	205	528	55																					788
Total	831	5,580	439																					6,850
20 years:																								
White oaks	77	928	715	174	39																			1,933
Black oaks	14	206	187	58	14																			479
Other intolerant	28	236	106	38	5																			473
Other tolerant	52	222	82	15	4																			375
Total	171	1,592	1,150	285	62																			3,260
30 years:																								
White oaks	10	162	334	267	124	48	10																	955
Black oaks		14	64	81	50	21	7																	237
Other intolerant	9	51	75	56	28	9	5																	233
Other tolerant	13	94	61	13	2	2																		185
Total	32	321	534	417	204	80	22																	1,610
40 years:																								
White oaks		36	121	170	139	85	36	12	6															605
Black oaks			12	33	43	33	18	8	3															150
Other intolerant	4	21	36	37	25	15	6	3	1															148
Other tolerant	4	47	47	13	5	1																		117
Total	8	104	216	253	212	134	60	23	10															1,020

50 years:																								
White oaks		14	57	109	119	86	52	24	10	5														476
Black oaks			2	12	26	31	25	14	6	2														118
Other intolerant	3	12	22	26	22	15	8	5	2	1														116
Other tolerant		32	40	13	5	1	1																	92
Total	3	58	121	160	172	133	86	43	18	8														802
60 years:																								
White oaks		4	23	62	89	85	62	35	15	7	4													386
Black oaks			1	4	11	20	23	17	12	6	2													96
Other intolerant	2	6	15	19	18	14	8	6	3	2	1													94
Other tolerant		18	29	17	7	2	1	1																75
Total	2	28	68	102	125	121	94	59	30	15	7													651
70 years:																								
White oaks			13	35	64	71	61	39	22	10	3	3												321
Black oaks				2	5	11	17	17	13	8	4	2	1											80
Other intolerant	2	5	10	14	15	12	9	5	3	2	1													78
Other tolerant		11	21	18	7	3	1	1																62
Total	2	16	44	69	91	97	88	62	38	20	8	5	1											541
80 years:																								
White oaks			6	20	46	60	57	46	28	14	6	3												286
Black oaks				1	3	6	11	14	14	11	6	3	1	1										71
Other intolerant	1	4	7	11	13	12	9	6	4	2	1													70
Other tolerant		7	14	18	9	4	2	1	1															56
Total	1	11	27	50	71	82	79	67	47	27	13	6	1	1										483
90 years:																								
White oaks			5	16	32	48	53	45	32	18	10	3	3											265
Black oaks				1	1	4	8	11	12	11	8	5	3	1	1									66
Other intolerant	1	3	5	9	11	11	10	6	4	3	1	1												65
Other tolerant		5	11	16	11	5	2	1	0	0														51
Total	1	8	21	42	55	68	73	63	48	32	19	9	6	1	1									447
100 years:																								
White oaks			3	12	24	39	46	44	34	22	12	5	3											244
Black oaks					1	2	5	8	11	11	9	6	3	2	1	1								60
Other intolerant	1	1	4	7	9	10	9	7	5	3	2	1	1											60
Other tolerant		2	9	12	12	6	3	2	1	0														47
Total	1	3	16	31	46	57	63	61	51	36	23	12	7	2	1	1								411

[1] Diameter classes are designated by midpoint values.

TABLE 37.—*Stand table—Distribution of trees by successive diameter classes, by species groups and age*—Continued

SITE INDEX 50—FAIR SITE

Age and species group	Trees in each diameter class																							
	0.25 inch	1 inch	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches	9 inches	10 inches	11 inches	12 inches	13 inches	14 inches	15 inches	16 inches	17 inches	18 inches	19 inches	20 inches	21 inches	22 inches	Total
10 years:	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
White oaks	255	2,238	340	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2,833
Black oaks	89	819	188	11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1,107
Other intolerant	83	571	98	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	752
Other tolerant	139	392	66	6	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	603
Total	566	4,020	692	17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	5,295
20 years:																								
White oaks	27	472	539	243	54	13	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1,348
Black oaks	5	127	216	126	42	11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	527
Other intolerant	14	125	132	61	22	4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	358
Other tolerant	32	103	75	14	3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	287
Total	78	887	962	444	121	28	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	2,520
30 years:																								
White oaks	7	60	173	200	133	60	27	7	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	667
Black oaks	----	5	36	73	73	44	18	8	3	----	----	----	----	----	----	----	----	----	----	----	----	----	----	260
Other intolerant	5	30	48	44	27	14	5	2	2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	177
Other tolerant	8	60	50	11	3	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	142
Total	20	164	307	328	236	119	50	17	5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1,246
40 years:																								
White oaks	----	13	51	97	106	76	46	21	8	4	----	----	----	----	----	----	----	----	----	----	----	----	----	422
Black oaks	----	----	3	17	36	43	35	20	8	3	----	----	----	----	----	----	----	----	----	----	----	----	----	165
Other intolerant	3	11	21	25	21	15	8	5	2	1	----	----	----	----	----	----	----	----	----	----	----	----	----	112
Other tolerant	----	31	40	13	4	1	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	90
Total	3	55	115	152	167	135	90	46	18	8	----	----	----	----	----	----	----	----	----	----	----	----	----	789

50 years:																								
White oaks		4	20	53	77	73	53	30	13	7	3													333
Black oaks			1	5	14	26	31	25	16	8	3	1												130
Other intolerant	2	6	14	18	17	13	8	5	3	2	1													89
Other tolerant		15	27	18	7	2	1	1																71
Total	2	25	62	94	115	114	93	61	32	17	7	1												623
60 years:																								
White oaks			8	22	46	59	54	41	24	11	3	3												271
Black oaks				2	5	13	20	22	19	13	8	3	1											106
Other intolerant	1	4	8	12	14	12	9	6	4	1	1													72
Other tolerant		9	17	19	7	3	1	1	1															58
Total	1	13	33	55	72	87	84	70	48	25	12	6	1											507
70 years:																								
White oaks			5	13	27	40	45	38	27	16	9	2	2											224
Black oaks				1	3	5	10	15	17	15	10	6	4	2										88
Other intolerant	1	2	5	8	10	10	9	6	4	2	1	1												59
Other tolerant		4	11	15	10	4	2	1	1	0														48
Total	1	6	21	37	50	59	66	60	49	33	20	9	6	2										419
80 years:																								
White oaks			2	8	18	30	37	36	28	20	12	6	2	2										201
Black oaks					1	2	6	10	13	14	13	8	5	3	2		1							78
Other intolerant	1	1	3	6	8	9	8	6	5	3	2	1	0											53
Other tolerant		2	8	11	11	6	2	2	1	0														43
Total	1	3	13	25	38	47	53	54	47	37	27	15	7	5	2		1							375
90 years:																								
White oaks			2	6	15	24	31	33	28	20	13	7	4	2										185
Black oaks					1	1	4	7	10	12	12	9	7	4	2	2	1							72
Other intolerant		1	2	4	6	8	8	7	5	3	2	1	1	1										49
Other tolerant		1	6	8	10	7	4	2	1	1	0													40
Total		2	10	18	32	40	47	49	44	36	27	17	12	7	2	2	1							346
100 years:																								
White oaks			2	3	10	19	26	29	27	22	15	9	5	2	2									171
Black oaks					1	1	2	5	7	10	12	10	8	5	3	2	1							67
Other intolerant		1	1	3	5	6	7	7	5	4	3	1	1	1										45
Other tolerant		0	5	6	9	7	4	3	2	1	0													37
Total		1	8	12	25	33	39	44	41	37	30	20	14	8	5	2	1							320

TABLE 37.—*Stand table—Distribution of trees by successive diameter classes, by species groups and age*—Continued

SITE INDEX 60—AVERAGE SITE

Age and species group	Trees in each diameter class																							
	0.25 inch	1 inch	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches	9 inches	10 inches	11 inches	12 inches	13 inches	14 inches	15 inches	16 inches	17 inches	18 inches	19 inches	20 inches	21 inches	22 inches	Total
10 years:	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
White oaks	136	1,320	427	58	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1,941
Black oaks	66	690	296	33	11	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1,096
Other intolerant	51	372	124	17	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	564
Other tolerant	92	289	69	5	4	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	459
Total	345	2,671	916	113	15	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	4,060
20 years:																								
White oaks	19	242	363	214	74	18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	930
Black oaks	5	74	189	157	74	21	5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	525
Other intolerant	11	78	97	54	22	8	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	270
Other tolerant	24	126	57	11	2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	220
Total	59	520	706	436	172	47	5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	1,945
30 years:																								
White oaks	----	28	88	124	106	69	32	9	5	----	----	----	----	----	----	----	----	----	----	----	----	----	----	461
Black oaks	----	----	13	47	73	63	39	18	5	3	----	----	----	----	----	----	----	----	----	----	----	----	----	261
Other intolerant	4	17	30	32	24	15	7	4	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	134
Other tolerant	3	45	44	12	4	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	109
Total	7	90	175	215	207	148	78	31	11	3	----	----	----	----	----	----	----	----	----	----	----	----	----	965
40 years:																								
White oaks	----	3	17	47	67	64	47	26	12	6	3	----	----	----	----	----	----	----	----	----	----	----	----	292
Black oaks	----	----	2	7	20	33	39	31	20	10	3	----	----	----	----	----	----	----	----	----	----	----	----	165
Other intolerant	2	7	13	17	16	13	8	5	2	2	----	----	----	----	----	----	----	----	----	----	----	----	----	85
Other tolerant	----	15	26	17	7	2	1	1	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	69
Total	2	25	58	88	110	112	95	63	34	18	6	----	----	----	----	----	----	----	----	----	----	----	----	611

50 years:																								
White oaks			7	18	37	48	46	34	21	12	5	2												230
Black oaks				1	5	13	22	26	25	18	11	5	3	1										130
Other intolerant	1	3	7	12	13	12	9	5	3	1	1													67
Other tolerant		7	15	19	8	4	1	1	0															55
Total	1	10	29	50	63	77	78	66	49	31	17	7	3	1										482
60 years:																								
White oaks			2	9	19	30	35	34	26	17	9	4	2											187
Black oaks					2	5	11	16	19	19	15	9	5	3	1									105
Other intolerant	0	1	3	6	9	9	9	6	5	3	2	1	0											54
Other tolerant		3	9	12	11	5	2	1	1	0														44
Total	0	4	14	27	41	49	57	57	51	39	26	14	7	3	1									390
70 years:																								
White oaks			2	5	12	20	27	28	23	17	11	6	3	2										156
Black oaks					1	2	5	9	12	15	15	11	8	5	3	2								88
Other intolerant		1	2	4	6	7	7	6	5	3	2	1	1	0										45
Other tolerant		1	6	8	10	6	3	2	1	0	0													37
Total		2	10	17	29	35	42	45	41	35	28	18	12	7	3	2								326
80 years:																								
White oaks			1	3	8	15	21	24	22	18	13	7	4	2	1									139
Black oaks					1	2	2	5	8	11	13	12	10	7	5	2	1							79
Other intolerant		0	1	3	5	6	7	6	5	4	2	1	1	0										41
Other tolerant			4	6	7	6	4	3	1	1	1													33
Total		0	6	12	21	29	34	38	36	34	29	20	15	9	6	2	1							292
90 years:																								
White oaks			1	3	6	10	15	19	21	18	14	9	7	3	1	1								128
Black oaks						1	1	3	6	9	11	12	11	8	6	3	1	1						73
Other intolerant		0	1	2	3	5	6	6	5	4	3	1	1	0	0									37
Other tolerant			2	5	6	6	4	3	2	1	1	0												30
Total		0	4	10	15	22	26	31	34	32	29	22	19	11	7	4	1	1						268
100 years:																								
White oaks			1	2	6	8	13	17	19	17	13	10	7	4	1	1								119
Black oaks							1	2	4	6	9	9	10	9	7	5	3	2	0					67
Other intolerant			0	2	3	4	5	5	5	4	3	2	1	0	0									34
Other tolerant			1	4	5	6	5	3	2	1	1	0	0											28
Total			2	8	14	18	24	27	30	28	26	21	18	13	8	6	3	2	0					248

TABLE 37.—*Stand table—Distribution of trees by successive diameter classes, by species groups and age*—Continued

SITE INDEX 70—GOOD SITE

Age and species group	Trees in each diameter class																							
	0.25 inch	1 inch	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches	9 inches	10 inches	11 inches	12 inches	13 inches	14 inches	15 inches	16 inches	17 inches	18 inches	19 inches	20 inches	21 inches	22 inches	Total
10 years:	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
White oaks	66	765	409	79	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,319
Black oaks	42	542	375	73	10	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,042
Other intolerant	30	235	132	26	4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	427
Other tolerant	60	215	67	7	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	352
Total	198	1,757	983	185	17	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	3,140
20 years:																								
White oaks	6	107	221	176	82	32	6	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	630
Black oaks	-----	30	134	169	105	45	15	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	498
Other intolerant	8	45	65	49	25	8	4	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	204
Other tolerant	12	85	55	12	2	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	168
Total	26	267	475	406	214	87	25	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	1,500
30 years:																								
White oaks	-----	9	34	69	78	59	38	16	6	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	312
Black oaks	-----	-----	3	22	47	62	54	32	17	7	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	247
Other intolerant	3	10	19	23	19	13	7	4	2	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	101
Other tolerant	-----	27	36	13	5	1	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	83
Total	3	46	92	127	149	135	100	52	25	11	3	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	743
40 years:																								
White oaks	-----	-----	6	18	36	43	39	28	16	8	2	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	198
Black oaks	-----	-----	-----	3	9	19	31	33	27	19	9	5	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	157
Other intolerant	1	3	8	11	12	11	8	5	3	1	1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	64
Other tolerant	-----	8	16	17	7	3	1	1	0	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	53
Total	1	11	30	49	64	76	79	67	46	28	12	7	2	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	472

50 years:																								
White oaks			2	8	16	25	30	28	22	14	8	3	1											157
Black oaks					3	6	13	19	22	22	17	11	6	4	1									124
Other intolerant	0	1	3	6	8	9	8	6	5	3	2	0												51
Other tolerant		3	8	12	10	5	2	1	1	0														42
Total	0	4	13	26	37	45	53	54	50	39	27	14	7	4	1									374
60 years:																								
White oaks			1	3	9	15	21	22	21	15	10	6	4	1										128
Black oaks					1	2	4	8	12	16	18	15	11	7	4	2	1							101
Other intolerant		1	2	3	5	7	7	6	4	3	2	1	0	0										41
Other tolerant		1	5	6	9	6	3	2	1	1	0													34
Total		2	8	12	24	30	35	38	38	35	30	22	15	8	4	2	1							304
70 years:																								
White oaks			1	2	5	10	14	17	17	15	11	6	4	2	1	1								106
Black oaks						1	2	4	7	10	12	13	13	9	7	3	2	1						84
Other intolerant		0	1	2	3	5	5	5	5	3	3	1	1	0	0									34
Other tolerant			2	5	5	6	4	3	1	1	1	0												28
Total		0	4	9	13	22	25	29	30	29	27	20	18	11	8	4	2	1						252
80 years:																								
White oaks			1	2	4	7	10	13	14	13	11	7	6	3	2	1								94
Black oaks							1	2	4	6	9	10	11	10	8	6	4	2	1					74
Other intolerant			0	1	2	4	4	5	4	4	3	2	1	1	0									31
Other tolerant			1	3	4	5	4	3	2	2	1	0	0	0										25
Total			2	6	10	16	19	23	24	25	24	19	18	14	10	7	4	2	1					224
90 years:																								
White oaks				1	3	5	9	11	13	12	10	8	6	4	2	2	1							87
Black oaks							1	1	3	4	7	8	10	10	8	7	5	3	1	1				69
Other intolerant			0	1	2	3	4	4	4	3	3	2	1	1	0									28
Other tolerant			0	3	3	4	4	3	2	2	1	1	0	0										23
Total			0	5	8	12	18	19	22	21	21	19	17	15	10	9	6	3	1	1				207
100 years:																								
White oaks				1	2	4	7	10	11	11	11	9	6	4	2	2	1							81
Black oaks							1	1	2	3	4	6	9	9	8	7	6	4	2	1	1			64
Other intolerant			0	1	1	2	3	4	4	3	3	2	1	1	1	0								26
Other tolerant			0	2	3	3	3	3	2	2	1	1	1	0										21
Total			0	4	6	9	14	18	19	19	19	18	17	14	11	9	7	4	2	1	1			192

TABLE 37.—*Stand table—Distribution of trees by successive diameter classes, by species groups and age*—Continued

SITE INDEX 80—EXCELLENT SITE

Age and species group	Trees in each diameter class																								
	0.25 inch	1 inch	2 inches	3 inches	4 inches	5 inches	6 inches	7 inches	8 inches	9 inches	10 inches	11 inches	12 inches	13 inches	14 inches	15 inches	16 inches	17 inches	18 inches	19 inches	20 inches	21 inches	22 inches	Total
10 years:	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
White oaks	35	424	327	80	18																			884
Black oaks	29	411	373	115	29																			957
Other intolerant	20	162	113	26	3																			324
Other tolerant	38	159	59	11	3																			270
Total	122	1,156	872	232	53																			2,435
20 years:																								
White oaks	4	38	110	126	84	38	17	4																421
Black oaks		9	64	128	128	77	32	14	4															456
Other intolerant	5	26	41	38	23	12	5	2	2															154
Other tolerant	8	62	45	10	3	1																		129
Total	17	135	260	302	238	128	54	20	6															1,160
30 years:																								
White oaks		2	13	34	48	46	34	19	8	4	2													210
Black oaks			2	9	27	45	55	43	27	14	5													227
Other intolerant	2	6	12	15	15	12	7	5	2	1														77
Other tolerant		14	24	16	6	2	1	1																64
Total	2	22	51	74	96	105	97	68	37	19	7													578
40 years:																								
White oaks			3	8	16	25	27	23	16	9	5	1												133
Black oaks				1	4	9	17	25	27	25	17	10	6	3										144
Other intolerant	1	2	4	7	8	8	7	5	3	2	1	1												49
Other tolerant		4	9	12	8	4	2	1	0	0														40
Total	1	6	16	28	36	46	53	54	46	36	23	12	6	3										366

50 years:																							
White oaks			1	2	7	13	17	18	17	13	8	5	3	1									105
Black oaks					1	2	5	9	14	18	19	17	13	8	5	2	1						114
Other intolerant		1	2	3	5	6	6	6	4	3	2	1	0	0									39
Other tolerant		0	5	6	8	6	3	2	1	1	0												32
Total		1	8	11	21	27	31	35	36	35	29	23	16	9	5	2	1						290
60 years:																							
White oaks			1	2	4	7	10	13	13	12	9	6	4	2	1	1							85
Black oaks					1	2	5	6	10	13	14	14	11	8	5	3	1						93
Other intolerant		0	1	2	3	4	5	5	4	3	2	1	1	0	0								31
Other tolerant			2	4	5	5	4	3	1	1	1	0											26
Total		0	4	8	12	17	21	26	24	26	25	21	19	13	9	6	3	1					235
70 years:																							
White oaks				1	3	5	7	9	11	10	9	6	4	3	2	1							71
Black oaks							1	1	3	5	8	10	12	11	9	7	5	3	1	1			77
Other intolerant			0	1	2	3	4	4	4	3	2	2	1	0	0								26
Other tolerant			1	3	3	4	3	3	2	2	1	0	0	0									22
Total			1	5	8	12	15	17	20	20	20	18	17	14	11	8	5	3	1	1			196
80 years:																							
White oaks				1	2	3	5	7	9	9	8	7	5	3	2	1	1						63
Black oaks							1	1	2	3	5	7	9	10	9	8	6	4	2	1	1		69
Other intolerant			0	1	1	2	3	3	3	3	2	2	1	1	1	0							23
Other tolerant			0	2	3	3	3	3	2	1	1	1	0	0									19
Total			0	4	6	8	12	14	16	16	16	17	15	14	12	9	7	4	2	1	1		174
90 years:																							
White oaks				1	2	3	4	6	8	8	8	6	5	3	2	2	1						59
Black oaks							1	1	1	2	3	5	7	8	9	8	7	5	3	2	1	1	63
Other intolerant			0	1	1	2	2	3	3	3	2	2	1	1	0	0							21
Other tolerant				1	2	2	3	3	2	2	1	1	1	0	0								18
Total			0	3	5	7	9	13	14	15	14	14	14	12	11	10	8	5	3	2	1	1	181
100 years:																							
White oaks				1	1	2	4	5	6	7	7	6	5	4	2	2	1	1	0				54
Black oaks									1	1	2	4	5	7	8	7	6	6	4	3	2	1	58
Other intolerant			0	0	1	1	2	3	3	3	2	2	1	1	1	0	0						20
Other tolerant				1	2	2	2	2	2	1	1	1	1	1	0	0							16
Total			0	2	4	5	8	10	12	12	12	13	12	13	11	9	7	7	4	3	2	1	1	148

DISCUSSION AND APPLICATION OF STAND TABLES

The stand tables are based on the assumption that the Pearson type III function fits the diameter distributions of these species groups. They are not expected to apply exactly to individual stands, but give an indication of the diameter range to be expected under natural conditions in extensive forest areas. Since the same percentage values apply on a particular site regardless of age, the same ratios actually found between the species groups in a given stand at the present time may be used at a future age. To predict the future stand the present ratios are computed, by sites, from the samples of the forest in question and then applied to the total number of trees estimated at the future age. To facilitate determination of these frequencies, table 38 is presented. It shows percentage values by mean diameter classes in each species group. The several steps in the computation are as follows:

(1) Estimating the future total number of trees and average diameter from the yield tables.
(2) Computing the future number of trees found in each species group from the present ratios between species.
(3) Reading the mean diameter of each species group from figure 22.
(4) Interpolating the corresponding percentage frequencies from table 38.
(5) Applying to the number of trees in each species group.

TABLE 38.—*Percentage distribution of trees by diameter for various mean diameters in each species group*

WHITE OAKS

Midpoint of diameter breast high class (inches)	Percent of trees by species group of mean diameter of—																					
	1.0 inch	1.5 inches	2.0 inches	2.5 inches	3.0 inches	3.5 inches	4.0 inches	4.5 inches	5.0 inches	5.5 inches	6.0 inches	6.5 inches	7.0 inches	7.5 inches	8.0 inches	9.0 inches	10.0 inches	11.0 inches	12.0 inches	13.0 inches	14.0 inches	15.0 inches	16.0 inches
0.25	9	4	2	1	1																		
1	79	52	31	18	10	6	3	2	1														
2	12	36	41	36	28	20	13	8	5	3	2	1	1	1	1								
3		7	20	28	30	28	24	19	14	9	6	5	3	2	2	1	1	1	1	1			
4		1	5	12	19	23	25	25	22	18	14	10	8	6	5	3	2	1	1	1	1		
5			1	4	8	14	18	21	23	22	20	16	13	11	8	5	4	3	2	2	1		
6				1	3	6	10	14	17	20	20	19	17	15	12	8	6	4	3	2	2		
7					1	2	4	7	10	14	17	18	18	17	15	12	8	6	5	3	2		
8						1	2	3	5	8	11	14	15	16	16	14	11	8	6	5	4		
9							1	1	2	4	6	9	11	13	14	14	12	10	8	6	5		
10									1	1	3	5	7	9	11	13	13	11	9	8	6		
11										1	1	2	4	5	7	11	12	12	10	9	7		
12												1	2	3	5	8	10	11	10	9	8		
13													1	1	2	5	8	10	10	10	9		
14														1	1	3	5	8	9	9	9		
15															1	2	4	6	8	8	9		
16																1	2	4	6	7	8		
17																	1	3	5	6	7		
18																	1	1	3	5	6		
19																		1	2	3	5		
20																			1	2	4		
21																			1	2	3		
22																				1	2		
23																				1	1		
24																					1		

TABLE 38.—*Percentage distribution of trees by diameter for various mean diameters in each species group*—Continued

BLACK OAKS

Midpoint of diameter breast high class (inches)	Percent of trees by species group of mean diameter of—																						
	1.0 inch	1.5 inches	2.0 inches	2.5 inches	3.0 inches	3.5 inches	4.0 inches	4.5 inches	5.0 inches	5.5 inches	6.0 inches	6.5 inches	7.0 inches	7.5 inches	8.0 inches	9.0 inches	10.0 inches	11.0 inches	12.0 inches	13.0 inches	14.0 inches	15.0 inches	16.0 inches
0.25	9	4	1	1																			
1	79	52	30	16	7	3	1																
2	12	36	43	38	29	19	11	5	3	1	1	1											
3		7	20	29	34	32	26	19	12	8	4	3	2	1	1								
4		1	5	12	20	26	30	29	24	18	13	9	6	4	3	1	1						
5			1	3	8	13	19	24	27	25	22	17	13	10	7	3	2	1					
6				1	2	5	9	14	19	23	24	23	20	17	13	7	4	2	1	1			
7						2	3	6	10	14	18	21	21	20	18	13	8	5	3	1	1		
8							1	2	4	7	11	14	17	19	20	17	12	8	5	3	2	1	
9								1	1	3	5	8	11	14	17	18	16	12	8	5	3	2	1
10										1	2	3	6	8	11	16	17	15	12	8	5	3	2
11												1	3	4	6	11	15	16	14	11	8	6	4
12													1	2	3	7	11	15	15	14	11	8	6
13														1	1	4	7	11	14	14	13	11	8
14																2	4	8	11	13	14	12	10
15																1	2	4	8	11	13	13	12
16																	1	2	5	8	11	12	13
17																		1	3	5	8	11	12
18																			1	3	5	8	10
19																				2	3	6	8
20																				1	2	3	6
21																					1	2	4
22																						1	2
23																						1	1
24																							1

OTHER INTOLERANT SPECIES

0.25	11	6	4	4	3	3	2	2	1	1														
1	76	50	31	20	14	10	7	5	4	2	2	1	1											
2	13	35	37	31	24	19	15	11	8	6	4	3	2	1	1	1	1							
3		8	19	25	25	22	20	17	14	11	9	7	5	4	3	2	1	1	1	1				
4		1	7	13	17	19	19	19	17	16	13	11	9	8	5	3	2	2	1	1	1			
5			2	5	10	13	15	17	17	17	16	14	13	11	9	6	4	3	2	2	1	1		
6				2	4	7	10	13	15	16	16	16	15	14	12	9	6	4	3	2	2	1	1	
7					2	4	6	8	10	12	14	15	15	15	14	11	8	6	5	3	2	2	1	1
8					1	2	3	5	7	9	11	12	14	14	14	13	10	8	6	5	4	3	2	1
9						1	2	2	4	5	7	9	11	12	13	14	12	10	8	6	5	4	3	2
10							1	1	2	3	4	6	7	9	10	12	12	11	9	8	6	5	4	3
11									1	1	2	3	4	6	8	10	12	11	10	9	7	6	5	4
12										1	1	2	2	3	5	8	10	11	10	9	8	7	6	5
13											1	1	1	2	3	5	8	9	10	10	9	8	7	6
14												1	1	1	2	3	5	8	9	9	9	9	8	7
15													1	1	2	3	6	8	9	9	9	9	9	8
16														1	2	4	6	8	8	9	9	9	9	9
17															1	2	4	6	7	8	8	9	9	9
18																1	3	5	6	7	8	8	9	9
19																1	2	3	5	6	7	8	8	9
20																	1	2	3	5	6	7	8	8
21																		1	2	4	5	6	7	8
22																			1	2	4	5	6	7
23																				1	2	4	5	6
24																					1	2	4	5

OTHER TOLERANT SPECIES

0.25	20	7																						
1	63	51	35	22	13	5	1																	
2	15	33	44	38	28	23	21	15	9	2														
3	1	7	14	25	34	30	22	17	17	18	15	10	4											
4	1	1	5	10	14	23	26	26	20	16	14	14	16	15	10									
5		1	1	3	7	10	15	19	21	20	18	14	11	12	13									
6			1	1	2	5	7	10	13	16	16	17	16	12	11									
7				1	1	2	5	6	10	11	13	14	15	15	13									
8					1	1	2	4	4	8	9	10	10	12	13									
9						1	1	2	3	4	7	8	9	9	10									
10								1	2	3	4	6	8	8	7									
11									1	1	2	3	4	7	8									
12										1	1	3	4	4	6									
13											1	1	2	3	4									
14													1	2	3									
15														1	2									
16															1									

THE VOLUME TABLES

Volume measurements were obtained from many sources. Previous records obtained from various State, Federal, and private agencies were supplemented by many hundred trees measured by the field parties. In all, between 5,000 and 6,000 tree measurements were assembled.

General volume tables were made for the five important oak species which make up 83 percent of the total basal area of the yield plots, and for seven other species aggregating 9 percent of the basal area. Not one of the other 53 species contains as much as 1 percent of the total basal area. (See table 1.) Reineke and Bruce's (*21*) alinement chart method was used to construct the tables.

Volume of the entire stem, excluding bark, is presented, for the various species, in tables 39–50; merchantable stem with bark to a 4-inch top outside bark in tables 51–62; board-foot volume, International rule, in tables 63–74; and board-foot volume, Scribner rule, in tables 75–83.

The accuracy of each table is shown by the check of the basic tree data with the tabular volumes. These results are presented in table 84.

TABLE 39.—*Total cubic-foot volume table: White oak* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet									Basis: Number of trees
Outside bark	Inside bark	20	30	40	50	60	70	80	90	100	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
3	2.7	0.44	0.61	0.83	.....	.....	.....	.....	.....	.....	75
4	3.6	.76	1.09	1.33	1.76	.....	.....	.....	.....	.....	66
5	4.5	1.15	1.68	2.20	2.71	3.21	.....	.....	.....	.....	54
6	5.4	1.63	2.46	3.12	3.81	4.54	.....	.....	.....	.....	44
7	6.3	2.10	3.20	4.16	5.1	6.08	6.96	.....	.....	.....	73
8	7.3	2.83	4.12	5.40	6.62	7.82	9.04	10.20	.....	.....	72
9	8.2	3.55	5.15	6.72	8.25	9.80	11.35	12.90	.....	.....	48
10	9.1	.....	6.3	8.2	10.2	12.1	14.1	16.0	18.1	.....	41
11	10.0	.....	7.6	9.9	12.3	14.7	17.1	19.5	22.0	.....	34
12	10.9	.....	9.0	11.8	14.6	17.6	20.4	23.3	26.2	29.0	38
13	11.8	.....	.....	13.9	17.2	20.7	23.9	27.4	30.8	34.0	30
14	12.8	.....	.....	16.2	20.0	24.1	27.9	31.8	35.5	39.4	23
15	13.7	.....	.....	18.6	23.1	27.7	32.0	36.6	41.0	45.5	12
16	14.6	.....	.....	21.2	26.4	31.6	36.5	41.6	46.5	52.0	15
17	15.5	.....	.....	.....	29.5	35.7	41.2	47.0	52.8	58.8	12
18	16.5	.....	.....	.....	33.3	39.9	46.2	52.7	59.2	65.8	2
19	17.4	.....	.....	.....	37.2	44.6	51.5	59.0	66.0	73.5	2
20	18.3	.....	.....	.....	.....	.....	57.5	65.5	74.5	82.0	.....
21	19.2	.....	.....	.....	.....	.....	63.5	72.0	81.0	90.0	1
Basis (trees)		40	105	123	185	80	31	53	10	.....	642

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Tennessee, Virginia, and West Virginia. Prepared by the alinement chart method by E. R. Martell in 1928. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.3 percent high. Average percentage deviation, 8.03. Heavy lines indicate limits of basic data.

TABLE 40.—*Total cubic-foot volume table: Black oak* [1]

Diameter, breast high (inches)		Volume (entire stem, less bark), by total height in feet									Basis: Number of trees
Outside bark	Inside bark	20	30	40	50	60	70	80	90	100	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
2	1.7	0.20	0.26	0.33	0.40						
3	2.6	.44	.55	.73	.89						16
4	3.5	.77	1.02	1.29	1.60	1.94					33
5	4.4	1.20	1.60	2.02	2.48	3.02					48
6	5.3	1.73	2.28	2.90	3.58	4.32	5.15				44
7	6.2	2.34	3.12	3.94	4.85	5.88	7.00				39
8	7.1	3.08	4.05	5.10	6.30	7.65	9.10	10.70			47
9	8.0	3.88	5.10	6.45	8.00	9.68	11.50	13.50	15.70		49
10	9.0		6.3	8.0	9.8	11.8	14.1	16.6	19.2	21.8	53
11	9.9			9.6	11.8	14.3	17.0	20.1	23.2	26.4	51
12	10.9			11.3	13.9	17.0	20.2	23.8	27.5	31.2	45
13	11.8			13.3	16.3	19.8	23.7	27.9	32.0	36.5	34
14	12.7			15.4	18.9	22.8	27.5	32.2	37.2	42.0	15
15	13.7			17.6	21.7	26.2	31.4	36.8	42.5	48.0	19
16	14.7				24.6	29.6	35.5	41.8	48.2	55.0	12
17	15.0				27.7	33.5	40.0	47.0	54.4	61.5	12
18	16.6					37.5	44.8	52.5	60.8	68.8	7
19	17.5					41.5	49.8	58.5	68.0	76.6	10
20	18.5					46.0	55.0	65.0	74.0	85.0	6
21	19.5					51.0	60.0	71.0	82.0	93.0	4
22	20.5					55.0	66.0	78.0	90.0	102.0	3
23	21.4					60.0	72.0	85.0	98.0	111.0	
Basis (trees)		6	76	57	79	111	102	76	30	1	537

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New Jersey, New York, Ohio, Tennessee, and West Virginia. Prepared by the alinement chart method by E. R. Martell, J. H. Buell, G. L. Schnur, and R. K. Day in 1928. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.73 percent high. Average percentage deviation, 8.17. Heavy lines indicate limits of basic data.

TABLE 41.—*Total cubic-foot volume table: Scarlet oak* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	20	30	40	50	60	70	80	90	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
3	2.6	0.49	0.68	0.85	1.04					17
4	3.6	.80	1.15	1.46	1.78	2.10				36
5	4.5	1.21	1.74	2.27	2.77	3.27	3.78			52
6	5.5	1.74	2.48	3.20	3.93	4.65	5.45			39
7	6.4	2.26	3.30	4.28	5.30	6.30	7.40	8.50		50
8	7.3	2.92	4.25	5.60	7.00	8.45	9.90	11.40		33
9	8.3	3.62	5.40	7.15	8.99	10.90	12.80	14.80	16.80	32
10	9.2		6.6	8.9	11.1	13.5	16.0	18.4	20.8	41
11	10.2		8.1	10.9	13.8	16.8	19.5	22.3	24.9	49
12	11.1			13.0	16.5	19.8	23.0	26.2	29.3	70
13	12.0			15.2	19.2	23.0	26.6	30.0	33.7	41
14	13.0				22.0	26.3	30.3	34.5	39.0	28
15	13.9				25.0	29.3	34.3	39.5	44.0	12
16	14.8				28.0	33.3	38.8	44.0	49.5	11
17	15.8				31.3	37.5	43.7	49.9	55.5	5
18	16.7					41.5	48.0	55.0	61.5	1
19	17.6					45.5	53.0	60.2	67.5	2
20	18.6					50.3	58.5	67.0	74.5	2
21	19.5					55.0	64.0	72.5	80.2	
22	20.4					59.5	69.0	78.0	88.0	1
Basis (trees)		14	75	55	66	111	134	50	13	518

[1] Measured by the Allegheny and Central States Forest Experiment Stations in Connecticut, Indiana, Maryland, New Jersey, Ohio, Pennsylvania, Tennessee, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1930. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.50 percent low. Average percentage deviation, 7.1. Heavy lines indicate limits of basic data.

TABLE 42.—*Total cubic-foot volume table: Chestnut oak* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet									Basis: Number of trees
Outside bark	Inside bark	20	30	40	50	60	70	80	90	100	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
3	2.5	0.39	0.55	0.72	0.88	1.05					69
4	3.3	.73	1.00	1.30	1.60	1.91					87
5	4.2	1.16	1.60	2.08	2.55	3.01	3.60				77
6	5.1		2.33	3.01	3.70	4.40	5.20				63
7	6.0		3.20	4.16	5.08	6.00	7.15	8.35			71
8	6.9		4.22	5.42	6.62	7.85	9.28	10.70			56
9	7.8		5.35	6.95	8.40	9.85	11.60	13.70	16.30		59
10	8.7		6.7	8.6	10.2	12.2	14.6	17.5	20.6		54
11	9.6		8.6	10.1	12.4	14.9	17.9	21.3	24.5	28.2	49
12	10.5			12.0	14.8	18.0	21.6	25.2	29.1	33.5	54
13	11.4			14.3	17.9	21.4	25.3	29.6	34.1	39.2	32
14	12.3				20.9	24.8	29.3	34.0	39.2	45.0	24
15	13.2				24.0	28.5	33.5	39.0	45.0	52.0	6
16	14.1				27.1	32.2	37.9	44.0	51.0	58.8	2
17	15.1				30.8	36.1	42.7	49.6	57.4	66.0	3
18	16.0					40.2	47.8	55.8	64.0	74.0	1
19	16.9						52.8	61.8	71.2	82.0	
20	17.8						58.0	68.0	78.8	90.0	1
21	18.7						64.0	75.2	86.5	98.5	
22	19.7						70.6	82.0	94.0	107.0	
23	20.6						77.0	89.0	102.0	116.0	1
24	21.5						84.0	96.0	110.0	125.0	
Basis (trees)		7	95	147	177	195	72	14	1	1	709

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, and Pennsylvania. Prepared by the alinement chart method by G. Luther Schnur in 1928. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.71 percent low. Average percentage deviation, 8.7. *Heavy lines indicate limits of basic data.*

TABLE 43.—*Total cubic-foot volume table: Red oak* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet										Basis: Number of trees
Outside bark	Inside bark	20	30	40	50	60	70	80	90	100	110	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
2	1.9	0.18	0.27	0.36								7
3	2.8	.40	.60	.80	1.01							16
4	3.6	.72	1.06	1.42	1.78	2.13						12
5	4.5	1.12	1.66	2.22	2.77	3.32						12
6	5.4		2.39	3.20	3.98	4.75						6
7	6.3		3.25	4.34	5.40	6.45	7.50					16
8	7.2		4.26	5.70	7.08	8.50	9.85	11.20				29
9	8.1		5.38	7.15	8.95	10.65	12.30	14.05	15.70			40
10	9.0		6.7	8.8	11.0	13.0	15.1	17.2	19.3			34
11	10.0		8.1	10.6	13.2	15.8	18.3	20.8	23.3			25
12	10.9		9.6	12.6	15.6	18.6	21.6	24.7	27.6			31
13	11.9			14.7	18.3	21.8	25.3	28.6	32.0	35.5		21
14	12.8			16.9	20.9	25.2	29.0	33.0	36.8	40.8		22
15	13.7			19.4	24.0	28.7	33.2	37.5	42.2	46.6		14
16	14.7				27.2	32.5	37.4	42.6	47.5	52.8		15
17	15.6				30.7	36.5	42.2	48.0	53.6	59.4		9
18	16.6				34.2	40.8	47.0	53.5	60.0	66.5		7
19	17.6				37.8	45.2	52.0	59.5	66.5	74.0		7
20	18.6				42	50	58	66	74	82	89	4
21	19.6				46	55	64	72	81	90	98	3
22	20.6							79	88	98	107	
23	21.6							86	96	106	116	
24	22.5							93	104	115	125	
25	23.5							100	112	124	135	1
26	24.4								121	134	146	
27	25.4								130	144	157	
28	26.4								139	154	168	1
29	27.4								149	165	180	
Basis (trees)		9	20	26	70	104	40	39	18	2		332

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Virginia, and West Virginia. Prepared by the alinement chart method by J. H. Buell in 1928. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.42 percent low. Average percentage deviation, 7.68. Heavy lines indicate limits of basic data.

TABLE 44.—*Total cubic-foot volume table: Hickory* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet										Basis: Number of trees
Outside bark	Inside bark	10	20	30	40	50	60	70	80	90	100	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
1	0.9	0.04	0.07	0.10								47
2	1.8	.12	.22	.32	0.40							78
3	2.7	.25	.45	.65	.85	1.01						66
4	3.6	.41	.75	1.08	1.38	1.67						61
5	4.4		1.12	1.60	2.07	2.56	2.95					39
6	5.3		1.55	2.20	2.85	3.45	4.10					32
7	6.1		2.05	2.90	3.80	4.60	5.50	6.40	7.25			29
8	7.0		2.60	3.75	4.90	6.05	7.20	8.40	9.50			32
9	8.0				6.30	7.80	9.20	10.80	12.10	13.70		30
10	8.9				8.0	9.8	11.5	13.6	15.5	17.4		20
11	9.9				9.6	12.0	14.3	16.6	19.0	21.2		20
12	10.9				11.6	14.2	17.0	19.9	22.6	25.7		15
13	11.9				13.4	16.8	20.0	23.2	26.8	30.0		7
14	12.9				15.6	19.5	23.2	27.2	31.2	34.8		3
15	13.8				18	22	27	31	35	40	44	5
16	14.8				20	25	30	35	40	45	50	2
17	15.8					28	34	39	45	51	57	1
18	16.8						38	44	50	57	64	
19	17.8						42	49	56	64	72	
20	18.8							54	62	70		
21	19.8							60	69	78		
22	20.8							66	76	86		
23	21.8							72	84	95		1
Basis (trees)		38	91	113	77	61	51	41	14	1	1	488

[1] Measured by the Yale Forest School, and Allegheny and Central States Forest Experiment Stations, and others, in Alabama, Arkansas, Connecticut, Indiana, Kentucky, Maryland, Missouri, New York, Ohio, Tennessee, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1929. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. *Aggregate deviation:* Table 0.7 percent low. *Average percentage deviation, 8.9. Heavy lines* indicate limits of basic data.

TABLE 45.—*Total cubic-foot volume table: Virginia pine* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	10	20	30	40	50	60	70	80	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
2	1.8	0.11	0.22	0.32	0.42	0.52				13
3	2.7	.26	.50	.73	.95	1.18	1.39			8
4	3.6	.44	.85	1.23	1.61	2.00	2.40			10
5	4.5	.68	1.28	1.88	2.45	3.00	3.60			14
6	5.4	.95	1.82	2.66	3.50	4.30	5.10	5.90		11
7	6.4	1.29	2.47	3.63	4.80	5.80	6.90	8.00	9.00	18
8	7.3	1.65	3.19	4.68	6.10	7.50	8.90	10.30	11.70	7
9	8.2	2.11	4.00	5.90	7.70	9.50	11.30	13.10	15.00	8
10	9.2		5.0	7.3	9.5	11.9	14.0	16.2	18.6	2
11	10.1		6.0	8.7	11.6	14.2	16.9	19.8	22.5	4
12	11.1			10.3	13.8	16.9	20.1	23.4	26.5	5
13	12.0			12.1	16.0	19.9	23.6	27.3	31.0	8
14	13.0			14.1	18.8	23.3	27.5	32.0	36.0	10
15	14.0				21.7	26.2	31.5	36.0	40.8	1
16	15.1					30.0	35.8	41.2	46.8	
17	16.1					34.0	40.0	46.4	53.5	
18	17.1					38.0	44.8	52.0	59.5	
Basis (trees)		2	21	12	28	30	14	12		119

[1] Measured by the Central States Forest Experiment Station and W. D. Sterrett, in Maryland, Ohio, Pennsylvania, Virginia, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1929. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.03 percent low. Average percentage deviation, 8.3. Heavy lines indicate limits of basic data.

TABLE 46.—*Total cubic-foot volume table: Chestnut* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet										Basis: Number of trees
Outside bark	Inside bark	10	20	30	40	50	60	70	80	90	100	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
1	0.9	0.02	0.06									24
2	1.8	.11	.20	0.29	0.39							28
3	2.8	.22	.42	.62	.81	0.99						29
4	3.7	.38	.72	1.05	1.38	1.72	2.02					37
5	4.6	.6	1.1	1.6	2.1	2.6	3.1	3.6				45
6	5.5			2.3	3.0	3.7	4.4	5.1				55
7	6.4			3.1	4.1	5.0	6.0	6.9	7.7			48
8	7.3			4.1	5.3	6.5	7.7	9.0	10.1	11.4		51
9	8.1				6.6	8.1	9.7	11.2	12.8	14.3		57
10	9.0				8.2	10.0	12.0	13.9	15.8	17.6		58
11	9.9				9.9	12.2	14.8	16.9	19.2	21.4		51
12	10.8				12.0	14.8	17.4	20.3	23.0	25.8	28.2	54
13	11.7				14.0	17.2	20.3	23.4	26.5	30.0	32.8	50
14	12.6				16.0	19.9	23.3	27.0	30.8	34.5	37.6	26
15	13.5				18.4	22.7	26.8	31.0	35.0	39.0	43.0	28
16	14.5					25.2	30.0	34.5	39.0	43.8	48.2	20
17	15.4					28.0	33.0	38.2	43.5	48.5	54.0	21
18	16.4					30.5	36.2	42.0	47.5	53.0	59.0	14
19	17.4						39.5	45.5	51.5	58.0	64.0	6
20	18.4						42.8	49.6	56.5	62.6	69.0	2
21	19.4						45.5	52.0	59.0	66.0	73.0	
Basis (trees)		3	48	52	58	119	168	188	63	5		704

[1] Measured by the Central States Forest Experiment Station, Frothingham, Schwarz, and others in Connecticut, Kentucky, Maryland, New York, Ohio, and Tennessee. Prepared by the alinement chart method by V. A. Clements in 1929. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.4 percent low. Average percentage deviation, 7.4. Heavy lines indicate limits of basic data.

TABLE 47.—*Total cubic-foot volume table: Red maple* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet									Basis: Number of trees
Outside bark	Inside bark	10	20	30	40	50	60	70	80	90	
		Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	
2	1.9	0.12	0.23	0.34	0.44	0.54					67
3	2.9	.27	.51	.73	.96	1.18	1.39				97
4	3.9		.87	1.25	1.65	2.04	2.30	2.78			58
5	4.8			1.89	2.48	3.08	3.60	4.18			38
6	5.7			2.60	3.42	4.25	5.05	5.80			37
7	6.6			3.48	4.55	5.65	6.60	7.70	8.70		55
8	7.5			4.42	5.80	7.20	8.50	10.00	11.10		64
9	8.4			5.60	7.25	9.00	10.60	12.10	13.80		43
10	9.3			6.6	8.7	10.8	12.7	14.5	16.5	18.4	25
11	10.2			8.0	10.6	12.9	15.1	17.5	20.0	22.2	18
12	11.2				12.5	15.2	18.0	21.0	23.8	26.4	11
13	12.2				14.5	17.9	21.2	24.8	27.8	31.0	10
14	13.2				16.8	20.8	24.7	28.3	31.8	35.6	4
15	14.1					24.0	28.2	32.4	36.8	40.8	2
16	15.1					26.9	31.8	36.4	41.5	46.0	1
17	16.1					30.1	35.6	41.0	46.2	51.8	2
18	17.1					33.5	39.8	45.8	51.6	57.8	
Basis (trees)			16	80	106	150	136	38	6		532

[1] Measured by the Yale Forest School, Allegheny and Central States Forest Experiment Stations, and others, in Connecticut, Maryland, Michigan, New York, Ohio, and Pennsylvania. Prepared by the alinement chart method by B. R. Lexen in 1929. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.10 percent high. Average percentage deviation, 7.3. Heavy lines indicate limits of basic data.

TABLE 48.—*Total cubic-foot volume table: Yellow poplar* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet											Basis: Number of trees
Outside bark	Inside bark	10	20	30	40	50	60	70	80	90	100	110	
		Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	
1	0.0	0.04	0.06	0.09									7
2	1.8	.11	.20	.28	0.36								7
3	2.7	.23	.42	.60	.77	0.95							5
4	3.6	.39	.73	1.05	1.30	1.71	2.05	2.35					6
5	4.5		1.11	1.66	2.18	2.68	3.18	3.65					13
6	5.5			2.38	3.14	3.85	4.56	5.30	6.00				10
7	6.4			3.20	4.20	5.20	6.10	7.05	8.00				31
8	7.3			4.20	5.50	6.74	7.95	9.20	10.50				31
9	8.2			5.30	6.90	8.50	10.00	11.70	13.10				25
10	9.2			6.5	8.5	10.5	12.3	14.2	16.2	18.0			28
11	10.1			7.6	10.0	12.4	14.8	17.0	19.2	21.7	24.0		28
12	11.0				12.0	14.7	17.5	20.0	23.0	25.5	28.0	31.0	21
13	12.0					17.0	20.2	23.5	26.7	30.0	33.2	36.0	21
14	12.9					19.5	23.2	27.0	30.8	34.5	38.0	42.0	18
15	13.8					22.4	26.5	31.0	35.4	39.5	44.0	48.0	7
16	14.8						30.0	35.5	40.0	45.0	50.0	55.0	4
17	15.7							39.5	45.0	50.0	56.0	62.0	
18	16.6							44.3	50.0	57.0	63.5	70.0	1
19	17.5							49.9	56.0	63.5	70.0	78.0	
20	18.5							54	63	70	78	86	
21	19.4							60	70	78	87	95	1
22	20.4							66	76	86	95	105	
23	21.3							72	83	94	104	115	
24	22.2							80	90	101	113	125	
Basis (trees)		4	10	7	13	27	82	93	20	3	5		264

[1] Measured by the Appalachian and Central States Forest Experiment Stations in Ohio and West Virginia. Prepared by the alinement chart method by L. I. Barrett in 1930. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.04 percent low. Average percentage deviation, 6.3. Heavy lines indicate limits of basic data.

TABLE 49.—*Total cubic-foot volume table: Red gum* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet												Basis: Number of trees
Outside bark	Inside bark	10	20	30	40	50	60	70	80	90	100	110	120	
		Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	
2	1.5	0.09	0.16	0.22	0.28	0.34	.....	.....	.....	.....	.....	.....	.....	21
3	2.4	.20	.36	.50	.64	.78	.....	.....	.....	.....	.....	.....	.....	23
4	3.3	.34	.62	.87	1.13	1.39	.....	.....	.....	.....	.....	.....	.....	21
5	4.2	.....	.94	1.28	1.66	2.03	2.37	.....	.....	.....	.....	.....	.....	12
6	5.1	.....	1.20	1.84	2.39	2.91	3.45	4.00	.....	.....	.....	.....	.....	16
7	6.1	.....	1.75	2.50	3.25	4.10	4.90	5.70	6.50	.....	.....	.....	.....	15
8	7.1	.....	.....	3.30	4.40	5.50	6.55	7.70	9.00	10.20	11.40	.....	.....	20
9	8.1	.....	.....	4.33	5.75	7.30	8.70	10.40	12.00	13.80	15.30	.....	.....	14
10	9.1	.....	.....	5.5	7.4	9.4	11.3	13.5	15.6	17.7	19.8	20.8	.....	16
11	10.1	.....	.....	.....	9.2	11.8	14.1	16.7	19.2	21.8	24.0	25.4	.....	21
12	11.1	.....	.....	.....	11.2	14.4	17.0	20.0	23.0	26.0	29.0	31.0	.....	25
13	12.1	.....	.....	.....	.....	16.9	20.4	23.8	27.3	31.0	34.0	36.0	.....	34
14	13.0	.....	.....	.....	.....	19.7	23.5	27.3	32.0	36.0	39.5	42.0	44.0	27
15	14.0	.....	.....	.....	.....	.....	27.0	32.0	37.0	41.5	46.0	48.5	50.0	19
16	14.9	.....	.....	.....	.....	.....	31.3	36.3	42.0	47.5	52.5	55.5	58.0	23
17	15.9	.....	.....	.....	.....	.....	35.5	41.5	48.0	54.0	59.5	63.0	65.0	22
18	16.9	.....	.....	.....	.....	.....	39.5	46.0	54.0	60.0	66.0	70.0	72.5	12
19	17.8	.....	.....	.....	.....	.....	44.5	52.0	60.0	67.0	74.0	78.0	82.0	9
20	18.7	.....	.....	.....	.....	.....	.....	58	66	74	82	87	90	7
21	19.7	.....	.....	.....	.....	.....	.....	63	73	82	90	95	99	9
22	20.6	.....	.....	.....	.....	.....	.....	69	80	90	99	104	109	3
23	21.6	.....	.....	.....	.....	.....	.....	75	87	98	109	114	119	2
24	22.6	.....	.....	.....	.....	.....	.....	82	95	107	118	124	130	5
25	23.6	.....	.....	.....	.....	.....	.....	89	103	115	128	135	140	.....
Basis (trees)		3	23	52	27	21	17	24	62	61	71	14	3	381

[1] Measured by the Central States Forest Experiment Station and Chittenden, in Indiana, Missouri, and South Carolina. Prepared by the alinement chart method by H. R. Lexen in 1929. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.3 percent high. Average percentage deviation, S.I. Heavy lines indicate limits of basic data.

TABLE 50.—*Total cubic-foot volume table: Black cherry* [1]

Diameter breast high (inches)		Volume (entire stem, less bark), by total height in feet										Basis: Number of trees
Outside bark	Inside bark	20	30	40	50	60	70	80	90	100	110	
		Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
2	1.9	0.26	0.36	0.46								2
3	2.9	.54	.73	.95								13
4	3.8	.83	1.22	1.60	1.94	2.30						15
5	4.8	1.3	1.9	2.4	3.0	3.6	4.1					3
6	5.7		2.6	3.4	4.4	5.0	5.8	6.7				13
7	6.6		3.5	4.8	5.7	6.8	8.0	9.0				11
8	7.6		4.6	6.1	7.5	9.0	10.5	11.8	13.2			13
9	8.5			7.6	9.5	11.3	13.0	15.0	16.8			11
10	9.4			9.5	11.8	14.0	16.2	18.5	21.0	23.2		3
11	10.4			11.4	14.2	16.8	19.8	22.3	25.0	27.8		19
12	11.3			13.4	16.8	20.0	23.2	26.5	30.0	33.0	36.0	16
13	12.2				19.5	23.2	27.2	31.0	35.0	39.0	43.0	16
14	13.2				22.7	27.0	32.0	36.9	41.9	46.0	50.5	14
15	14.1				26.0	31.5	36.5	42.0	46.5	53.0	58.0	6
16	15.0				29.5	35.5	41.5	47.5	54.0	60.0	67.0	2
17	16.0					40.5	47.5	54.5	61.5	68.0	76.0	2
18	16.9					45.0	53.0	60.0	68.0	77.0	85.0	
19	17.9					51.0	59.0	68.0	78.0	87.0	96.0	
20	18.8						65.0	76.0	89.0	96.0	105.0	
Basis (trees)		6	16	14	30	20	8	44	18			159

[1] Measured by the Allegheny and Central States Forest Experiment Stations in Ohio and Pennsylvania. Prepared by the alinement chart method by O. Luther Schnur in 1929. Volume computed from tree graphs by the planimeter method. Stumps 1.0 foot high cubed as cylinders. Aggregate deviation: Table 0.06 percent low. Average percentage deviation, 7.15. Heavy lines indicate limits of basic data.

TABLE 51.—*Merchantable cubic-foot volume table: White oak* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark) by total height in feet										Basis: Number of trees
	20	30	40	50	60	70	80	90	100	110	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
4		0.15	0.62	1.16							74
5	0.42	1.16	1.76	2.37	3.02	3.68					59
6	1.33	2.00	2.93	3.81	4.72	5.70					45
7	2.14	3.20	4.32	5.52	6.72	8.04	9.40				63
8		4.44	5.92	7.47	9.09	10.80	12.30				82
9		5.84	7.72	9.60	11.50	13.50	15.60				52
10			9.7	11.9	14.3	16.7	19.3	22.0			42
11			11.7	14.5	17.3	20.1	23.3	26.4	30.0		36
12			14.1	17.4	20.6	24.0	27.7	31.4	35.5		33
13			16.5	20.3	24.1	28.0	32.3	36.4	41.2		33
14				23.3	27.8	32.5	37.0	42.0	47.2	52.6	29
15				26.8	31.8	36.8	42.3	47.8	54.0	59.9	15
16				30.5	36.0	41.6	47.8	54.0	61.0	67.0	15
17				34.0	40.0	46.5	53.2	60.0	68.0	75.0	13
18				38.0	45.0	52.0	60.0	67.0	75.0	83.0	5
19				42.0	50.0	58.0	66.0	74.0	83.0	92.0	2
20							72	81	91	101	
21							78	88	100	110	1
22							86	96	108	119	
Basis (trees)	1	73	102	159	143	30	48	40	3		599

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Pennsylvania, Tennessee, and West Virginia. Prepared by the alinement chart method by E. R. Martell in 1928. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.16 percent high. Average percentage deviation (525 trees, 5 inches plus), 8.07. Heavy lines indicate limits of basic data.

TABLE 52.—*Merchantable cubic-foot volume table: Black oak* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet									Basis: Number of trees
	20	30	40	50	60	70	80	90	100	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
5	0.89	1.23	1.57	1.90	2.27					48
6	1.58	2.21	2.86	3.50	4.19	4.92				44
7	2.30	3.25	4.22	5.20	6.25	7.40				39
8	3.06	4.40	5.74	7.15	8.50	10.10	11.70			47
9	3.80	5.60	7.38	9.12	11.10	13.10	15.20	17.30		49
10		7.0	9.2	11.4	13.9	16.3	18.9	21.8	24.6	43
11			11.2	14.0	16.8	19.9	23.2	26.5	30.0	51
12			13.4	16.7	20.2	23.8	27.7	31.8	35.8	45
13			15.8	19.6	23.7	27.9	32.5	37.2	42.0	34
14			18.3	22.9	27.6	32.8	38.0	43.2	48.8	15
15			21.0	26.3	32.0	37.8	43.5	49.8	56.5	19
16			24.0	30.0	36.2	42.8	49.6	56.8	63.0	12
17				33.9	40.8	48.2	56.1	64.0	72.0	12
18					45.7	54.3	62.8	71.5	80.8	7
19					51.2	60.0	69.9	80.0	90.0	10
20					56	67	77	88	100	6
21					62	73	85	98	110	4
22					68	81	94	107	121	3
23					74	88	102	118	133	
Basis (trees)	2	43	45	78	111	101	70	31	1	488

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Pennsylvania, Tennessee, and West Virginia. Prepared by the alinement chart method by J. H. Buell and E. R. Martell in 1928. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.1 percent low. Average percentage deviation (488 trees, 5 inches plus), 9.5. Heavy lines indicate limits of basic data.

TABLE 53.—*Merchantable cubic-foot volume table: Scarlet oak* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet								Basis: Number of trees
	20	30	40	50	60	70	80	90	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
5	1.05	1.34	1.60	2.01	2.40	2.78			80
6	1.08	2.24	2.91	3.65	4.41	5.17			39
7	2.30	3.25	4.25	5.40	6.50	7.70	8.95		50
8	3.13	4.40	5.75	7.40	9.10	10.90	12.40		33
9	4.00	5.05	7.50	9.75	12.00	14.00	16.10	18.00	32
10		7.0	9.4	12.0	14.8	17.1	19.7	22.0	41
11		8.5	11.6	14.8	17.9	20.9	24.0	26.9	49
12			13.8	17.5	21.2	24.9	28.5	32.1	70
13			16.1	20.4	24.9	29.0	33.5	37.7	41
14				23.8	29.0	34.0	38.8	44.0	28
15				27.2	33.5	39.0	44.5	50.2	12
16				31.0	37.7	44.0	50.5	57.0	11
17				34.5	42.5	49.8	57.0	64.0	5
18					48.0	55.5	64.0	71.0	1
19					53.0	62.0	70.0	79.5	2
20					58.5	68.0	77.5	87.0	2
21					64.0	75.0	85.0	96.0	
22					70.0	82.0	93.5	104.0	1
Basis (trees)	6	63	54	66	111	134	50	13	497

[1] Measured by the Allegheny and Central States Forest Experiment Stations in Connecticut, Indiana, Maryland, New Jersey, Ohio, Pennsylvania, Tennessee, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1930. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.12 percent high. Average percentage deviation (449 trees, 5.0 inches and over), 7.1. Heavy lines indicate limits of basic data.

TABLE 54.—*Merchantable cubic-foot volume table: Chestnut oak* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet								Basis: Number of trees
	30	40	50	60	70	80	90	100	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
4	0.09	0.51	0.94	1.48	------	------	------	------	83
5	1.00	1.69	2.41	3.20	4.00	------	------	------	77
6	2.20	3.08	4.08	5.22	6.30	------	------	------	63
7	3.55	4.70	6.00	7.50	8.88	10.25	------	------	71
8	5.05	6.55	8.20	9.95	11.60	13.30	------	------	56
9	6.68	8.50	10.45	12.55	14.55	16.50	18.60	------	59
10	8.5	10.5	12.8	15.5	17.5	20.3	22.8	25.2	54
11	10.2	12.6	15.3	18.4	21.1	24.0	27.0	29.9	49
12	------	14.9	18.0	21.6	25.0	28.4	31.5	35.0	54
13	------	17.2	20.9	25.0	28.8	32.5	36.2	40.2	32
14	------	------	24.0	28.6	32.9	37.2	41.7	45.8	24
15	------	------	27.3	32.2	37.2	42.3	46.8	51.8	6
16	------	------	30.5	36.0	42.0	47.0	52.0	57.0	2
17	------	------	34.0	40.0	46.0	52.0	58.0	64.0	3
18	------	------	------	45.0	51.0	58.0	64.0	70.0	1
19	------	------	------	49.0	56.0	63.0	70.0	77.0	------
20	------	------	------	------	62	69	77	84	1
21	------	------	------	------	67	75	83	92	------
22	------	------	------	------	72	81	90	99	------
23	------	------	------	------	78	87	96	106	1
24	------	------	------	------	84	94	105	114	------
Basis (trees)	45	134	177	192	72	14	1	1	636

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, and Pennsylvania. Prepared by the alinement chart method by G. Luther Schnur in 1928. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.73 percent low. Average percentage deviation (553 trees, 5.0 inches and over), 9.77. Heavy lines indicate limits of basic data.

TABLE 55.—*Merchantable cubic-foot volume table: Red oak* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet									Basis: Number of trees
	30	40	50	60	70	80	90	100	110	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
4	0.22	0.57	0.90	1.30						5
5	1.11	1.59	2.17	2.78						13
6	2.15	2.86	3.64	4.48						6
7	3.39	4.33	5.32	6.48	7.05					16
8	4.78	6.05	7.25	8.75	10.30	11.80				29
9	6.28	7.70	9.45	11.05	13.00	15.10	17.60			46
10	7.9	9.8	11.8	14.0	16.3	18.9	22.0			34
11	9.8	12.0	14.3	17.0	20.0	23.0	26.7			25
12	11.8	14.3	17.1	20.4	23.8	27.4	31.6	36.5		31
13		16.8	20.2	23.9	27.9	32.3	37.0	42.9		21
14		19.7	23.7	27.8	32.5	37.4	43.2	50.2		22
15		22.8	27.3	32.2	37.3	43.0	49.9	57.2		14
16			31.0	36.5	42.6	49.2	56.5	65.2		15
17			35.1	41.4	48.2	55.5	63.9	73.0		9
18			39.4	46.4	53.8	62.0	71.0	82.0		7
19			43.8	51.6	60.0	68.8	78.8	90.5	102.0	7
20			48.5	57.0	66.5	76.0	87.4	100.5	112.0	4
21			53.4	63.0	72.8	83.5	95.5	110.5	124.0	3
22						91.0	105.0	121.0	136.0	
23						100.0	115.0	132.0	148.0	
24						108.0	125.0	144.0	160.0	
25						117	135	156	174	1
26							145	168	188	
27							156	180	205	
28							168	195	232	1
29							180	218	262	
Basis (trees)	3	20	69	103	59	39	16	2		302

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Virginia, and West Virginia. Prepared by the alinement chart method by J. H. Buell in 1928. Volume computed from tree graphs by the planimeter method. Stump height, 1.0 foot. Aggregate deviation: Table 0.66 percent low. Average percentage deviation (297 trees, 5.0 inches and over), 8.14. Heavy lines indicate limits of basic data.

TABLE 56.—*Merchantable cubic-foot volume table: Hickory* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet										Basis: Number of trees
	20	30	40	50	60	70	80	90	100	110	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
5	0.83	1.13	1.44	1.78	2.10	2.40					49
6	1.35	2.01	2.67	3.35	3.95	4.65	5.20				37
7	1.96	2.94	3.95	4.95	6.00	6.95	8.00				42
8		4.00	5.42	6.85	8.25	9.80	11.20	12.50			39
9		5.20	7.10	8.95	10.90	12.70	14.40	16.00			47
10		6.5	8.8	11.3	13.4	15.5	17.9	20.0	22.0		49
11		8.0	11.0	13.6	16.3	19.1	21.8	24.3	26.9		35
12			13.0	16.2	19.6	22.9	25.9	28.3	32.0		18
13			15.2	19.2	23.0	26.7	30.5	34.0	38.0		27
14			17.8	22.2	26.5	31.2	35.5	40.0	44.0		15
15			20.5	25.5	30.8	36.0	41.5	46.0	52.0	56.0	10
16			23.0	29.1	35.0	41.0	46.5	53.0	59.0	64.0	5
17				32.5	39.5	46.0	53.0	60.0	67.0	73.0	5
18				37.0	44.0	52.5	60.0	68.0	76.0	83.0	
19				41.5	50.0	59.0	67.5	77.0	86.0	94.0	
20					55.5	65.0	76.0	86.0	96.0	104.0	
21					62.0	73.0	85.0	96.0	106.0	115.0	
22					68.0	81.0	94.0	106.0	116.0	125.0	
23					76.0	89.0	102.0	115.0	126.0	137.0	1
Basis (trees)		13	52	87	86	80	39	19	2	1	379

[1] Measured by the Yale Forest School, Allegheny and Central States Forest Experiment Stations, and others, in the States of Alabama, Arkansas, Connecticut, Indiana, Kentucky, Maryland, Missouri, New York, Ohio, Tennessee, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1929. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.2 percent low. Average percentage deviation (379 trees 5.0 inches and over) 10.2. Heavy lines indicate limits of basic data.

TABLE 57.—*Merchantable cubic-foot volume table: Virginia pine* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet								Basis: Number of trees
	20	30	40	50	60	70	80	90	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
5	0.08	1.42	1.95	2.43	2.83				50
6	1.63	2.32	3.15	4.05	4.85	5.55			28
7	2.20	3.13	4.40	5.80	7.10	8.40			38
8		4.02	5.85	7.90	9.85	11.50	13.10		29
9		5.10	7.50	10.40	12.90	15.00	16.80		18
10		6.2	9.4	13.0	15.8	18.2	20.2		6
11			11.4	15.6	18.9	21.6	23.9	26.2	10
12			13.8	18.4	22.0	25.0	27.8	30.5	8
13			15.9	21.1	25.1	29.0	32.0	35.3	9
14			18.2	23.8	28.8	33.0	36.5	40.2	11
15			20.6	27.0	32.3	37.2	41.3	45.5	1
16				30.2	36.2	41.5	46.2	51.0	
17				33.3	40.0	46.0	51.3	56.2	
18				37.0	44.0	51.0	56.5	62.0	
Basis (trees)		13	46	88	44	16	1		208

[1] Measured by the Central States Forest Experiment Station and W. D. Sterrett in Maryland, Ohio, Pennsylvania, Virginia, and West Virginia. Prepared by the alinement chart method by B. R. Lexen in 1929. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.2% percent low. Average percentage deviation (208 trees) 8.6. Heavy lines indicate limits of basic data.

TABLE 58.—*Merchantable cubic-foot volume table: Chestnut* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet									Basis: Number of trees
	20	30	40	50	60	70	80	90	100	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
5	0.9	1.2	1.6	2.0	2.3	2.7				45
6	1.6	2.3	3.0	3.6	4.3	5.0				55
7		3.3	4.3	5.3	6.3	7.4	8.5	9.5		49
8		4.4	5.7	7.2	8.6	9.9	11.4	13.0		51
9		5.6	7.5	9.4	11.2	13.2	15.2	17.2		58
10			9.3	11.5	14.1	16.4	18.8	21.2		64
11			11.2	14.4	17.2	20.0	23.0	25.8		62
12			13.8	17.1	20.6	23.8	27.0	30.1		63
13			16.0	20.0	24.0	28.0	31.9	35.4	39.8	59
14			18.9	23.2	28.0	32.2	36.5	41.6	45.5	42
15			22	27	32	37	42	47	52	37
16				30	36	42	47	52	58	32
17				34	40	46	52	59	65	28
18				38	45	52	59	65	72	23
19				42	50	57	65	72	79	11
20				46	55	63	71	79	87	5
21				50	60	69	77	86	94	3
22				55	65	74	84	92	100	3
23				60	71	81	91	100	108	4
24					77	88	98	106	114	2
25					84	95	104	112	122	2
26					90	102	110	120	130	1
27					96	107	117	126	136	
Basis (trees)	1	8	36	118	194	235	100	7		699

[1] Measured by the Central States Forest Experiment Station, Frothingham, Schwarz, and others in Connecticut, Kentucky, Maryland, New York, Ohio, and Tennessee. Prepared by the alinement chart method by V. A. Clements in 1929. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.2 percent low. Average percentage deviation (699 trees) 7.7. Heavy lines indicate limits of basic data.

TABLE 59.—*Merchantable cubic-foot volume table: Red maple* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet							Basis: Number of trees
	30	40	50	60	70	80	90	
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	
5	1.38	1.78	2.15	2.52	2.90	3.25	.....	38
6	2.47	3.18	3.88	4.50	5.25	5.80	.....	37
7	3.52	4.56	5.64	6.55	7.55	8.50	.....	55
8	4.68	6.10	7.50	8.80	10.10	11.50	.....	65
9	5.90	7.70	9.50	11.20	12.80	14.60	.....	42
10	7.2	9.4	11.5	13.6	15.7	17.8	19.8	25
11	8.6	11.3	13.9	16.3	18.9	21.6	24.0	18
12	10.1	13.2	16.3	19.3	22.5	25.5	28.6	11
13	11.6	15.4	19.0	22.6	26.1	29.8	33.3	10
14	13.4	17.7	22.0	26.0	30.2	34.5	38.8	4
15	.....	.....	25.2	30.0	34.8	39.5	44.4	2
16	.....	.....	28.3	34.0	39.2	44.8	50.0	1
17	.....	.....	31.5	37.8	44.0	50.2	57.0	2
18	.....	.....	35.5	42.3	49.5	57.0	63.0	.....
19	.....	.....	39.2	47.0	55.0	63.0	70.0	.....
Basis (trees)	.....	15	117	136	36	0	.....	310

[1] Measured by the Yale Forest School, Allegheny and Central States Forest Experiment Stations, and others, in Connecticut, Maryland, Michigan, New York, Ohio, and Pennsylvania. Prepared by the alinement chart method by B. R. Lexen in 1929. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.22 percent low. Average percentage deviation (310 trees) 8.5. Heavy lines indicate limits of basic data.

TABLE 60.—*Merchantable cubic-foot volume table: Yellow poplar* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet										Basis: Number of trees
	20	30	40	50	60	70	80	90	100	110	
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	
5	0.93	1.26	1.59	1.95	2.33	2.7[illegible]	.....	.....	.....	.....	13
6	1.57	2.18	2.80	3.50	4.22	5.00	5.95	.....	.....	.....	10
7	.....	3.10	4.03	5.05	6.25	7.45	8.75	.....	.....	.....	30
8	.....	4.15	5.48	6.90	8.50	10.10	11.80	.....	.....	.....	32
9	.....	5.30	7.00	8.90	10.90	12.80	15.00	.....	.....	.....	25
10	.....	6.5	8.6	10.9	13.0	15.5	18.1	20.6	.....	.....	29
11	.....	.....	10.5	13.0	15.8	18.7	21.8	24.8	27.0	.....	29
12	.....	.....	12.2	15.2	18.6	22.0	25.8	29.0	32.0	34.8	20
13	.....	.....	14.1	17.6	21.4	25.4	30.0	34.0	37.8	41.0	21
14	.....	.....	.....	20.2	24.7	29.0	34.7	39.8	44.0	48.0	18
15	.....	.....	.....	23.0	28.1	33.8	40.0	46.0	51.0	55.5	7
16	.....	.....	.....	25.8	31.8	38.0	45.5	52.5	58.0	64.0	4
17	.....	.....	.....	.....	35.5	43.0	51.5	59.5	66.5	72.5	.....
18	.....	.....	.....	.....	.....	.....	.....	67.5	75.0	82.5	1
19	.....	.....	.....	.....	.....	.....	.....	75.5	85.0	93.0	.....
20	.....	.....	.....	.....	.....	.....	.....	86	95	106	.....
21	.....	.....	.....	.....	.....	.....	.....	95	108	118	1
22	.....	.....	.....	.....	.....	.....	.....	109	120	130	.....
Basis (trees)	.....	1	10	25	82	95	19	3	5	.....	240

[1] Measured by the Appalachian and Central States Forest Experiment Stations in Ohio, Pennsylvania, Virginia, and West Virginia. Prepared by the alinement chart method by L. I. Barrett in 1929. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.39 percent high. Average percentage deviation (234 trees, 5.0 inches plus) 6.6. Heavy lines indicate limits of basic data.

TABLE 61.—*Merchantable cubic-foot volume table: Red gum* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark), by total height in feet												Basis: Number of trees
	20	30	40	50	60	70	80	90	100	110	120	130	
	Cu. ft.	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	*Cu. ft.*	
5	0.6	1.0	1.3	1.6	.....	.....	.....	.....	.....	.....	.....	.....	12
6	1.1	1.7	2.2	2.7	3.2	3.8	.....	.....	.....	.....	.....	.....	16
7	1.6	2.4	3.1	4.0	4.9	6.0	7	.....	.....	.....	.....	.....	15
8	.....	3.2	4.4	5.7	7.1	8.5	10	12	.....	.....	.....	.....	20
9	.....	4.2	5.9	7.8	9.8	12.0	14	17	19	.....	.....	.....	14
10	.....	5.4	7.6	10.0	13.0	16.0	18	21	23	25	.....	.....	18
11	.....	.....	10	13	17	20	23	25	28	30	.....	.....	21
12	.....	.....	12	16	20	24	27	30	33	36	.....	.....	25
13	.....	.....	.....	19	23	27	31	35	38	42	.....	.....	34
14	.....	.....	.....	23	27	31	36	40	44	48	53	.....	27
15	.....	.....	.....	.....	31	36	41	46	51	56	61	.....	19
16	.....	.....	.....	.....	35	41	47	53	58	64	69	73	23
17	.....	.....	.....	.....	40	46	52	59	65	71	77	83	23
18	.....	.....	.....	.....	44	52	59	66	73	80	87	94	12
19	.....	.....	.....	.....	49	57	65	73	81	89	97	104	9
20	.....	.....	.....	.....	54	63	72	81	90	99	108	115	7
21	.....	.....	.....	.....	.....	70	80	90	99	109	118	126	9
22	.....	.....	.....	.....	.....	77	88	99	110	120	130	140	3
23	.....	.....	.....	.....	.....	85	97	109	120	131	142	152	2
24	.....	.....	.....	.....	.....	93	106	119	131	143	155	167	6
25	.....	.....	.....	.....	.....	100	114	129	142	155	169	180	.....
Basis (trees)	.....	11	24	24	17	24	62	61	73	14	3	.....	313

[1] Measured by the Central States Forest Experiment Station and Chittenden in Indiana, Missouri, and South Carolina. Prepared by the alinement chart method by J. H. Hanley in 1929. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.03 percent high. Average percentage deviation (313 trees) 10.0. Heavy lines indicate limits of basic data.

TABLE 62.—*Merchantable cubic-foot volume table: Black cherry* [1]

Diameter breast high (inches)	Volume (to a 4.0-inch top outside bark) by total height in feet								Basis: Number of trees
	30	40	50	60	70	80	90	100	
	Cubic feet	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	*Cubic feet*	
4	0.27	0.45	0.55	0.63	.....	.....	.....	.....	7
5	1.0	1.8	2.2	2.7	3.2	.....	.....	.....	7
6	1.7	3.2	4.0	4.8	5.5	6.0	.....	.....	8
7	2.4	4.5	5.8	7.0	8.1	8.9	.....	.....	13
8	3.1	5.9	7.6	9.2	10.7	11.8	13.2	.....	13
9	.....	7.4	9.7	11.6	13.5	14.8	16.5	.....	8
10	.....	9.0	11.8	14.3	16.5	18.2	20.2	21.9	7
11	.....	10.7	14.0	16.8	19.5	21.3	23.2	25.2	12
12	.....	12.8	16.8	20.2	22.9	25.2	27.8	30.3	12
13	.....	.....	20.0	23.8	27.0	30.1	33.5	37.0	16
14	.....	.....	23.7	28.5	33.0	37.0	42.0	47.0	15
15	.....	.....	28.5	36.0	41.0	46.0	55.5	63.0	14
16	.....	.....	36.0	46.0	56.0	67.0	82.0	98.0	6
Basis (trees)	4	9	29	31	5	44	15	.....	137

[1] Measured by the Allegheny and Central States Forest Experiment Stations in Ohio and Pennsylvania. Prepared by the alinement chart method by G. L. Schnur in 1929. Volume computed from tree graphs by the planimeter method. Stump height 1.0 foot. Aggregate deviation: Table 0.06 percent high. Average percentage deviation (137 trees) 7.88. Heavy lines indicate limits of basic data.

TABLE 63.—*Board-foot volume table International (¼-inch) rule: White oak*[1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark) by total height in feet								Basis: Number of trees
Outside bark	Inside bark	30	40	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.3	0	1	0	14	20				72
8	7.3	2	9	20	28	35	42			72
9	8.2	6	21	31	40	49	59			48
10	9.1	16	29	41	53	65	78	91		41
11	10.0	23	37	52	66	82	98	114		33
12	10.9	29	45	64	82	101	121	141	161	38
13	11.8		54	76	98	122	146	170	195	30
14	12.8		65	91	117	145	175	203	231	23
15	13.7		76	107	139	172	206	238	273	12
16	14.6		88	123	160	198	237	277	314	15
17	15.5			142	184	228	272	320	364	12
18	16.5			162	210	260	312	364	415	2
19	17.4			182	237	295	354	412	470	2
20	18.3					330	395	464	530	
21	19.2					368	442	515	590	1
22	20.1					410	490	570	660	
Basis (trees)		2	52	165	80	31	52	19		401

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Pennsylvania, Tennessee, and West Virginia. Prepared by the alinement chart method by R. K. Day in 1923. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.38 percent low. Average percentage deviation (358 trees, 8.6 inches inside bark plus) 13.87. Heavy lines indicate limits of basic data.

TABLE 64.—*Board-foot volume table International (¼-inch) rule: Black oak*[1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark) by total height in feet								Basis: Number of trees
Outside bark	Inside bark	30	40	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.2	0	0	6	16	24				29
8	7.1	0	7	20	29	37	45			47
9	8.0	3	18	30	41	52	64	77		48
10	9.0		27	40	53	68	84	102	123	43
11	9.9		34	49	66	85	105	128	152	51
12	10.9		41	60	82	105	130	156	187	45
13	11.8		49	72	98	127	156	188	226	34
14	12.7		58	85	117	149	184	225	270	15
15	13.7		68	101	137	176	218	265	315	19
16	14.7			117	158	202	252	308	362	12
17	15.6			134	180	232	292	350	415	12
18	16.6				204	265	328	396	473	7
19	17.5				230	298	370	445	533	10
20	18.5				260	332	410	498	595	6
21	19.5				288	370	460	558	660	4
22	20.5				320	410	505	615	740	3
23	21.4				350	450	560	675	815	
Basis (trees)		1	10	50	105	103	75	31	1	385

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New Jersey, New York, Ohio, Tennessee, and West Virginia. Prepared by the alinement chart method by E. R. Martell in 1928. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.55 percent low. Average percentage deviation (351 trees, 8.0 inches inside bark plus) 14.7. Heavy lines indicate limits of basic data.

TABLE 65.—*Board-foot volume table International (¼-inch) rule: Scarlet oak* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet						Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.4	3	11	20	27	35		43
8	7.3	9	25	36	46	56		32
9	8.3	19	38	52	65	78	95	32
10	9.2	29	52	69	85	102	124	41
11	10.2	38	65	85	107	126	151	49
12	11.1	47	78	104	128	150	184	70
13	12.0	56	94	121	149	179	219	41
14	13.0		109	140	176	210	254	28
15	13.9		125	161	202	240	292	12
16	14.8		140	185	230	274	332	11
17	15.8		160	210	260	310	377	5
18	16.7			234	290	345	420	1
19	17.6			259	319	382	460	2
20	18.6			287	355	423	510	2
21	19.5			315	390	462	560	
22	20.4			343	425	502	610	1
Basis (trees)		9	54	110	134	50	13	370

[1] Mensured by the Allegheny and Central States Forest Experiment Stations in Connecticut, Indiana, Maryland, New Jersey, Ohio, Pennsylvania, Tennessee, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1930. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.54 percent high. Average percentage deviation (257 trees, 9.0 inches inside bark plus) 11.7. Heavy lines indicate limits of basic data.

TABLE 66.—*Board-foot volume table International (¼-inch) rule: Chestnut oak* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	30	40	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.0	0	3	12	19	24	29			71
8	6.9	3	14	24	31	37	44			56
9	7.8	11	24	33	42	51	60			59
10	8.7	19	31	43	54	66	78			54
11	9.6	25	39	53	68	82	96	112		49
12	10.5	31	47	65	83	101	119	137		54
13	11.4	37	56	77	98	120	143	163		32
14	12.3		66	90	116	141	167	192		24
15	13.2		77	105	134	163	194	224		6
16	14.1			121	155	189	223	258		2
17	15.1			137	176	215	254	293		3
18	16.0				198	241	287	330		1
19	16.9					270	320	370		
20	17.8					300	355	412	465	1
21	18.7					332	392	455	515	
22	19.7					365	432	500	565	
23	20.6					400	473	545	622	1
24	21.4					438	520	600	680	
Basis (trees)		3	52	173	138	40	6	1		413

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, and Pennsylvania. Prepared by the alinement chart method by E. R. Martell in 1928. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.48 percent low. Average percentage deviation (342 trees, 8.0 inches inside bark plus) 14.0. Heavy lines indicate limits of basic data.

TABLE 67.—*Board-foot volume table International (¼-inch) rule: Red oak* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	30	40	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.3	2	7	13	18	24				16
8	7.2	9	16	24	31	39	47			29
9	8.1	16	25	34	44	54	66	79		40
10	9.0	24	34	46	58	72	87	104	125	34
11	10.0		43	58	73	89	110	130	157	25
12	10.9		54	71	89	110	134	159	190	31
13	11.9		66	85	107	131	160	190	230	21
14	12.8		77	100	126	156	187	225	271	22
15	13.7		89	117	146	180	220	260	315	14
16	14.7			135	168	210	252	302	360	15
17	15.6			154	192	240	288	344	414	9
18	16.6			173	218	270	325	390	470	7
19	17.6			195	245	301	368	440	530	7
20	18.6			219	274	338	408	490	588	4
21	19.6			242	303	372	454	540	650	3
22	20.6						500	592	718	
23	21.6						545	650	785	
24	22.5						590	708	860	1
25	23.5							770	930	
26	24.4							830	1,010	
27	25.4							900	1,095	
28	26.4							980	1,195	1
29	27.4							1,050	1,270	
Basis (trees)			9	60	103	50	30	16	2	279

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Virginia, and West Virginia. Prepared by the alinement chart method by J. H. Buell in 1928. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 1.03 percent low. Average percentage deviation (262 trees, 8.0 inches inside bark plus) 11.87. Heavy lines indicate limits of basic data.

TABLE 68.—*Board-foot volume table International (¼-inch) rule: Hickory* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	110	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
6	5.3	0								2
7	6.1	0	1	9	17	24	29			28
8	7.0	3	16	26	34	41	48			31
9	8.0	14	26	39	49	58	67			36
10	8.9	25	40	52	64	77	90			20
11	9.9	33	50	65	81	96	111			20
12	10.9	41	60	79	97	117	137			15
13	11.9	49	71	94	118	142	168			7
14	12.9	58	84	110	140	170	200			3
15	13.8	66	96	129	165	200	235	275		5
16	14.8		111	150	190	230	275	315	360	2
17	15.8		126	172	220	268	312	360	420	1
18	16.8				250	305	355			
19	17.8				285	340	405			
20	18.8				320	385	460			
21	19.8				355	435	515			
22	20.8				395	485	580			
23	21.8									1
Basis (trees)		13	44	51	41	14	1		1	165

[1] Measured by the Yale Forest School, Allegheny and Central States Forest Experiment Stations, and others, in Alabama, Arkansas, Connecticut, Indiana, Kentucky, Maryland, Missouri, New York, Ohio, Tennessee, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot. Additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.15 percent high. Average percentage deviation (100 trees, 8.0 inches inside bark plus) 14.4. Heavy lines indicate limits of basic data.

TABLE 69.—*Board-foot volume table International (⅛-inch) rule: Virginia pine* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet						Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.4	10	17	25	33			33
8	7.3	20	31	42	54			22
9	8.2	30	45	60	75	90		14
10	9.2	42	61	79	98	114	130	4
11	10.1	53	75	98	118	138	157	8
12	11.1	66	92	116	140	162	182	5
13	12.0	78	107	134	160	184	208	8
14	13.0	91	123	153	180	209	234	10
15	14.0	105	140	171	203	231	259	1
16	15.1		155	189	223	254	283	
Basis (trees)		22	34	33	15	1		105

[1] Measured by the Central States Forest Experiment Station, W. D. Sterrett, and others, in Maryland, Ohio, Pennsylvania, Virginia, and West Virginia. Prepared by the alinement chart method by V. A. Clements and L. H. Reineke in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height, 1.0 foot. Aggregate deviation: Table 0.5 percent high. Average percentage deviation (49 trees, 8.0 inches inside bark plus) 11.5. Heavy lines indicate limits of basic data.

TABLE 70.—*Board-foot volume table International (⅛-inch) rule: Chestnut* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet							Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.4	3	8	13	19	24			42
8	7.3	9	19	27	33	40	46		51
9	8.1	19	31	40	49	58	70		58
10	9.0	28	42	54	66	78	91		64
11	9.9	36	53	68	82	95	112	130	62
12	10.8	45	66	84	100	117	139	160	63
13	11.7	54	78	99	119	140	168	193	59
14	12.6	64	92	117	140	167	199	225	41
15	13.5	75	107	137	165	196	230	260	35
16	14.5		124	159	191	225	260	302	30
17	15.4		143	184	220	255	300	340	27
18	16.4		163	208	245	285	340	382	21
19	17.4		185	232	275	320	375	428	10
20	18.4		205	255	305	357	415	462	3
21	19.4			282	338	390	450	505	2
22	20.3			315	368	425	485	550	1
23	21.3			340	403	460	530	595	3
24	22.3			370	435	495	570	640	
25	23.3			398	460	530	600	675	1
26	24.3			430	495	560	648	710	
27	25.3			455	525	600	680	750	
28	26.3			482	560	640	720	798	
Basis (trees)		5	62	180	227	92	7		573

[1] Measured by the Central States Forest Experiment Station, Frothingham, Schwarz, and others, in Connecticut, Kentucky, Maryland, New York, Ohio, and Tennessee. Prepared by the alinement chart method by V. A. Clements in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height, 1.0 foot. Aggregate deviation: Table 0.56 percent high. Average percentage deviation (332 trees, 10.0 inches inside bark plus) 10.5. Heavy lines indicate limits of basic data.

TABLE 71.—*Board-foot volume table International (¼-inch) rule: Red maple*[1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet						Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
7	6.6	5	14	22	29	35	.....	55
8	7.5	16	26	34	42	50	.....	65
9	8.4	25	37	46	55	65	.....	43
10	9.3	34	46	58	70	82	93	25
11	10.2	42	57	70	85	100	117	21
12	11.2	52	69	86	106	126	144	11
13	12.2	62	83	104	128	152	177	10
14	13.2	72	96	122	151	181	212	4
15	14.1	.....	115	147	180	216	252	2
16	15.1	.....	133	170	212	255	300	1
17	16.1	.....	153	199	245	300	350	2
Basis (trees)		11	85	117	40	6	.....	239

[1] Measured by the Yale Forest School, Allegheny and Central States Forest Experiment Stations, and others, in Connecticut, Maryland, Michigan, New York, Ohio, and Pennsylvania. Prepared by the alinement chart method by B. R. Lexen in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.32 percent low. Average percentage deviation (115 trees, 8.0 inches inside bark plus) 13.5. Heavy lines indicate limits of basic data.

TABLE 72.—*Board-foot volume table International (¼-inch) rule: Yellow poplar*[1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet									Basis: Number of trees
Outside bark	Inside bark	30	40	50	60	70	80	90	100	110	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
6	5.5	0	0	0	5	12	.....	.....	.....	.....	3
7	6.4	6	0	11	18	25	31	.....	.....	.....	23
8	7.3	7	15	22	30	38	46	.....	.....	.....	32
9	8.2	16	24	32	42	52	64	.....	.....	.....	24
10	9.2	24	32	42	54	68	82	95	.....	.....	29
11	10.1	31	40	52	68	85	105	122	136	.....	29
12	11.0	.....	49	64	83	104	130	152	170	185	20
13	12.0	.....	58	76	98	127	159	187	209	225	21
14	12.9	.....	.....	87	114	148	184	218	241	260	18
15	13.8	.....	.....	98	131	169	214	250	280	304	7
16	14.8	.....	.....	.....	140	190	242	285	320	350	5
17	15.7	.....	.....	.....	.....	214	272	320	362	392	.....
18	16.6	.....	.....	.....	.....	.....	.....	360	405	440	1
19	17.5	.....	.....	.....	.....	.....	.....	395	442	480	1
20	18.5	.....	.....	.....	.....	.....	.....	430	480	525	.....
Basis (trees)		.....	3	17	70	93	22	3	5	.....	213

[1] Measured by the Appalachian and Central States Forest Experiment Stations in Ohio and West Virginia. Prepared by the alinement chart method by L. I. Barrett in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.044 percent high. Average percentage deviation (151 trees, 8.0 inches inside bark plus) 10.4. Heavy lines indicate limits of basic data.

TABLE 73.—*Board-foot volume table International (¼-inch) rule: Red gum* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet										Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	110	120	130	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
8	7.1	0	6	16	26	36						18
9	8.1	5	17	31	45	55	65					14
10	9.1	14	31	48	65	80	93	100				16
11	10.1	22	44	65	85	101	118	129	140			21
12	11.1	32	57	82	105	123	143	157	170			25
13	12.1		73	100	129	152	175	192	208	222		34
14	13.0		89	120	154	181	211	232	250	270		27
15	14.0			140	180	218	245	275	300	320	340	19
16	14.9			160	208	245	288	320	340	365	395	23
17	15.9			185	240	285	330	360	390	420	450	22
18	16.9				270	320	375	415	450	490	525	12
19	17.8				308	362	420	465	510	550	595	9
20	18.7				340	410	480	530	580	630	670	7
21	19.7				380	460	540	595	645	695	745	9
22	20.6				420	510	597	650	705	765	825	3
23	21.6				465	560	650	720	790	850	900	2
24	22.6				525	625	725	800	880	950	1,010	5
25	23.6				505	675	790	880	950	1,030	1,110	
Basis (trees)		4	10	16	24	63	61	71	14	3		266

[1] Measured by the Central States Forest Experiment Station and Chittenden in Indiana, Missouri, and South Carolina. Prepared by the alinement chart method by J. H. Hanley in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.34 percent low. Average percentage deviation (214 trees, 10.0 inches inside bark plus) 12.1. Heavy lines indicate limits of basic data.

TABLE 74.—*Board-foot volume table International (¼-inch) rule: Black cherry* [1]

Diameter breast high (inches)		Volume (to a 5.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	30	40	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
6	5.7	0	0	11	14	17	20			12
7	6.6	10	15	20	25	30	34			11
8	7.6	17	24	31	38	45	52	58		13
9	8.5		34	45	54	64	73	82		11
10	9.4		47	60	74	87	100	114	126	3
11	10.4		58	75	92	112	128	142	150	19
12	11.3		73	95	120	141	150	175	192	16
13	12.2			123	150	173	195	215	232	16
14	13.2			154	184	212	235	257	275	14
15	14.1			190	225	255	280	302	320	6
16	15.0			228	262	295	320	342	362	2
17	16.0				302	335	362	383	405	2
18	16.9				340	375	400	425	444	
19	17.9				375	410	438	460	480	
20	18.8					442	470	492	510	
Basis (trees)				26	30	7	44	18		125

[1] Measured by the Allegheny and Central States Forest Experiment Stations in Ohio and Pennsylvania. Prepared by the alinement chart method by G. L. Schnur in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 5.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.14 percent low. Average percentage deviation (125 trees) 12. Heavy lines indicate limits of basic data.

TABLE 75.—*Board-foot volume table Scribner rule: White oak* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	110	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
10	9.1	0	1	9	22	33				41
11	10.0	2	10	34	46	57	67	77		38
12	10.9	14	30	53	66	80	93	105		33
13	11.8	31	53	71	88	103	122	138		33
14	12.8	44	68	90	111	133	156	175		29
15	13.7		83	109	137	163	190	213	241	15
16	14.6		98	130	162	192	224	252	287	15
17	15.5		116	154	192	226	264	297	338	13
18	16.5		134	178	219	260	303	342	390	5
19	17.4		154	203	252	298	350	395	449	2
20	18.3				287	342	400	450	510	
21	19.2				324	386	450	505	574	1
22	20.1				362	430	500	560	640	
Basis (trees)			33	76	24	47	40	3		223

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Tennessee, Virginia, and West Virginia. Prepared by the alinement chart method by R. K. Day in 1928. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.0 percent high. Average percentage deviation (145 trees, 12.0 inches inside bark plus) 16.07. Heavy lines indicate limits of basic data.

TABLE 76.—*Board-foot volume table Scribner rule: Black oak* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	110	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
10	9.0	0	0	4	13	30	47	61		27
11	9.9	0	4	20	45	63	80	93		51
12	10.9	1	14	50	73	92	109	127		45
13	11.8	4	36	72	95	116	140	164		34
14	12.7	10	54	90	116	144	173	202		15
15	13.7	21	70	107	140	173	208	240		10
16	14.7		84	125	163	203	240	278	318	12
17	15.6		96	144	187	233	277	321	367	12
18	16.6			163	214	263	312	362	418	7
19	17.5			184	240	295	352	409	472	10
20	18.5			206	266	330	394	456	525	6
21	19.5			228	292	365	435	507	584	4
22	20.5			250	326	401	480	560	644	3
23	21.4			272	358	442	528	615	708	
Basis (trees)			12	46	81	74	31	1		245

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New Jersey, New York, Ohio, Tennessee, and West Virginia. Prepared by alinement chart method by J. H. Buell, R. K. Day, E. R. Martell, and O. L. Schnur, in 1928. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.10 percent high. Average percentage deviation (184 trees, 12.0 inches inside bark plus) 14.78. Heavy lines indicate limits of basic data.

TABLE 77.—*Board-foot volume table Scribner rule: Scarlet oak* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet					Basis: Number of trees
Outside bark	Inside bark	50	60	70	80	90	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
10	9.2	8	14	30	51	69	35
11	10.2	22	45	66	82	95	49
12	11.1	67	77	92	108	127	70
13	12.0	79	94	113	133	157	41
14	13.0	95	113	134	159	188	28
15	13.9	110	131	156	185	219	12
16	14.8	127	152	180	212	250	11
17	16.8	145	174	206	241	285	5
18	16.7	.....	197	232	273	319	1
19	17.6	.....	219	258	303	352	2
20	18.6	.....	243	285	333	388	2
21	19.5	.....	268	312	364	420	.....
22	20.4	.....	291	339	394	453	1
Basis (trees)		10	67	110	48	13	257

[1] Measured by the Allegheny and Central States Forest Experiment Stations in Connecticut, Indiana, Maryland, New Jersey, Ohio, Pennsylvania, Tennessee, and West Virginia. Prepared by the alinement chart method by V. A. Clements in 1930. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.04 percent high. Average percentage deviation (201 trees, 10.0 inches inside bark plus) 16.0. Heavy lines indicate limits of basic data.

TABLE 78.—*Board-foot volume table Scribner rule: Chestnut oak* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	110	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
10	8.7	0	0	0	21	34	.....	.....	.....	33
11	9.6	2	16	29	44	59	77	96	.....	49
12	10.5	18	33	48	65	84	105	130	.....	54
13	11.4	32	48	65	85	108	135	162	.....	32
14	12.3	.....	62	83	107	133	164	197	.....	24
15	13.2	.....	77	101	128	158	194	234	.....	6
16	14.1	.....	92	118	148	185	226	270	.....	2
17	15.1	.....	107	136	172	210	258	309	.....	3
18	16.0	.....	.....	.....	194	240	290	347	.....	1
19	16.9	.....	.....	.....	219	268	324	387	.....	.....
20	17.8	.....	.....	.....	241	296	359	426	.....	1
21	18.7	.....	.....	.....	269	328	396	470	544	.....
22	19.7	.....	.....	.....	296	360	434	515	595	.....
23	20.6	.....	.....	.....	325	395	475	562	652	1
24	21.5	.....	.....	.....	357	430	520	618	712	.....
Basis (trees)		1	37	106	47	13	1	1	.....	206

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, and Pennsylvania. Prepared by the alinement chart method by R. K. Day in 1928. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.69 percent high. Average percentage deviation (115 trees, 12.0 inches inside bark plus) 16.89. Heavy lines indicate limits of basic data.

TABLE 79.—*Board-foot volume table Scribner rule: Red oak* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	110	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
12	10.9	34	52	67	81	96	112	----	----	31
13	11.9	54	71	87	102	118	138	103	----	21
14	12.8	70	88	105	123	142	167	108	----	22
15	13.7	84	104	123	143	167	198	230	----	14
16	14.7	----	119	141	166	195	231	276	----	15
17	15.6	----	134	161	190	223	266	317	----	9
18	16.6	----	151	181	215	254	301	360	----	7
19	17.6	----	168	203	240	284	340	408	487	7
20	18.6	----	186	226	270	319	380	455	545	4
21	19.6	----	208	252	300	358	428	512	615	3
22	20.6	----	----	----	----	398	474	570	682	----
23	21.6	----	----	----	----	440	528	633	760	----
24	22.5	----	----	----	----	487	581	700	840	1
25	23.4	----	----	----	----	----	640	765	920	----
26	24.4	----	----	----	----	----	700	840	1,005	----
27	25.4	----	----	----	----	----	765	920	1,090	----
28	26.4	----	----	----	----	----	830	995	1,180	1
29	27.4	----	----	----	----	----	895	1,070	1,275	----
Basis (trees)		----	7	41	37	32	16	2	----	135

[1] Measured by the Allegheny, Appalachian, and Central States Forest Experiment Stations in Connecticut, Maryland, New York, Ohio, Virginia, and West Virginia. Prepared by the alinement chart method by J. H. Buell in 1928. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 1.98 percent low. Average percentage deviation (135 trees, 12.0 inches inside bark plus) 12.02. Heavy lines indicate limits of basic data.

TABLE 80.—*Board-foot volume table Scribner rule: Chestnut* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet							Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
11	9.9	12	22	30	38	46	54	----	30
12	10.8	25	30	53	66	79	91	----	62
13	11.7	34	53	70	87	104	119	134	59
14	12.6	43	65	86	107	127	145	161	42
15	13.5	51	79	103	128	149	170	192	37
16	14.5	----	92	120	147	174	201	225	30
17	15.4	----	106	138	169	200	230	260	28
18	16.4	----	119	155	190	227	260	293	23
19	17.4	----	134	175	215	255	295	330	11
20	18.4	----	150	196	240	285	328	370	5
21	19.4	----	165	217	267	315	365	418	3
22	20.3	----	183	239	293	348	408	462	3
23	21.3	----	200	260	320	382	450	515	3
24	22.3	----	219	288	355	425	500	565	----
25	23.3	----	240	313	387	467	545	625	2
26	24.3	----	260	340	422	510	600	680	1
27	25.3	----	283	373	465	560	655	750	----
Basis (trees)		----	3	72	165	92	7	----	339

[1] Measured by the Central States Forest Experiment Station, Frothingham, Schwarz, and others, in Connecticut, Kentucky, Maryland, New York, Ohio, and Tennessee. Prepared by the alinement chart method by V. A. Clements in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 6.1 percent low. Average percentage deviation (200 trees, 12.0 inches inside bark plus) 11.6. Heavy lines indicate limits of basic data.

TABLE 81.—*Board-foot volume table Scribner rule: Yellow poplar* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	40	50	60	70	80	90	100	110	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
10	9.2	29	32	37	42	48	55	-------	-------	10
11	10.1	33	37	42	51	66	78	82	-------	26
12	11.0	38	43	52	71	94	109	115	119	20
13	12.0	43	50	68	93	120	140	148	158	21
14	12.9	48	60	84	112	147	168	177	185	18
15	13.8	-------	72	99	131	169	198	209	217	7
16	14.8	-------	84	114	150	196	229	243	251	4
17	15.7	-------	95	129	170	223	261	277	289	-------
18	16.6	-------	108	146	192	253	297	313	327	1
19	17.5	-------	119	161	215	282	332	350	365	-------
20	18.5	-------	-------	-------	240	318	370	389	405	-------
21	19.4	-------	-------	-------	265	348	408	430	445	1
22	20.4	-------	-------	-------	290	382	445	470	488	-------
Basis (trees)		-------	2	18	61	19	3	5	-------	108

[1] Measured by the Appalachian and Central States Forest Experiment Stations in Ohio, Pennsylvania, Virginia, and West Virginia. Prepared by alinement chart method by L. I. Barrett in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.57 percent high. Average percentage deviation (46 trees, 12.0 inches inside bark plus) 10.2. Heavy lines indicate limits of basic data.

TABLE 82.—*Board-foot volume table Scribner rule: Red gum* [1]

Diameter breast high (inches)		Volume (to an 8.0-inch top inside bark), by total height in feet								Basis: Number of trees
Outside bark	Inside bark	50	60	70	80	90	100	110	120	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
11	10.1	14	20	27	35	43	50	59	-------	20
12	11.1	28	41	55	68	81	94	102	-------	25
13	12.1	43	62	79	95	110	125	139	-------	34
14	13.0	58	79	98	117	136	152	172	190	27
15	14.0	-------	97	119	141	162	187	209	230	19
16	14.9	-------	115	142	170	195	220	250	278	23
17	15.9	-------	136	167	198	230	263	294	328	22
18	16.9	-------	158	193	230	269	302	344	380	12
19	17.8	-------	-------	220	260	305	350	392	439	9
20	18.7	-------	-------	250	298	350	398	448	500	7
21	19.7	-------	-------	280	340	394	450	510	563	9
22	20.6	-------	-------	320	380	448	510	575	640	3
23	21.6	-------	-------	360	430	500	570	645	720	2
24	22.6	-------	-------	400	480	560	640	720	800	5
25	23.6	-------	-------	442	530	620	710	800	900	-------
Basis (trees)		-------	3	9	57	60	71	14	3	217

[1] Measured by the Central States Forest Experiment Station and Chittenden in Indiana, Missouri, and South Carolina. Prepared by the alinement chart method by J. H. Hanley in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.16 percent low. Average percentage deviation (160 trees, 12.0 inches inside bark plus) 13.8. Heavy lines indicate limits of basic data.

TABLE 83.—*Board-foot volume table Scribner rule: Black cherry* [1]

Diameter breast high		Volume (to an 8.0-inch top inside bark), by total height in feet						Basis: Number of trees
Outside bark	Inside bark	50	60	70	80	90	100	
		Board feet	*Board feet*	*Board feet*	*Board feet*	*Board feet*	*Board feet*	
11	10.4	50	65	78	90	97	106	22
12	11.3	85	97	111	122	133	144	16
13	12.2	108	122	140	153	168	182	16
14	13.2	130	148	168	185	202	218	14
15	14.1	150	172	193	212	232	250	6
16	15.0	175	200	222	246	268	290	2
17	16.0	----------	228	253	279	302	328	2
18	16.9	----------	258	287	315	342	368	----------
Basis (trees)		1	10	7	42	18	----------	78

[1] Measured by the Allegheny and Central States Forest Experiment Stations in Ohio and Pennsylvania. Prepared by alinement chart method by G. L. Schnur, in 1929. Scaled in 16-foot log lengths with trimming allowance of 0.3 foot, additional top sections scaled as fractions of a 16-foot, 8.0-inch log. Stump height 1.0 foot. Aggregate deviation: Table 0.6 percent low. Average percentage deviation (78 trees) 13. Heavy lines indicate limits of basic data.

TABLE 84.—*Check of basic data against volume tables* [1]

Species	Total cubic volume		Merchantable cubic volume		International board foot volume		Scribner board foot volume	
	Aggregate deviation	Average percent deviation	Aggregate deviation	Average percent deviation	Aggregate deviation	Average percent deviation	Aggregate deviation	Average percent deviation
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
White oak	+0.30	8.03	+0.16	8.67	−0.38	13.87	+0.90	16.07
Black oak	+.73	8.17	−.10	9.50	−.55	14.70	+.19	14.78
Scarlet oak	−.30	7.10	+.12	7.10	+.54	11.78	+.04	16.00
Chestnut oak	−.71	8.70	−.73	9.77	−.48	14.00	+.69	16.89
Red oak	−.42	7.68	−.06	8.14	−1.03	11.87	−1.98	12.92
Hickory	−.70	8.90	−.20	10.20	+.15	14.40	----------	----------
Virginia pine	−.03	8.30	−.25	8.60	+.50	11.50	----------	----------
Chestnut	−.40	7.40	−.20	7.70	+.56	10.50	−.10	11.60
Red maple	+.10	7.30	−.22	8.50	−.32	13.50	----------	----------
Yellow poplar	−.04	6.30	+.39	6.60	+.04	10.40	+.57	10.20
Red gum	+.30	8.10	+.03	10.00	−.34	12.10	−.16	13.80
Black cherry	−.06	7.15	+.06	8.08	−.14	12.00	−.60	13.00

[1] The average percent deviations are not exactly comparable. (See individual tables.)

LITERATURE CITED

(1) AUGHANBAUGH, J. E.
1934. YIELD OF THE OAK-CHESTNUT-HARD PINE FOREST TYPE IN PENNSYLVANIA. Jour. Forestry 32: 80–89.

(2) BAKER, F. S.
1923. NOTES ON THE COMPOSITION OF EVEN AGED STANDS. Jour. Forestry 21: 712–717, illus.

(3) BRUCE, D.
1926. A METHOD OF PREPARING TIMBER-YIELD TABLES. Jour. Agr. Research 32: 543–557, illus.

(4) ——— and REINEKE, L. H.
1931. CORRELATION ALINEMENT CHARTS IN FOREST RESEARCH: A METHOD OF SOLVING PROBLEMS IN CURVILINEAR MULTIPLE CORRELATION. U. S. Dept. Agr. Tech. Bull. 210, 88 pp., illus.

(5) ——— and SCHUMACHER, F. X.
1935. FOREST MENSURATION. 360 pp., illus. New York and London.

(6) DUNLAP, F.
1921. GROWTH OF OAK IN THE OZARKS. Mo. Agr. Expt. Sta. Research Bull. 41, 28 pp., illus.

(7) FORBES, R. D., and BRUCE, D.
1930. RATE OF GROWTH OF SECOND-GROWTH SOUTHERN PINES IN FULL STANDS. U. S. Dept. Agr. Circ. 124, 77 pp., illus.

(8) FROTHINGHAM, E. H.
1912. SECOND-GROWTH HARDWOODS IN CONNECTICUT. U. S. Dept. Agr., Forest Serv. Bull. 96, 70 pp., illus.

(9) ———
1931. TIMBER GROWING AND LOGGING PRACTICE IN THE SOUTHERN APPALACHIAN REGION. U. S. Dept. Agr. Tech. Bull. 250, 93 pp., illus.

(10) HAIG, I. T.
1932. SECOND-GROWTH YIELD, STAND, AND VOLUME TABLES FOR THE WESTERN WHITE PINE TYPE. U. S. Dept. Agr. Tech. Bull. 323, 68 pp., illus.

(11) ILVESSALO, Y.
1920. [UNTERSUCHUNGEN ÜBER DIE TAXATORISCHE BEDEUTUNG DER WALDTYPEN, HAUPTSÄCHLICH AUF DEN ARBEITEN FÜR DIE AUFSTELLUNG DER NEUEN ERTRAGSTAFELN FINNLANDS FUSSEND.] Acta Forest. Fennica 15, 157 pp., illus. [In Finnish. German summary, 26 pp.]

(12) KITTREDGE, J., and CHITTENDEN, A. K.
1929. OAK FORESTS OF NORTHERN MICHIGAN. Mich. Agr. Expt. Sta. Spec. Bull. 190, 47 pp., illus.

(13) KORSTIAN, C. F., and STICKEL, P. W.
1927. THE NATURAL REPLACEMENT OF BLIGHT-KILLED CHESTNUT. U. S. Dept. Misc. Circ. 100, 15 pp., illus.

(14) MCARDLE, R. E., and MEYER, W. H.
1930. THE YIELD OF DOUGLAS FIR IN THE PACIFIC NORTHWEST. U. S. Dept. Agr. Tech. Bull. 201, 64 pp., illus.

(15) MCINTYRE, A. C.
1933. GROWTH AND YIELD IN OAK FORESTS OF PENNSYLVANIA. Pa. Agr. Expt. Sta. Bull. 283, 28 pp., illus.

(16) MEYER, W. H.
1928. RATES OF GROWTH OF IMMATURE DOUGLAS FIR AS SHOWN BY PERIODIC REMEASUREMENTS ON PERMANENT SAMPLE PLOTS. Jour. Agr. Research 36: 193–215, illus.

(17) ———
1930. DIAMETER DISTRIBUTION SERIES IN EVEN-AGED FOREST STANDS. Yale Univ. School Forestry Bull. 28, 105 pp., illus.

(18) PATTON, R. T.
1922. RED OAK AND WHITE OAK: A STUDY OF GROWTH AND YIELD. Harvard Forest Bull. 4, 38 pp., illus.
(19) REINEKE, L. H.
1927. A MODIFICATION OF BRUCE'S METHOD OF PREPARING TIMBER-YIELD TABLES. Jour. Agr. Research 35: 843–856, illus.
(20) ———
1933. PERFECTING A STAND-DENSITY INDEX FOR EVEN-AGED FORESTS. Jour. Agr. Research 46: 627–638, illus.
(21) ——— and BRUCE, D.
1932. AN ALINEMENT-CHART METHOD FOR PREPARING FOREST-TREE VOLUME TABLES. U. S. Dept. Agr. Tech. Bull. 304, 28 pp., illus.
(22) SALVOSA, L. R.
1930. TABLES OF PEARSON'S TYPE III FUNCTION. Ann. Math. Statis. 1: 191–198.
(23) SCHNUR, G. L.
1934. DIAMETER DISTRIBUTIONS FOR OLD-FIELD LOBLOLLY PINE STANDS IN MARYLAND. Jour. Agr. Research 49: 731–743, illus.
(24) SCHUMACHER, F. X.
1928. YIELD, STAND AND VOLUME TABLES FOR RED FIR IN CALIFORNIA. Calif. Agr. Expt. Sta. Bull. 456, 29 pp., illus.
(25) ———
1930. YIELD, STAND AND VOLUME TABLES FOR DOUGLAS FIR IN CALIFORNIA. Calif. Agr. Expt. Sta. Bull. 491, 41 pp., illus.
(26) SHANTZ, H. L., and ZON, R.
1924. NATURAL VEGETATION. U. S. Dept. Agr., Bur. Agr. Econ., 29 pp., illus. Washington, D. C.
(27) SOCIETY OF AMERICAN FORESTERS, COMMITTEE ON FOREST TYPES.
1932. FOREST COVER TYPES OF THE EASTERN UNITED STATES. Jour. Forestry 30: 451–498.
(28) ——— COMMITTEE ON STANDARDIZATION OF VOLUME AND YIELD TABLES.
1926. METHODS OF PREPARING VOLUME AND YIELD TABLES. Jour. Forestry 24: 653–666.
(29) SPAETH, J. N.
1928. TWENTY YEARS GROWTH OF A SPROUT HARDWOOD FOREST IN NEW YORK: A STUDY OF THE EFFECTS OF INTERMEDIATE AND REPRODUCTION CUTTINGS. N. Y. (Cornell) Agr. Expt. Sta. Bull. 465, 49 pp., illus.
(30) TELFORD, C. J.
1927. A MANUAL OF WOODLOT MANAGEMENT. Ill. Nat. Hist. Survey Bull. v. 17, art. II, pp. [101]–194, illus.
(31) UNITED STATES DEPARTMENT OF AGRICULTURE, FOREST SERVICE.
1929. VOLUME, YIELD, AND STAND TABLES FOR SECOND-GROWTH SOUTHERN PINES. U. S. Dept. Agr. Misc. Pub. 50, 202 pp., illus.

ORGANIZATION OF THE UNITED STATES DEPARTMENT OF AGRICULTURE WHEN THIS PUBLICATION WAS LAST PRINTED

Secretary of Agriculture	HENRY A. WALLACE.
Under Secretary	M. L. WILSON.
Assistant Secretary	HARRY L. BROWN.
Director of Extension Work	C. W. WARBURTON.
Director of Finance	W. A. JUMP.
Director of Information	M. S. EISENHOWER.
Director of Personnel	W. W. STOCKBERGER.
Director of Research	JAMES T. JARDINE.
Solicitor	MASTIN G. WHITE.
Agricultural Adjustment Administration	H. R. TOLLEY, *Administrator.*
Bureau of Agricultural Economics	A. G. BLACK, *Chief.*
Bureau of Agricultural Engineering	S. H. MCCRORY, *Chief.*
Bureau of Animal Industry	JOHN R. MOHLER, *Chief.*
Bureau of Biological Survey	IRA N. GABRIELSON, *Chief.*
Bureau of Chemistry and Soils	HENRY G. KNIGHT, *Chief.*
Commodity Exchange Administration	J. W. T. DUVEL, *Chief.*
Bureau of Dairy Industry	O. E. REED, *Chief.*
Bureau of Entomology and Plant Quarantine	LEE A. STRONG, *Chief.*
Office of Experiment Stations	JAMES T. JARDINE, *Chief.*
Food and Drug Administration	WALTER G. CAMPBELL, *Chief.*
Forest Service	FERDINAND A. SILCOX, *Chief.*
Bureau of Home Economics	LOUISE STANLEY, *Chief.*
Library	CLARIBEL R. BARNETT, *Librarian.*
Bureau of Plant Industry	FREDERICK D. RICHEY, *Chief.*
Bureau of Public Roads	THOMAS H. MACDONALD, *Chief.*
Resettlement Administration	W. W. ALEXANDER, *Administrator.*
Soil Conservation Service	H. H. BENNETT, *Chief.*
Weather Bureau	WILLIS R. GREGG, *Chief.*

This bulletin is a contribution from

Forest Service	FERDINAND A. SILCOX, *Chief.*
Allegheny Forest Experiment Station	R. D. FORBES, *Director.*

U. S. GOVERNMENT PRINTING OFFICE: 1937

END